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Health-related quality of life among dialysis patients on three continents: The Dialysis Outcomes and Practice Patterns Study

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Background. Assessing health-related quality of life (HRQOL) can provide information on the types and degrees of burdens that afflict patients with chronic medical conditions, including end-stage renal disease (ESRD). Several studies have shown important international differences among ESRD patients treated with hemodialysis, but no studies have compared these patients' HRQOL. Our goal was to document international differences in HRQOL among dialysis patients and to identify possible explanations of those differences.

Methods. We examined data from the Dialysis Outcomes and Practice Patterns Study (DOPPS), a prospective, observational, international study of hemodialysis patients. We performed a cross-sectional analysis of DOPPS data from the United States, five countries in Europe (France, Germany, Italy, Spain, and the United Kingdom), and Japan. Linear mixed models were used to analyze differences in HRQOL, using the KDQOL-SF™. Norm-based scores were used to minimize cultural response bias. Linear regression analysis was used to adjust for confounding factors. Other variables included demographic variables, comorbidities, primary cause of ESRD, complications of ESRD and treatment, and socioeconomic status.

Results. In all generic HRQOL subscales, patients on all three continents had much lower scores than their respective population norm values. Patients in the United States had the highest scores on the mental health subscale and the highest mental component summary scores. Japanese patients reported better physical functioning than did patients in the United States or Europe, but they also reported the greatest burden of kidney disease. Overall, these differences remained even after adjusting for possible confounders.

Conclusion. On all three continents, ESRD and hemodialysis profoundly affect HRQOL. In the United States, the effects on mental health are smaller than in other countries. Japanese hemodialysis patients perceived that their kidney disease imposes a greater burden, but their physical functioning was significantly higher. Different distributions of socioeconomic factors and major comorbid conditions could explain little of this difference in physical functioning. Other possible factors, such as quality of dialysis and related health care, deserve careful study.

Key words: health-related quality of life, SF-36, KDQOL, end-stage renal disease, hemodialysis.

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Advances in dialysis treatment have contributed to improved survival of patients with end-stage renal disease (ESRD). However, despite improvements in the treatment of ESRD, the level of health-related quality of life (HRQOL) is much lower for these patients than for the general population [1–3]. The assessment of HRQOL can help identify ways to improve the well-being of ESRD patients and potentially identify strategies to prevent adverse outcomes. It has been shown, for example, that HRQOL is a reliable and responsive measure of the effectiveness of renal anemia treatment [4]. Moreover, the evaluation of HRQOL may help identify an individual's risk of death and hospitalization [5–7].

The incidence, prevalence, and distribution of causes of ESRD have been shown to differ among dialysis centers in Japan, Europe, and the United States [8]. Numerous studies have also documented international variation in patient survival, compliance, withdrawal from dialysis, and the patterns of medical practice related to ESRD [9–12]. For example, the survival of ESRD patients is much higher and the withdrawal rate is lower in Japan than in Europe or the United States. [12] To date, however, no studies have compared data on HRQOL of hemodialysis patients in these different regions. In this

paper, we examined data from the Dialysis Outcomes and Practice Patterns Study (DOPPS), a prospective, observational, international study of hemodialysis patients. We sought to evaluate HRQOL among hemodialysis patients in five European countries (France, Germany, Italy, Spain, and the United Kingdom), the United States, and Japan. We also investigated variables that could explain similarities or differences in HRQOL among dialysis patients treated in different countries.

METHODS

Design

This paper is based on cross-sectional observational analyses of data from DOPPS, an international, prospective, observational study of hemodialysis practice patterns and associated outcomes [13, 14]. The study is ongoing in the United States, five countries in Europe (France, Germany, Italy, Spain, and the United Kingdom; known collectively as the Euro-DOPPS countries), and Japan. The study was recently expanded to include Australia, Belgium, Canada, New Zealand, and Sweden, but not enough data have yet been collected from these countries to be included in the present analysis. The DOPPS investigates four major outcomes (mortality, hospitalization, quality of life, and vascular access), using the same questionnaires in each country. The design of the DOPPS has been published previously [13].

Sampling and data collection

The dialysis facilities included in DOPPS are nationally representative and patients are replaced when they die or leave the facilities. Random samples of 20 to 40 hemodialysis patients were selected from each facility. At study entry a medical questionnaire completed by the nurse coordinator in the dialysis unit provided information about the patients and the practice pattern of the facility. Within 60 days of completion of the medical questionnaire, the study participants filled out a patient questionnaire, which included the questions of the Kidney Disease Quality of Life Short Form (KDQOL-SF™). HRQOL data were obtained from approximately 60% of the eligible patients. Translated versions of the KDQOL-SF were used in Japan and the European countries. The questionnaire was generally self-administered; therefore, healthier patients were more likely to complete the questionnaire, which might have biased the sample toward healthier respondents. However, a study of the characteristics of nonrespondents showed no clinically important bias.

