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Clinical Factors Influencing Participation in Society after Successful Kidney Transplantation

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Background. Little information is available on the degree of actual social functioning after successful kidney transplantation. Moreover, information on factors that influence participation in social activities is scarce. The aim of this study was to examine the influence of clinical factors on social outcome.

Methods. A retrospective study was performed on a cohort of primary kidney transplantation patients, transplanted between 1996 and 2001. Cross-sectional data on participation in obligatory activities (i.e. employment, education, household tasks), leisure activities (i.e. volunteer work, assisting others, sports, clubs/associations, recreation, socializing, going out) and change in participation were collected by in-home interviews (n=239). Multivariate regression analysis was performed.

Results. Thirty-six percent of the patients scored low on obligatory participation and only 52.4% was employed. Patients were actively involved in a wide range of leisure activities. Twenty-six percent participated in sports. Multivariate analysis (age-, sex-, and education-adjusted) of participation in obligatory activities showed negative associations with advanced age ($P<0.01$), comorbidity (previous cardiovascular events; $P<0.01$) and cadaveric transplantation ($P<0.01$). There was a positive association with time since transplantation ($P<0.01$). Multivariate analysis of diversity of participation in leisure activities and perceived change in participation after transplantation showed no statistically significant associations with clinical factors.

Conclusions. Besides age, clinical factors such as type of donation (cadaveric versus living), comorbidity (previous cardiovascular events), and time since transplantation were associated with participation in obligatory activities such as employment, education and household tasks. Diversity of leisure activities and change in participation was not affected by clinical factors.

Keywords: Kidney transplantation, Employment, Leisure activities, Rehabilitation, Social participation.

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In addition to survival as a clinical outcome measure, assessment of quality of life (QoL) has become a relevant issue with respect to the evaluation of medical treatment. Kidney transplantation nowadays has become a routine procedure and treatment of choice for end-stage renal disease, as it is associated with a better prognosis (*1*, *2*), but also because of the associated favorable QoL outcomes when compared to dialysis (*3*–*8*). Health-related QoL includes the physical, psychological and social domain of health, each of which represents a diversity of components (*9*). Within the social domain vocational rehabilitation is considered a significant component and already has been the subject of study (*10*–*12*). In contrast, other components of the social domain such as active participation in household tasks, leisure activities, volunteer work, recreation, and social relations are less well studied. These additional components however are relevant for a comprehensive understanding of social outcome.

Demographic, non-disease factors such as age and gender are related to participation in society (*13*, *14*). These factors are also associated with return to work after kidney transplantation (*12*, *15*). Besides demographic factors employment is affected by clinical factors such as time since transplantation (*11*) and nondiabetic status (*10*). Apart from these studies with employment as outcome measure little is known of factors that affect the other components of social outcome mentioned above. The paucity of information regarding social functioning as outcome measure of kidney transplantation and clinical factors influencing social functioning was the reason for the present study.

Aim of this study was to examine the influence of clinical factors on social outcome after successful primary kidney transplantation. Therefore we assessed, besides employment, a range of activities relevant with respect to social functioning, with a particular emphasis on the patient's physical participation in these activities. In addition, we examined associated demographic and clinical factors. As posttransplantation time is needed for recovery and adaptation to a life without dialysis, we examined social functioning from the first year after transplantation.

PATIENTS AND METHODS

Patients who visited the outpatient clinic of the Transplantation Centre of the University Medical Centre

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Groningen for follow-up after primary kidney transplantation were invited for this retrospective cross-sectional study. Patients who were transplanted between January 1, 1996 and December 31, 2001 were eligible subject to having had their transplant at least 1 year preliminary to entrance of the study, being 18 years old or older, and having a functioning allograft. Combined transplantation patients (i.e. kidney/pancreas or kidney/liver) and retransplantation patients were excluded as were patients unable to understand Dutch. Patients with a poor mental or physical health status were excluded as well. Dutch-speaking patients with a visual impairment were assisted in completing the questionnaires. Patients were enrolled between May 2002 and March 2003. The study was approved by the Medical Ethics Review Committee of the University Medical Centre Groningen. After receiving oral and written information about the study, patients signed informed consent.

From the cohort of patients transplanted between 1996 and 2001 (n=421) 9% had died by the time of the study, 11% had renal graft failure, and 1% had moved elsewhere. Of the remaining 334 patients, 23 were found to be ineligible because of mental retardation (n=5), severe physical or mental health problems (n=9), inadequate mastery of Dutch (n=5), and miscellaneous reasons (n=4). Of the 311 patients approached for participation in this study, 249 (80%) agreed to participate. Ten patients participated in the pilot study, so 239 patients were enrolled in this study.

