Quality of Life in Patients on Chronic Dialysis: Self-Assessment 3 Months After the Start of Treatment

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● The aim of the present multicenter study was to assess quality of life of Dutch dialysis patients 3 months after the start of chronic dialysis treatment. The quality of life was compared with the quality of life of a general population sample, and the impact of demographic, clinical, renal function, and dialysis characteristics on patients' quality of life was studied. New end-stage renal disease (ESRD) patients who were started on chronic hemodialysis or peritoneal dialysis in 13 dialysis centers in The Netherlands were consecutively included. Patients' self-assessment of quality of life was measured by the SF-36, a 36-item Short Form Health Survey Questionnaire encompassing eight dimensions: physical functioning, social functioning, role-functioning physical, role-functioning emotional, mental health, vitality, bodily pain, and general health perceptions. One hundred twenty hemodialysis and 106 peritoneal dialysis patients completed the SF-36. Quality of life of hemodialysis and peritoneal dialysis patients was substantially impaired in comparison to the general population sample, particularly with respect to role-functioning physical and general health perceptions. Mean role-functioning physical and general health perceptions scores of the hemodialysis patients corresponded with the lowest scoring 8% and 12%, respectively, of the reference group. Mean role-functioning physical and general health perceptions scores of the peritoneal dialysis patients corresponded with the lowest scoring 10% and 12%, respectively, of the reference group. Hemodialysis patients showed lower levels of quality of life than peritoneal dialysis patients on physical functioning, role-functioning emotional, mental health, and pain. However, on the multivariate level, we could only demonstrate an impact of dialysis modality on mental health. A higher number of comorbid conditions, a lower hemoglobin level, and a lower residual renal function were independently related to poorer quality of life. The variability of the SF-36 scores explained by selected demographic, clinical, renal function, and dialysis characteristics was highest for physical functioning (29.7%). Explained variability of the other SF-36 dimensions ranged from 6.9% for general health perceptions to 15.4% for vitality. We conclude that quality of life of new ESRD patients is substantially impaired. Comorbid conditions, hemoglobin, and residual renal function could explain poor quality of life only to a limited extent. Further research exploring determinants and indices of quality of life in ESRD patients is warranted. From a clinical perspective, we may conclude that quality of life should be considered in the monitoring of dialysis patients.

INDEX WORDS: End-stage renal disease; chronic dialysis; quality of life.

HEALTH-RELATED quality of life is a multidimensional, patient-centered, dynamic concept encompassing physical health and symptoms, functional status, mental well-being, and social functioning.[1] Studies comparing quality of life between dialysis patients and general population samples have not yielded conclusive results. Some studies have found quality of life of dialysis patients to be inferior to quality of life of the general population[2-6]; others,[7-9] however, have not observed a difference. In addition, comparisons of quality of life between hemodialysis and peritoneal dialysis did not indicate one of these to be clearly superior.[10-15] These inconsistent results may have been caused by small sample sizes and the cross-sectional study design of these studies. The latter leads to heterogeneous treatment groups with respect to the duration of therapy and a divergent therapy history. In addition, insufficient control of background characteristics and the use of different definitions and assessment methods of quality of life may have attributed to the inconsistent results. Finally, it recently became clear that use of recombinant human erythropoietin significantly improves quality of life.[16,17] Therefore, the results of stud-

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ies conducted before the availability of erythropoietin that did not adjust for the level of anemia are questionable.

Quality-of-life assessment in reasonable numbers of chronic dialysis patients with a multidimensional, reliable, and validated instrument is needed. In studies from the United States, the United Kingdom, and The Netherlands, the 36-item Short Form Health Survey Questionnaire (SF-36) has been found to satisfy these requirements.[18-21] Moreover, the SF-36 recently has been shown to be applicable to dialysis patients.[2-5] However, these latter studies were conducted in limited patient groups, and no adjustment was made for patient and dialysis characteristics.