Outcome and predictor variables

The KDQOL-SF includes both general measures and measures specific to patients with kidney disease. The general measures were based on questions from the 36-item Short-Form Health Survey (SF-36), developed by Ware and Sherbourne [15]. Previous data support the use of the SF-36 and the KDQOL-SF as research instruments to HRQOL [15–20]. The SF-36 Health Survey was translated into Japanese and many other languages, and national-norm data for Japan and for many other countries are available from the International Quality of Life Assessment project (IQOLA) [21]. The internal consistency and reliability are similar among translations of the SF-36 and the KDQOL-SF [19–29]. Patient responses to the SF-36 questions were used to determine scores for the mental component summary (MCS) and the physical component summary (PCS). The scales for MCS and PCS are derived from eight different subscales: physical functioning role (physical, bodily pain, general health, and vitality) and social functioning role (emotional, and mental health) [30].

The KDQOL-SF includes questions that supplement the SF-36. These additional questions were designed to assess the particular health-related concerns of individuals with kidney diseases and ESRD patients treated by dialysis [16]. The kidney disease component summary (KDCS) score, which corresponds to the MCS and PCS of the SF-36, is derived from 11 subscales: symptoms/problems, effects of kidney disease on daily life, burden of kidney disease, work status, cognitive function, quality of social interaction, sexual function, sleep, social support, dialysis staff encouragement, and patient satisfaction.

We examined scores on all eight subscales of the SF-36 and the 11 subscales related to KDCS. Scores on each of the 11 kidney disease–targeted subscales were examined, as was an average of the 11 scores. Many patients did not answer questions on the sexual-functioning scale, and in those cases the average of kidney disease–targeted scale scores was the average of the remaining 10 scores. The SF-36 and kidney disease–targeted portions of the questionnaire were scored according to the manual by Ware et al [31] and the KDQOL scoring manual [16]. On all scales, the possible scores range from 0 to 100; higher scores indicate more or better functioning, or better quality of life. The summary scales have the same interpretation, but do not span the entire 0 to 100 range.

Demographic and comorbidity data were abstracted from patients' medical records at their entry into the study. This baseline information included age, gender, race, primary cause of ESRD, hematocrit, number of years on dialysis, complications of ESRD, annual household income, employment status, and 15 comorbidities. The comorbidities examined were coronary artery disease, congestive heart failure, other cardiac conditions, hypertension, cerebrovascular disease, peripheral vascular disease, diabetes (primary or contributing), lung disease, cancer (other than skin cancer), HIV/AIDS, gastrointestinal bleeding, neurological disease, recurrent

cellulitis/skin infection, and dyspnea. The common complications of ESRD that were examined included carpal tunnel syndrome, amyloidosis (β_2-microglobulin), and parathyroidectomy.

To take into account the facts that SF-36 scores vary with age and with gender, and that those variations could differ between countries, SF-36 scores were adjusted for each country's general population data. Details of this norm-based scoring have been described elsewhere [22]. Scoring each country's patient data on the basis of that country's general population data is also useful for another reason: If people of different countries or cultures are asked to judge, for example, the painfulness of the same painful stimulus, the average responses could differ between groups. Norm-based scoring can minimize this "cultural response bias." As part of the IQOLA project, SF-36 data were collected from representative samples of the general populations of many countries, including the United States, the Euro-DOPPS countries, and Japan. Norm-based scoring of the questions targeting kidney disease was not possible, because these measures are meaningful to patients only, not to all members of the general population.

Statistical analysis

Analyses included simple means and frequencies for the crude baseline scores. Linear mixed models were used to take into account possible influences on the comparisons of HRQOL scores among continents, including the effects of demographic characteristics, comorbidities, cause of ESRD, hematocrit, time on dialysis, employment status, and annual household income. Sensitivity analyses were conducted to investigate the choice of adjustment variables. Adjustments were made for patient hematocrit and into possible interactions with a patient's working status. We investigated an interaction between working status and continent of residence. Finally, we investigated an interaction between working and age.

We also used the linear mixed models to determine adjusted HRQOL scores and to compare average values among the continents, taking into account clustering at the facility level. Mixed models were also used to compare simple means among the continents, adjusting for facility clustering. All statistical analyses were performed with SAS, version 8.2 [SAS, Inc., Cary, NC, USA].

RESULTS

A total of 7378 patients were included in the analyses, including 2406 patients in Europe, 2087 patients in Japan, and 2885 patients in the United States. Overall, the average age was 59.4 years and the percentage of males was 57.3%. Table 1 lists factors considered likely to be associated with HRQOL. Almost all the comorbid conditions were most common among the United States patients and least common among the Japanese patients. A notable exception was diabetes, which was least common among the Euro-DOPPS patients. Overall, the Japanese patients were most likely to have been receiving dialysis for at least 4 years. High annual incomes were most common among the Japanese patients and least common among the Euro-DOPPS patients. Both unemployment and disability were most common among the United States patients and least common among the Japanese patients.