Data Collection Procedures

Data on renal function, hematology and biochemistry parameters, comorbidity, and follow-up hospitalization were collected by review of medical charts. Data on primary kidney disease, type and duration of dialysis therapy, type and date of transplantation, duration of initial hospitalization, and acute allograft rejection were extracted from the Groningen Renal Transplant Database. Data on demographic and anthropometric characteristics, and the outcome measure social participation were collected by interview at the patient's homes. For this purpose, an interview schedule was developed based on relevant literature, consulting of experts in rehabilitation research, and unstructured interviews with kidney transplantation patients. The interview schedule was assessed on face and content validity by a panel consisting of patients, researchers and methodologists, and tested in a pilot study of ten kidney transplantation patients. The interviews, with an average duration of 1 hr and 45 min, were performed by a team of seven experienced and skilled interviewers of the Northern Centre for Healthcare Research. The interviewers attended training sessions preceding the start of the study and also attended regular meetings during the period of data collection, aimed to reduce measurement error through enhancement of standardization of interview technique. Furthermore, the first in-home interview of each interviewer was tape recorded and listened to by the first author (SFvdM) and discussed afterwards.

Definitions

Outcome Measure

Social participation was defined as patient's actual involvement in society and divided in two types of participation: 1) participation in activities with obligatory characteristics including paid work, education and household tasks. The number of hours per week spent on these activities were added, yielding a continuous score (range 4–70); 2) participation in leisure activities including volunteer work, assisting others, sports (walking/cycling as means of getting about excluded) and involvement in clubs/associations were dichotomously (yes/no) assessed. Participation in recreation and socializing with relatives and friends respectively (both scored as 'yes' if frequency >1x/week), and going out to public and cultural places ('yes' if ≥1×/2 weeks). The scores on these seven dichotomous leisure activities were summed, to obtain a total score (range 0–7) representing the diversity or width of participation in leisure time. A more detailed description of this measurement methodology is described elsewhere (16).

Change in social functioning was defined as the self-reported change in overall participation in daily life, including obligatory activities as well as leisure activities. Study participants were requested to compare the degree of participation just before transplantation with the situation at interview. This resulted in a dichotomous outcome, i.e. increase versus decrease or steady state of social functioning.

Demographic Characteristics

Living arrangement is defined as: 1) living with a partner without children; 2) living as a parent with one or more children at home (one- and two-parent family); 3) living alone; 4) living with parents. Educational status was defined as the highest attained level of education and classified as: 1) primary education; 2) lower secondary education; 3) upper secondary education; and 4) tertiary education (*17*).

Clinical Characteristics

Primary renal disease was classified according to the codes of the European Renal Association-Dialysis and Transplant Association (ERA-EDTA) (*18*). Comorbidity was defined as: 1) presence of diabetes mellitus (insulin or oral antidiabetic drugs dependent); 2) presence of cardiovascular disease evidenced by previous myocardial infarction (MI), coronary artery bypass grafting (CABG), percutaneous transluminal coronary angioplasty (PTCA), cardiac valve replacement, previous cerebrovascular accident (CVA), transient ischemic attack (TIA), carotid artery bypass grafting, percutaneous transluminal femoral angioplasty (PTFA) or peripheral vascular disease surgery (bypass, embolectomy, amputation). Dialysis (peritoneal vs. hemodialysis) was considered a previous renal replacement therapy if received more than 6 weeks. If patients changed from dialysis modality, the predominantly applied modality was registered. Additional clinical factors included type of transplantation (cadaveric vs. living), duration of dialysis (years) prior to transplantation, time since transplantation measured as time in years between date of transplantation and date of interview, and acute allograft rejection (biopsy proven). Duration of initial hospitalization (days) and frequency of follow-up hospitalization at the University Medical Centre Groningen were also registered. Renal allograft function was assessed as 24-hour urinary creatinine clearance (ml/min). The estimated glomerular filtration rate (GFR, ml/min/1.73 m^2) was calculated using the abbreviated Modification of Diet in Re-

nal Disease (MDRD) equation with serum creatinine measured in mg/dL (*19*). The equation is as follows:

Estimated GFR=

$$186.3 \times \text{serum creatinine}^{-1.154} \times \text{age}^{-0.203} \times 0.742 \text{ (if female)}$$

Body mass index (BMI) was calculated as weight (kg)/height (m^2). In accordance with the World Health Organization a BMI≥25.0 was defined as overweight, and a BMI≥30.0 as obese.