The aim of the present multicenter study was to assess quality of life, using the SF-36, of Dutch patients with end-stage renal disease (ESRD) who were newly started on chronic dialysis treatment. The quality of life of these patients was compared with the quality of life of a general population sample, and demographic, clinical, renal function, and dialysis characteristics, associated with quality of life, were identified.

PATIENTS AND METHODS

Patients and Procedures

Between October 1, 1993, and April 1, 1995, new ESRD patients aged ≥18 years who were started on chronic hemodialysis or peritoneal dialysis in 13 Dutch dialysis centers were consecutively included. These 13 dialysis centers comprise 27% of the total number of dialysis centers that treat adult patients in The Netherlands.

The following major categories of data were analyzed: demographic, clinical, renal function, dialysis, and quality of life. These data were collected from each subject 3 months after the start of chronic dialysis treatment. The choice for performing all measurements at 3 months was made because the mode of dialysis treatment usually has stabilized by this time. Hence, measurements at 3 months are less likely to be influenced by metabolic instability than at the initiation of treatment.

Demographic, Clinical, Renal Function, and Dialysis Characteristics

Demographic variables studied were age, sex, marital status, level of education, and employment status. Clinical characteristics comprised primary kidney disease, comorbidity, use of erythropoietin, hemoglobin, and serum albumin concentration. Renal function and dialysis characteristics comprised residual renal function, dose of dialysis in terms of dialysis-related urea clearance, and protein catabolic rate (PCR).

Primary kidney disease was classified according to the European Dialysis and Transplantation Association-European Renal Association registry. "Renal vascular disease" refers to renal vascular disease excluding vasculitis and comprises the following subcategories: renal vascular disease, type unspecified; renal vascular disease due to malignant hypertension (no primary renal disease); renal vascular disease due to hypertension (no primary renal disease); and renal vascular disease, classified. Comorbidity was defined in terms of presence of nonrenal diseases at the time of commencing renal replacement therapy or in the medical history. It was divided into three major categories: cardiovascular comorbidity, diabetes mellitus, and malignancy. In addition, the total number of comorbid conditions was calculated for each patient.

Residual renal function (residual glomerular filtration rate [rGFR]) was calculated as the mean renal clearance of urea and creatinine. The removal of urea by dialysis was expressed as the dialysis Kt/V_{urea}. In the hemodialysis patients, dialysis Kt/V_{urea} was calculated by the equation of Daugirdas.[22] To obtain the weekly Kt/V_{urea}, this number was multiplied by the number of treatments per week. The volume of distribution of urea (V) was estimated as 55% of body weight. This estimation also was used in all other calculations. In the peritoneal dialysis patients, dialysis Kt/V_{urea} was calculated as the peritoneal Kt/V_{urea} per 24 hours multiplied by 7. The normalized PCR (nPCR) was calculated according to Daugirdas[22] in the hemodialysis patients. In the peritoneal dialysis patients, it was calculated as normalized protein nitrogen appearance (nPNA) according to the equation of Bergström et al.[23] The nPCR and nPNA reflect the protein intake in metabolically stable patients. The hemodialysis patients collected all urine during an interdialytic interval. Blood samples were taken before and after the dialysis preceding this interval and at the end of this interval. The peritoneal dialysis patients collected urine and dialysate during a 24-hour period. A blood sample was taken during the collection period. Urea and creatinine in the plasma, urine, and peritoneal dialysate were determined.

Quality-of-Life Assessment

Patients' self-assessment of quality of life was measured by the MOS SF-36.[18-21] The SF-36 is a generic multidimensional instrument consisting of eight multi-item scales representing (1) physical functioning (extent to which health limits physical activities, such as self-care, walking, and climbing stairs), (2) social functioning (extent to which physical health or emotional problems interfere with normal social activities), (3) role-functioning physical (extent to which physical health interferes with work or other daily activities), (4) role-functioning emotional (extent to which emotional problems interfere with work or other daily activities), (5) mental health (general mental health, including depression, anxiety, behavioral-emotional control, and general positive effect), (6) vitality (feeling energetic and full of pep rather than tired and worn out), (7) bodily pain (intensity of pain and effect of pain on normal work, both inside and outside the home), and (8) general health perceptions (personal evaluations of current health, health outlook, and resistance to illness). The SF-36 scores of our ESRD population were compared with the SF-36 scores of a general Dutch population sample (n = 1,063; age range, 18 to 89 years; 35% male) as described by van der Zee et al.[21] SF-36 scores were transformed to a scale of

Table 1. Dialysis Modality in Relation to Demographic, Clinical, and Dialysis Characteristics

	Hemodialysis (n = 120)	Peritoneal Dialysis (n = 106)
Demographic		
Age (yr), mean ± SD (range)*	59.3 ± 15.5 (18-86)	52.3 ± 14.0 (20-79)
Male	57%	65%
Married†	68%	79%
Employed*	16%	38%
Educational status‡		
Low	64%	52%
Intermediate and high	36%	48%
Clinical		
Primary kidney disease		
Glomerulonephritis	10%	18%
Interstitial nephritis	18%	13%
Cystic kidney disease	13%	10%
Renal vascular, excluding vasculitis	25%	23%
Diabetes mellitus	13%	15%
Other multisystem diseases	8%	9%
Others/unknown	13%	12%
No. of comorbid conditions, mean ± SD (range)	2.2 ± 1.5 (0-8)	1.9 ± 1.4 (0-7)
Type of comorbidity		
Cardiovascular	73%	73%
Malignancy*	10%	3%
Diabetes mellitus	16%	19%
Erythropoietin*	83%	67%
Hemoglobin (g/dL),* mean ± SD (range)	9.9 ± 1.4 (5.9-14.0)	11.2 ± 1.4 (7.6-14.3)
Serum albumin (g/dL), mean ± SD (range)	3.8 ± 0.5 (2.7-4.6)	3.7 ± 0.6 (2.2-5.1)
Renal function and dialysis adequacy, mean ± SD (range)		
Residual GFR (mL/min)	3.1 ± 2.6 (0.0-14.6)	3.3 ± 2.4 (0.0-10.5)
Dialysis Kt/V_{urea}*	2.7 ± 0.9 (0.6-5.5)	1.5 ± 0.4 (0.6-2.6)
nPCR/nPNA (g/kg/d)*	1.0 ± 0.3 (0.5-1.7)	1.3 ± 0.4 (0.7-2.4)

* $P < 0.05$, hemodialysis *v* peritoneal dialysis.

† Patients living together included.

‡ Low: primary school, low-level vocational training, low-level secondary school; intermediate and high: high-level secondary school, intermediate and high vocational training, university.

0 to 100, a higher score indicating a better quality-of-life state.

Statistical Analysis

Either *t*-statistics or chi-square statistics (Fisher's exact test, when appropriate) were applied for independent group comparisons. Differences between the mean SF-36 scores of the hemodialysis and peritoneal dialysis patients with those of the reference population were converted to mean standard scores. Standard scores were calculated by dividing the difference between a given mean SF-36 score of the dialysis group and the mean SF-36 score in the reference group by the standard deviation of SF-36 scores in the reference group. The standard scores indicate how many standard deviations the observed SF-36 scores of dialysis patients fall below the scores of the reference population (with the scores of the reference population set at zero). Univariate relationships between demographic, clinical, renal function, and dialysis characteristics on the one hand, and SF-36 scores on the other hand were assessed by Student's *t*-test, one-way ANOVA, or Pearson's correlation coefficient. As values of dialysis-related urea clearance are not equal by technique origin, univariate relations were assessed for each treatment modality separately. All significant characteristics (set at $P = 0.20$) identified from univariate analysis were studied with multiple linear regression (with a stepwise forward selection strategy), using the F-statistics with $P = 0.05$ as the criterion level for selection. To search for violations of necessary assumptions in multiple regression, normal plots of the residuals of the regression models were produced. Furthermore, the influence of outliers (Cook's distances) and possible presence of collinearity (Tolerance/Variance Inflation Factor statistics) were assessed. All analyses were made with SAS for Windows 6.10 (SAS Institute Inc, Cary, NC).