Statistical Analysis

A maximum score for duration of dialysis (14 years) and initial hospitalization (85 days) was set to prevent outliers. Nonresponse analysis was performed with the Student's *t* test and chi-square test. Regression analysis was applied to examine the association between the outcome measures, i.e. total time spent on obligatory activities and diversity of leisure activities respectively, and the potential explanatory factors. First, the univariate association with each individual factor was examined. Then, this association was adjusted for age, gender and educational status. Lastly, multivariate regression analysis was performed also with adjustment for age, gender and educational status. All variables with an adjusted association of $P<0.1$ were entered into the model and then sequentially deleted, starting with the variable having the weakest adjusted association with the outcome measure. Continued deletion of variables resulted in a final model containing only variables related to the outcome ($P<0.05$). Interactions between factors were tested if relevant and residual analysis was executed. Likewise, univariate and multivariate logistic regression analysis was applied to examine the association between change in social functioning and the potential explanatory factors. Data analysis was performed using the statistical software package SPSS, version 12.0.2 (SPSS, Inc., Chicago).

RESULTS

Demographic and Clinical Characteristics

A total of 239 primary kidney transplantation patients (57.3% men) were interviewed (Table 1). Mean age was 50.3 years (SD 12.7; range 19–71). Table 2 shows data on clinical characteristics. Glomerulonephritis was the most frequent cause of ESRD. Before transplantation, 14.6% of the patients had a history of cardiovascular events. Posttransplantation, at the time of interview, this percentage had increased to 19.7% for cardiovascular events and 15.5% of the patients had DM. The majority of the patients (79%) underwent cadaveric transplantation. Preemptive transplantation was performed in 11 patients and two patients dialyzed <6 weeks. The median duration of dialysis was 2.5 yr (range 0.3–14) and mean time since transplantation 3.8 yr (range 1.0–7.3). Twenty percent of the patients were obese. There were no differences between patients included in the study and nonresponders considering age (mean 52.0 yr; mean difference 1.8 yr; 95% CI: −2.3–5.9), gender (58% male; $P=0.43$), type of transplantation (86% cadaveric; $P=0.26$) and time since transplantation (mean 4.0 yr; mean difference 0.17 yr; 95% CI: −0.35–0.70).

TABLE 1. Demographic characteristics at the time of interview (n=239)

Characteristic	Mean ± SD or n (%)
Age, years	50.3±12.7
Male	137 (57.3)
Living arrangement	
Cohabitation without children	117 (49.0)
Parent living with children	68 (28.5)
Living alone	43 (18.0)
Living with parents	11 (4.6)
Educational status	
Primary	45 (18.8)
Lower secondary	89 (37.2)
Upper secondary	69 (28.9)
Tertiary	36 (15.1)

Participation in Obligatory and Leisure Activities, and Perceived Change in Participation

The total time spent on obligatory activities, i.e. employment, education and household tasks, showed a median of 23 hr per week. Thirty-six percent of the patients scored ≤16 hr, indicating a low degree of participation in obligatory activities. Thirty-nine percent had a high degree of participation (>32 hr/week). With respect to employment, 52.4% of the working age patients (n=210)—in the Netherlands, official retirement starts at the age of 65 years—had a paid job, of which 54.5% worked full-time (≥30 hr/week). However, 48% (n=53) of these patients also reported receiving additional social security benefits due to work disability. Furthermore, work disability was reported by 68% of the patients not being employed.

The frequencies of leisure activities showed active participation of patients in volunteer work (40%), assisting others (38%), sports (26%), clubs or associations (64%), recreation (53%), socializing (59%), and going out (42%). Mean diversity of leisure activities was 3.2 (SD 1.6; range 0–7).

Seventy-eight percent (n=187) of the patients reported an increase in participation in daily life between pretransplantation and the interview.