RESULTS

Characteristics of Participants and Nonparticipants

Two hundred fifty ESRD patients were available for the study. Of these patients, 226 (90.4%)

Table 2. Mean (± SD) SF-36 Scores for the General Population Sample and the Hemodialysis and Peritoneal Dialysis Patients

Group	No.	PF*†	SF*	RP*	RE*†	MH*†	VT*	BP*†	GH*
Hemodialysis	120	50.7 ± 30.8	63.1 ± 29.6	28.6 ± 37.2	52.5 ± 45.4	63.3 ± 20.5	48.9 ± 24.0	63.7 ± 27.3	43.0 ± 20.2
Peritoneal dialysis	106	60.9 ± 24.7	68.9 ± 25.8	31.7 ± 38.3	63.8 ± 39.8	72.2 ± 16.9	51.6 ± 17.9	74.2 ± 23.2	46.4 ± 20.5
General population sample	1,063	82.0 ± 23.2	86.9 ± 20.5	79.4 ± 35.5	84.1 ± 32.3	76.8 ± 18.4	67.4 ± 19.9	79.5 ± 25.6	72.7 ± 22.7

Abbreviations: PF, physical functioning; SF, social functioning; RP, role-functioning physical; RE, role-functioning emotional; MH, mental health; VT, vitality; BP, bodily pain; GH, general health perceptions.

* $P < 0.05$, hemodialysis and peritoneal dialysis patients compared with the reference population.

† $P < 0.05$, hemodialysis compared with peritoneal dialysis patients.

completed the SF-36. Twenty-four patients did not complete the SF-36 because they did not speak the Dutch language sufficiently and/or were not able to read and fill out the questionnaire by themselves. Except for a lower proportion of males and a lower hemoglobin level ($P < 0.05$), nonparticipants were comparable to the participants. In the participating hemodialysis patients, mean age was slightly higher, employment rate was lower, prevalence of malignancy was higher, dialysis-related Kt/V_{urea} was higher, and nPCR was lower than in the participating peritoneal dialysis patients ($P < 0.05$; Table 1).

Comparison of Quality of Life Between the End-Stage Renal Disease Patients and a General Population Sample

In Table 2, mean SF-36 scores of the ESRD patients according to treatment modality and the general population sample are shown. Both hemodialysis and peritoneal dialysis patients perceived their quality of life as worse than the general population sample on all quality-of-life dimensions, particularly on the role-functioning physical and general health perceptions dimensions. Figure 1 shows the differences between the dialysis patients and the reference group expressed in standard scores. Mean role-functioning physical scores of the hemodialysis and peritoneal dialysis patients were 1.4 and 1.3 SD below the values of the reference group. Mean general health perception scores of hemodialysis and peritoneal dialysis patients were 1.3 and 1.2 SD below the values of the reference group. In other words, mean role-functioning physical scores of the hemodialysis patients and the peritoneal dialysis patients corresponded to the lowest scoring 8% and 10% of the reference group, respectively. Similarly, mean general health perceptions scores of the hemodialysis and peritoneal dialysis patients corresponded to the lowest scoring 10% and 12% of the reference population, respectively. Hemodialysis patients demonstrated an impaired quality of life compared with peritoneal dialysis patients with respect to physical