Explanatory Factors of Participation in Obligatory Activities

Results of univariate regression analysis of total hours spent on obligatory activities on demographic and clinical factors indicated an association between a lower level of participation and advanced age (regression coefficient [*B*] −0.62; $P<.01$), the presence of cardiovascular events (*B* −12.55; $P<.01$), prolonged duration of dialysis (*B* −1.23; $P<.01$) and a higher BMI score (*B* −0.51; $P<.05$). A higher level of participation was associated with advanced levels of educational status ($B_{\text{upper sec}}$ 9.32, $P<.01$; B_{tertiary} 12.98, $P<.01$). Patients living with children had a higher level of participation compared with cohabiting patients without children (*B* 6.47; $P<.01$). Living donation (*B* 10.50; $P<.01$), peritoneal dialysis as pretransplantation renal replacement

TABLE 2. Clinical characteristics at the time of interview (n=239)

Characteristic	Mean ± SD or n (%)
Primary renal disease	
Glomerulonephritis	96 (40.2)
Renal vascular disease	19 (7.9)
Polycystic renal disease	45 (18.8)
Diabetes mellitus	5 (2.1)
Other/unknown cause	74 (31.0)
Type of comorbidity	
Diabetes mellitus	37 (15.5)
Cardiovascular events	47 (19.7)
Type of transplantation	
Cadaveric	189 (79.1)
Living	50 (20.9)
Pretransplant dialysis	
None	13 (5.4)
Hemodialysis	108 (45.2)
Peritoneal	118 (49.4)
Duration of dialysis, median years (range)	2.5 (0.3–14.0)
Time since transplantation, years (range)	3.8±1.9 (1.0–7.3)
Duration of initial hospitalization, median days (range)	23.5 (13–85)
Follow-up hospitalization	101 (42.3)
Frequency, median (range)	1 (1–7)
Acute allograft rejection	95 (37.7)
Renal allograft function	
Estimated GFR, mL/min/1.73 m^2 (range)	46.0±14.0 (16.1–81.0)
24-hour creatinine clearance, mL/min (range)	63.5±21.0 (21–129)
Hemoglobin, mmol/L (range)	8.6±1.0 (5.6–12.7)
Hematocrit, % (range)	41.1±4.7 (27–55)
Serum albumin, g/L (range)	40.9±3.2 (29–47)
BMI, kg/m^2 (range)	26.4±4.3 (15.4–41.3)
BMI	
<25.0	100 (41.8)
25.0–29.9	90 (37.7)
≥30.0	49 (20.5)

GFR, glomerular filtration rate; BMI, body mass index.

therapy (*B* 4.68; $P<.05$), a better renal allograft function (*B* 0.24; $P<.01$) and a higher serum albumin (*B* 1.15; $P<.01$) were also associated with higher levels of participation. Sex, diabetes mellitus, time since transplantation, initial and follow-up hospitalization, rejection and hemoglobin were not associated with participation.

After adjustment for age, sex and educational status the effect of cardiovascular events (*B* −7.05; $P<.01$) and type of transplantation (living *B* 6.05; $P<.01$) remained. The effect of renal function however weakened (*B* 0.14; $P<.05$) and no associations were observed for living arrangement, type and duration of dialysis, serum albumin and BMI. Adjustment for age, sex and educational status resulted in a significant positive association between time since transplantation (*B* 0.99; $P<.05$) and obligatory participation.

Multivariate analysis, including adjustment for age, sex and educational status, resulted in a model (*F* 15.87; $P<.01$; R^2 0.36) with significant associations for four variables (Table 3). Age was negatively associated with the outcome, indicating a lower level of obligatory participation with advanced age. Also less participation was observed for patients with a history of cardiovascular events. Time since transplantation showed a positive association, indicating a higher level of participation as time passes. Type of transplantation showed a higher level of participation for living donation. The standardized regression coefficients showed that age mostly affected the outcome of obligatory participation, whereas the effects of cardiovascular events, type of transplantation and time since transplantation were comparable. There were no significant interaction effects.

Explanatory Factors of Participation in Leisure Activities

Results of univariate regression analysis of diversity of leisure activities demonstrated an association between a less diverse pattern of leisure activities and advanced age (*B* −0.02; $P<.05$), the presence of cardiovascular events (*B* −0.74; $P<.01$), prolonged duration of dialysis (*B* −0.11; $P<.05$) and prolonged initial hospitalization (*B* −0.02; $P<.05$). High diversity of leisure activities was associated with advanced levels of educational status ($B_{\text{upper sec}}$ 0.87, $P<.05$; B_{tertiary} 0.82, $P<.05$), living donation (*B* 0.65; $P<.05$), and peritoneal dialysis as pretransplantation renal replacement therapy (*B* 0.49; $P<.05$). Sex, living arrangement, diabetes mellitus, time since transplantation, follow-up hospitalization, rejection, hematology, and biochemistry parameters were not associated with diversity of leisure activities.