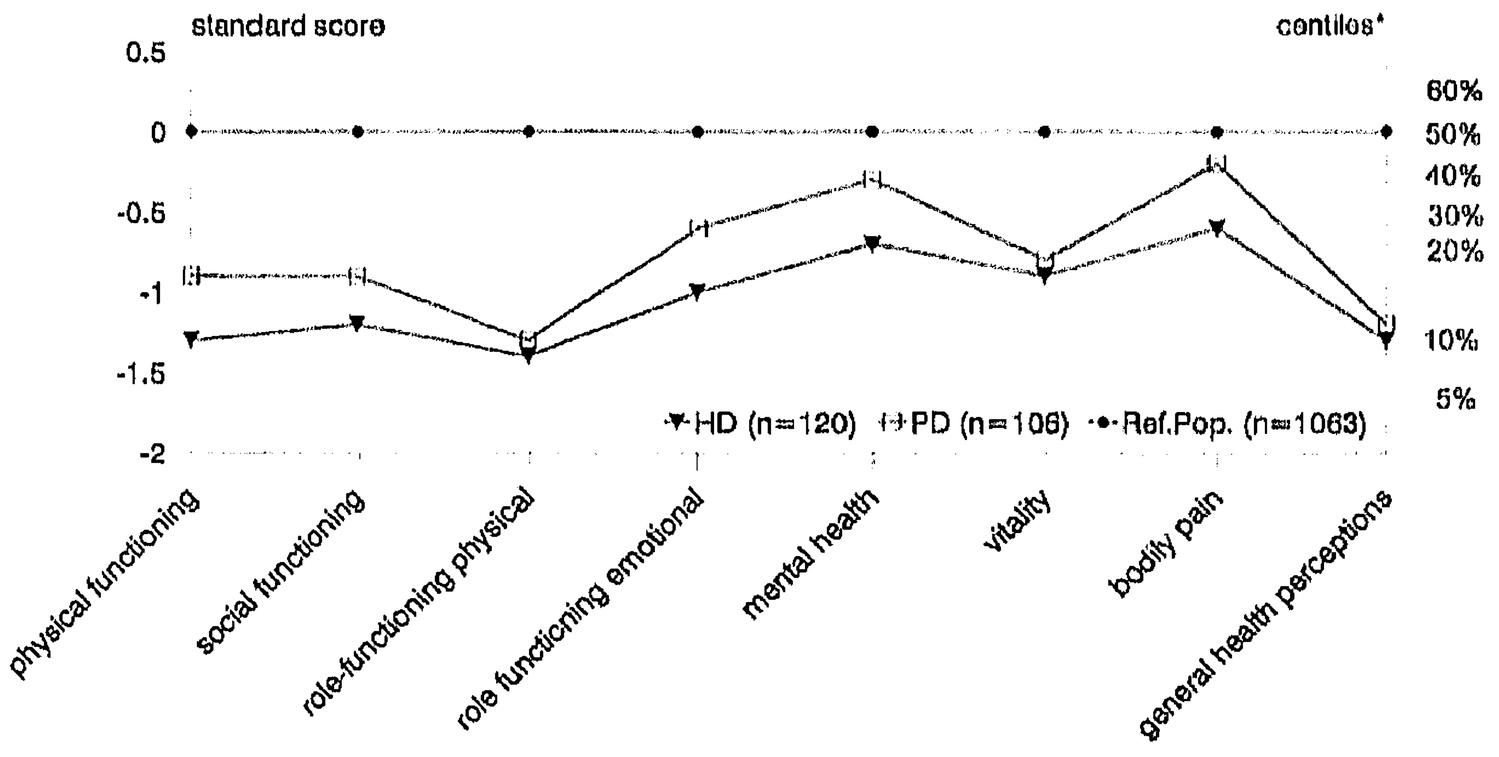

Fig 1. Differences in SF-36 scores between the dialysis patients and the reference group expressed in mean standard scores. *Centiles of the reference population: for example, X% of the reference population falls below Xth centile and the remaining members fall above that point. Significance values are similar to those in Table 2.