After adjustment for age, sex and educational status the above-mentioned effects of clinical factors were not statistically significant anymore. Multivariate analysis—including adjustment for age, sex, and educational status—did not re-

TABLE 3. Multivariate regression analysis of total time spent on obligatory activities on demographic and clinical characteristics (n=239)

	β	*B*	95% CI		*P* value
Age	−0.41	−0.51	−0.65	−0.37	<0.001
Sex (reference: male)					
Female	−0.07	−2.12	−5.52	1.29	0.22
Educational status (reference: primary)					
Lower secondary	−0.05	−1.57	−6.50	3.36	0.53
Upper secondary	0.02	0.84	−4.39	6.07	0.75
Tertiary	0.10	4.23	−1.93	10.38	0.18
Cardiovascular events	−0.17	−6.93	−11.49	−2.38	0.003
Type of transplantation (reference: cadaveric)					
Living	0.17	6.65	2.38	10.93	0.002
Time since transplantation	0.16	1.33	0.42	2.23	0.004

β, standardized regression coefficient; *B*, regression coefficient; CI, confidence interval.

sult in a significant explanatory model of diversity of leisure activities.

Explanatory Factors of Perceived Change in Participation

Results of univariate logistic regression showed an association between a positive change, i.e. an increase, in participation after transplantation and younger age (odds ratio [OR] 0.97; $P<.05$), and an association with higher levels of education ($OR_{lower\ sec}$ 2.63, $P<.05$; $OR_{upper\ sec}$ 2.87, $P<.05$; $OR_{tertiary}$ 7.33, $P<.01$). Furthermore, living donation (OR 3.92; $P<.05$), shorter duration of initial hospitalization (OR 0.98; $P<.05$), a better renal allograft function (OR 1.03; $P<.05$) and a higher serum albumin level (OR 1.10; $P<.05$) were associated with an perceived increase in participation after transplantation. However, after adjustment for age, sex and educational status these effects were not statistically significant, although type of donation (OR 3.00; $P=0.052$) was close. Multivariate analysis did not result in a significant explanatory model of perceived change in participation after transplantation.

DISCUSSION

Aim of this study has been to examine the influence of clinical factors on social outcome, measured as participation in obligatory activities (i.e. employment, education, household tasks) and leisure activities. Multivariate regression analysis showed a decreased level of obligatory participation for cadaveric transplantation, comorbidity (history of cardiovascular events) and a shorter follow-up after kidney transplantation. Besides these clinical factors, age as demographic factor was negatively associated with obligatory participation and with diversity of leisure activities as well. However, clinical factors in addition to age, gender and educational status did not contribute to the explanation of diversity of leisure activities.

The measurement of self-reported change in overall social participation after transplantation showed that although 78% reported an increase, still a considerable percentage of patients do not benefit of the transplantation in terms of an increased social functioning. These results appear to be in contradiction with studies reporting a satisfactory QoL after transplantation (*4*, *6*). However, criticism on methodology used in QoL studies identified shortcomings and questioned the results and optimistic outlook on life after transplantation (*20*).

Definition of social outcome as total time spent weekly on employment, educational activities and household tasks showed various levels of participation in these activities. A substantial percentage (36%) of the study participants spent 16 hr or less per week on these activities. The employment rate of 52.4%, of which only 54.5% worked full-time, in addition to the high percentage reporting work disability indicates that work force participation is a substantial problem in kidney transplantation patients. Markell et al. reported an employment rate of 43% (*11*), Matas et al. of 47% (*10*) and Raiz 58% (*12*). However, comparison of these figures is difficult because of existing differences in defining patients as employed, differences in social legislation between countries and the heterogeneity of study populations (*21*).

Social outcome expressed as participation in leisure activities showed that only 26% of patients practiced sports. Previous research on leisure activities is scarce and results regarding sports are contradictory, as other authors found rates of 15% (*22*) and 74% (*23*). Forty percent involvement in volunteer work, a proportion also found in a study on liver transplantation patients (*24*), demonstrates the desire of patients to interact with others in a beneficial manner and also their ability and initiative to do so.