Table 3. Mean SF-36 Scores by Demographic, Clinical, and Dialysis Characteristics

	PF	SF	RP	RE	MH	VT	BP	GH
Sex								
Male				61.0				
Female				52.9				
Educational level								
Low	51.6*			52.7*	64.6*	48.2		43.3
Intermediate/high	61.1			64.9	71.5	52.9		46.4
Employment status								
Employed	70.2*	74.4*	38.6*	74.6*	73.6*	55.1*	72.5	49.1*
Unemployed	50.3	62.8	27.0	52.1	65.3	48.4	67.2	43.0
Primary kidney disease								
Glomerulonephritis	60.3	68.1*				50.0*		
Interstitial nephritis	58.4	59.6				51.3		
Cystic kidney	61.1	73.1				54.4		
Renal vascular	51.6	59.9				43.1		
Diabetes mellitus	44.3	68.8				48.5		
Other multisystem	55.8	57.9				50.6		
Others/unknown	60.9	77.2				59.7		
Diabetes mellitus								
Yes	40.8*							39.9
No	58.6							45.6
Cardiovascular comorbidity								
Yes	52.8*		27.6	55.4		48.0*		42.6*
No	63.0		36.7	64.4		56.1		50.0
Malignancy								
Yes	43.3	54.5					55.7*	
No	56.5	66.6					69.5	
Erythropoietin								
Yes	53.7							43.5
No	61.1							47.9
Dialysis modality								
Hemodialysis	50.7*	63.1		52.5*	63.3*		63.7*	
Peritoneal dialysis	56.5	68.9		63.8	72.2		74.2	

NOTE. Only characteristics significant at the $P \leq 0.20$ level are shown. See Table 2 for abbreviations.
* $P < 0.05$.

functioning, role-functioning emotional, mental health, and bodily pain (Table 2).

Associations Between Demographic, Clinical, Renal Function, and Dialysis Characteristics and Quality of Life

Univariate associations between SF-36 scores and demographic, clinical, renal function, and dialysis characteristics are shown in Tables 3 and 4. Of the demographic characteristics, higher age and unemployment were associated with lower levels of quality of life on most subdimensions. None of the SF-36 scores differed between married and unmarried patients. With respect to the clinical characteristics, a lower hemoglobin and an increasing number of comorbid conditions correlated with decreasing quality-of-life scores. Patients with cardiovascular comorbidity scored lower on physical functioning, vitality, and general health perceptions than patients without this condition. Diabetes mellitus was associated with worse physical functioning. Patients with malignant comorbid conditions reported higher levels of pain than patients without malignancy. Patients with renal vascular disease or multisystem disease as the primary cause of renal failure reported lower levels of social functioning and vitality than patients with other underlying causes. Of parameters of renal function and dialysis adequacy, a lower rGFR correlated with poorer quality of life on five subdimensions. The nPCR/nPNA only correlated with worse physical func-

Table 4. Pearson's Correlation of SF-36 Scores With Demographic, Clinical, and Dialysis Characteristics

	PF	SF	RP	RE	MH	VT	BP	GH
Total population								
Age (yr)	−0.44*	−0.15*	−0.19*	−0.22*	−0.14*	−0.13*	−0.12*	
No. of comorbid conditions	−0.44*	−0.12	−0.17*	−0.22*	−0.13*	−0.19*	−0.21*	−0.23*
Serum albumin	0.21*		0.12					
Hemoglobin	0.17*	0.18*	0.12	0.15*	0.18*	0.15*	0.14*	
rGFR		0.17*	0.17*	0.22*	0.18*	0.18*		
Hemodialysis								
Dialysis Kt/V_{urea}	−0.14			−0.15				
nPCR	0.18	0.18	0.14			0.20*		
Peritoneal dialysis								
Dialysis Kt/V_{urea}								0.16
nPNA	0.38*			0.14		0.14	0.19	0.16

NOTE. Only characteristics significant at the $P \leq 0.20$ level are shown. See Table 2 for abbreviations.
* $P \leq 0.05$.

tioning in peritoneal dialysis patients and with lower vitality in hemodialysis patients. No significant univariate associations were observed between dialysis Kt/V_{urea} and quality-of-life subdimensions.

After introduction of the most important univariate associations ($P \leq 0.20$) in multivariate regression analysis, many of the observed relationships disappeared (Table 5). However, a higher number of comorbid conditions, a lower hemoglobin, and a lower rGFR remained associated with poorer quality-of-life scores. With respect to dialysis modality, an effect on mental health persisted in favor of peritoneal dialysis. In addition, on the multivariate level, higher age and unemployment remained only related to lower levels of quality of life on two subdimensions. Primary kidney disease showed only an association with lower vitality, attributable to patients with renal vascular disease. Finally, lower nPCR/nPNA levels were associated with worse quality of life with respect to physical functioning and bodily pain. The selected characteristics explained only a small proportion of the variability (R^2) of the SF-36 scores: 6.9% to 29.7% (Table 5).

Table 5. Forward Stepwise Regression Models* to Explain Quality-of-Life Dimensions in Chronic Dialysis Patients (Standardized Regression Coefficients†), Partial Explained Variance (Partial R^2‡), and Total Explained Variance (Total R^2)

	PF	SF	RP	RE	MH	VT	BP	GH
Standardized regression coefficient (partial R^2)								
Age	0.29 (10.9%)		0.13 (4.2%)					
Employment status		0.14 (2.0%)		0.10 (0.3%)				
Primary kidney disease						0.15 (2.1%)		
No. of comorbid conditions	0.20 (6.3%)		0.14 (1.7%)	0.15 (2.6%)	0.15 (2.3%)	0.21 (6.2%)	0.17 (3.0%)	0.26 (6.9%)
Hemoglobin		0.23 (6.1%)		0.13 (1.7%)		0.15 (2.5%)		
nPCR/nPNA	0.20 (3.5%)						0.18 (4.4%)	
Residual GFR		0.15 (2.8%)	0.18 (2.5%)	0.21 (3.3%)	0.18 (2.0%)	0.20 (4.6%)		
Dialysis modality					0.22 (6.0%)			
Total R^2	29.7%	10.9%	8.4%	13.9%	11.2%	15.4%	7.4%	6.9%

NOTE. See Table 2 for abbreviations.
* No violations of necessary assumptions in multiple regression analysis could be detected (examination of residuals, detection of outliers, measures of collinearity).
† A standardized regression coefficient is computed by dividing a parameter estimate by the ratio of the sample standard deviation of the dependent variable to the sample standard deviation of the regressor.
‡ R^2 is the percentage of the total variation of the dependent variable score (SF-36 dimension) that is explained by the independent variables together. Partial R^2 is the percentage variance in the dependent variable score that is explained by the single independent variable adjusted.

DISCUSSION

New ESRD patients' assessment of quality of life was observed to be lower than that of a general population sample on all distinguished quality-of-life dimensions. Because the mean age of the reference group (44 years) was lower and because SF-36 scores are negatively related with age,[21] this might have resulted in a slight overestimation of the difference in quality of life. When scores of the ESRD population were compared with those of the subgroup of the reference population aged 55 to 64 years (n = 140), scores of both hemodialysis and peritoneal dialysis patients were still significantly lower, with the exception of bodily pain in peritoneal dialysis patients. In agreement with our finding, some recent studies[2-5] observed SF-36 scores of ESRD patients to be lower than scores of a general population sample. On the contrary, other investigators[7-9] have reported a comparable quality of life for ESRD patients and general population samples.