Multivariate regression analysis showed the importance of adjusting for confounding factors such as age, gender and educational status, as the effects of type and duration of dialysis, serum albumin, and BMI on obligatory participation were no longer significant. Remarkably, duration of dialysis which was expected to be of influence on posttransplantation social functioning, was not found to be a significant factor in the final model, nor was renal allograft functioning. Although this model shows the impact of clinical factors, age was still the most significant factor of obligatory participation. Comparison of these factors with results found in other studies is restricted, because to our knowledge only factors in relation to employment are studied, whereas participation in obligatory activities in the present study also encompasses educational activities and household tasks. The final model explained 36% of the variance in obligatory participation. Apparently, other explanatory factors such as physical, psycho-social or environmental factors may also be of influence.

Multivariate regression of diversity of leisure activities demonstrated no significant associations with clinical factors and as a result did not contribute to the explanation of variation in leisure patterns. This indicates that the variability in diversity of leisure activities is not explained by the variables in the present study. Likewise, multivariate regression of change in participation did not show statistically significant associations for clinical factors, although type of donation ($P=0.052$) may potentially be of influence on self-reported change in participation.

The association between type of transplantation (cadaveric vs. living) and obligatory participation was significant, even after adjustment for other related variables such as age, educational level and comorbidity (cardiovascular events). Patients after living donation were on average 5.9 years younger than patients after cadaveric transplantation, were higher educated (living 62% vs. cadaveric 39% upper secondary or tertiary) and also experienced fewer cardiovascular events (living 8% vs. cadaveric 23%). A tentative explanation may be the pretransplantation selection of highly motivated and socially integrated patients for living donor transplantation. Likely, these patients also may experience the greatest change in participation after transplantation. The positive effect of time since transplantation on obligatory participation may also be explained by selection due to survival of recipients with a favorable general health condition or allograft function. On the other hand Lumsdaine et al. (*25*) suggest that benefits in social domains of quality of life may become more apparent in the long term.

Concerning the generalizability of our study findings to kidney transplantation patients in other settings, it should be

noted that the present study examined patients between 1 to 7 years after transplantation. As a result patients short-term (<1 yr) and long-term (>7 yrs) after transplantation were not included. In the absence of consensus regarding the definition of comorbidity (*26*) our study considered the presence of diabetes mellitus (DM) as a relevant comorbid disease because DM in general is associated with worse health outcomes. In addition, we assessed the history of cardiovascular events, based on the opinion that treatment of cardiovascular disease is an objective measure of severity of the underlying disorder and as a consequence may have a potential impact on social functioning. The primary diagnosis of diabetes mellitus (DM) was present in only 2.1% of the patients, a substantial deviation from the percentages between 7% and 33% reported in other studies (*3*, *10*, *11*), but is in accordance with the low incidence of DM as primary renal disease in the Netherlands when compared to other countries (*27*). Moreover, combined kidney-pancreas transplant recipients were excluded in our study. Thirteen percent of the study group developed posttransplantation de novo DM. On average diabetic patients participated 3.4 hr less weekly than non-diabetics. Nevertheless, we found no statistically significant worse outcomes, which may be due to the small number of patients with DM. The fact that the majority of the respondents received peritoneal dialysis prior to transplantation may seem surprising, because hemodialysis is not only worldwide but also in the Netherlands the prevalent mode of therapy (*27*). However, selection regarding favorable eligibility for transplantation of patients on peritoneal dialysis may be an explanation for this finding. The 21% living donor transplantations corresponds with the increase in proportion of living donations from 9% in 1991 to 31% in 2001, the time span our study group underwent transplantation (Dutch End Stage Renal Disease Registry, www.renine.nl). Proportions ranging from 11% to 57% are reported in previous studies (*3*, *10*, *11*).

The present study examined clinical factors associated with social functioning after successful primary kidney transplantation. The substantial sample size, the follow-up of a cohort of patients transplanted between 1996 and 2001, the response rate of 80% and multivariate analysis are strengths of the present study. However, the cross-sectional design limits the inferences of causality and the identified associations of clinical factors must not be misconceived as causal factors.

To conclude, social outcome after kidney transplantation, measured as participation in obligatory activities (i.e. employment, education, household tasks), is influenced by clinical factors such as type of transplantation (cadaveric vs. living), comorbidity (cardiovascular events) and time since transplantation. No statistically significant clinical factors could be identified for the diversity of participation in leisure activities and change in participation. This study can be considered as the first comprehensive study in the social domain of quality of life and as a result is the first step to fill in the gap of knowledge with respect to participation in society of patients after kidney transplantation.

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