Multivariate analysis showed that a higher number of comorbid conditions, a lower hemoglobin level, and a lower residual renal function (rGFR) were the most important independent explanatory factors for poorer quality of life. The present study is, to our knowledge, the first to link residual renal function and amount of dialysis to quality of life. The finding that patients with a lower rGFR reported a worse quality of life, while no effect of dialysis Kt/V_{urea} could be demonstrated, might suggest that clearance achieved by the native kidneys is superior to clearance obtained by dialysis. This could be caused by the fact that more rGFR will be accompanied by better tubular secretion of, for example, organic acids and a better preserved hormonal function. In addition, deteriorating residual renal function may give rise to a worse perception of quality of life by a growing awareness of complete dependence on dialysis. Our finding of a negative influence of a higher number of comorbid conditions and a lower level of hemoglobin concentration on quality of life is in accordance with former studies.[8,10,16,17]

Notably, the total explained variation of quality of life by the selected characteristics was small. This suggests that quality of life is determined by many more factors than the ones we have assessed in this study. It is reasonable to assume that the patients' level of quality of life is a result of a complex interaction of disease outcome, personal traits, coping behavior, social support, and quality of the care received.

Comparison of quality of life between the present dialysis groups indicated peritoneal dialysis to be superior only with respect to mental health. However, the explained variation by dialysis modality was only 6%. The similarity of both dialysis groups with respect to quality of life may be due to the fact that all patients had just started on dialysis treatment. It can be postulated that in the early phase, perceived quality of life is more affected by the dependence on dialysis treatment than by the modality of treatment. Comparison of our results with previous comparisons of quality of life between different dialysis modalities did not yield a conclusive answer. In two large cross-sectional studies, no differences in perceived quality of life were detected between hemodialysis and peritoneal dialysis patients, after adjustment for some demographic characteristics, comorbidity status, and duration of treatment.[8,10] In addition, Tucker et al[14] found no difference in perceived quality of life between peritoneal dialysis and hemodialysis patients. Simmons et al,[6] however, observed peritoneal dialysis patients to report a more favorable outcome than hemodialysis patients in terms of physical well-being, emotional adjustment, and vocational rehabilitation. Additionally, in a comparison of quality of life of peritoneal dialysis and hemodialysis patients, matched for age, sex, race, diabetes, and duration of renal replacement therapy (regardless of modality), peritoneal dialysis appeared to be somewhat superior with regard to psychological and social rehabilitation.[15] On the other hand, Griffin et al[12] observed that hemodialysis patients were not more impaired in terms of functional status and showed better psychological adjustment compared with peritoneal dialysis patients. However, hemodialysis patients had received dialysis treatment for a significantly longer period of time than the peritoneal dialysis patients (52 months *v* 29 months), and therefore may have had more time to adjust their lifestyle and emotional reactions.

The inconsistent results in the literature may be explained by cross-sectional samples, small sample sizes, and improper adjustment for case

mix. Although some of the described studies adjusted for demographic variables, comorbidity, and length of dialysis therapy, heterogeneity regarding prior history of renal replacement therapy, like therapy turnover, has been hardly taken into account. It may be easily understood that a history of little or many therapy failures determines one's current assessment of quality of life. Moreover, application of different perspectives of quality of life assessed with a variety of quality-of-life instruments can also explain this inconclusive picture. This is illustrated by Deniston et al,[24] who assessed quality of life of a cross-sectional sample of 742 ESRD patients from Michigan with 19 different quality-of-life instruments. Depending on the choice of instrument, different conclusions were reached about the relationship between demographic characteristics and quality of life.

In conclusion, the present findings indicate that in new ESRD patients, quality of life is substantially impaired. Comorbidity, hemoglobin level, and residual renal function could explain variations in quality of life only to a limited extent. Therefore, other potential determinants of quality of life should be explored. In addition, health indices other than the SF-36 should be examined. Perhaps we should focus more on disease-targeted indices, such as renal disease and dialysis-related problems as perceived by the patient. Furthermore, longitudinal data are needed to obtain insight into the long-term effects of chronic dialysis treatment on patients' quality of life. We will elaborate on these issues in our future analyses. From a clinical perspective, we conclude that quality-of-life assessment should be considered in the monitoring of a dialyis patient as it seems that quality of life cannot be extrapolated from conventional clinical characteristics.

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