Table 2 shows the unadjusted and adjusted HRQOL scores for the three DOPPS continents. Japanese patients had the best physical functioning; their scores were markedly higher than those of patients on the other continents, by almost 20 points. The scores for MCS and mental health were significantly higher for patients treated in the United States than in Europe. The scores were also higher for United States patients than for Japanese patients, although this difference was not statistically significant. Together with their apparently high level of physical functioning, Japanese patients reported the greatest burden of kidney disease: Before the scores on the "burden" scale of the KDQOL were adjusted for the factors in Table 1, they were much lower in Japan than in the United States and the Euro-DOPPS countries; after adjustment for the covariates, the differences between continents maintained the same direction and were even larger.

Our sensitivity analyses revealed an interaction between working status and continent of residence. Among the 22 HRQOL scales, this interaction was important for only six scales in Europe and four scales in Japan. Therefore, the interactions were not used as overall adjustments. When significant, the interaction was in the direction of higher HRQOL for working patients in Europe and Japan compared to working patients in the United States. In examining the interaction between working and age, we did not see overwhelming evidence to adjust all the models (four out of 22 scales). This interaction, when significant, pointed to a reduced positive association between working and HRQOL as patients aged.

Table 3 shows the norm-based scoring of the SF-36 from the three continents, including the differences between the scores of hemodialysis patients and the population norm score divided by one standard deviation of the population. This table also shows the results from linear regression analysis, including comorbid conditions as additional independent variables. Age and gender were also included in this model. The difference between physical functioning of Japanese hemodialysis patients and those in other countries was smaller than that shown

Table 1. Mean demographic results, comorbid conditions, and clinical and socioeconomic variables

Characteristic	Europe	Japan	United States
Sample size *number*	2406	2087	2885
Age *years*	59.9	58.4[a]	59.6
Male %	57.9	62.6[a]	52.8[a]
Black %	1.6	0.0	39.0[b]
Comorbidities %			
Coronary artery disease	28.7	18.7[b]	48.3[b]
Congestive heart failure	24.1	5.6[b]	43.9[b]
Other cardiac problem	36.2	23.9[b]	34.6
Hypertension	72.5	56.1[b]	83.7[b]
Peripheral vascular disease	22.0	10.9[b]	24.3
Cerebrovascular disease	13.2	11.8	16.8[a]
Diabetes (primary or contributing)	19.3	25.4[a]	44.4[b]
Lung disease	10.7	1.2[b]	12.2
Cancer (other than skin)	9.0	5.1[b]	9.2
HIV/AIDS	0.2	0.0	1.1[a]
Gastrointestinal bleeding	5.2	3.3[a]	8.9[b]
Neurological disease	5.4	3.5[a]	11.1[b]
Psychiatric disorder	23.9	2.2[b]	22.6
Recurrent cellulitis	6.2	1.9[b]	10.0[b]
Dyspnea	18.9	2.4[b]	27.5[a]
Primary cause of ESRD %			
Diabetes	13.8	22.4	36.6
Glomerulonephritis	16.2	54.7	11.9
Hypertension	10.5	3.6 [b]	28.9 [b]
Other	59.5	19.3	22.6
Hematocrit % (mean and SD)	32.5 (5.2)	30.1 (4.2)[b]	32.9 (4.7)
Years on dialysis %			
<1	22.6	11.0	29.3
1–3	37.2	28.3	41.9
4–6	16.1	20.6 [b]	16.7 [b]
7–10	10.4	14.1	7.3
>11	13.7	26.0	4.8
Complications of ESRD %			
Carpal tunnel syndrome	7.6	11.0[a]	5.3[a]
Amyloidosis (β_2-microglobulin)	7.3	14.9[b]	1.5[b]
Parathyroidectomy	8.3	4.2[a]	4.0[b]
Annual household income (US $)			
<$5000	16.6	6.3	15.8
$5000–$10,000	29.2	26.8	27.4
$10,000–$20,000	30.0	27.6 [b]	26.1 [b]
$20,000–$40,000	18.3	19.7	20.0
$40,000–$75,000	4.8	9.5	8.5
>$75,000	1.1	10.2	2.1
Employment status[a] %			
Employed	26.8	53.3[b]	16.8[a]
Disabled	20.0	4.0[a]	36.6[b]

[a] P value < 0.05 vs. Europe
[b] P value < 0.0001 vs. Europe

in the unadjusted analysis, but it was still statistically significant.

DISCUSSION

ESRD patients treated by hemodialysis in Japan reported a much greater burden of kidney disease than did those in the United States or Europe (Fig. 1). On the "burden" scale, patients are asked how much they agree or disagree with four statements: "My kidney disease interferes too much with my life," "Too much of my time is spent dealing with my kidney disease," "I feel frustrated dealing with my kidney disease," and "I feel like a burden on my family." The differences between continents in the "burden" scores were not reduced by adjustments for the patient characteristics listed in Table 1; in fact, the differences grew wider after adjustments. Therefore, we cannot attribute the greater burden reported by Japanese patients to differences in comorbid conditions or in socioeconomic factors. Because there are no national-norm data for disease-targeted scales, we cannot distinguish among the many possible explanations for the greater burden reported by Japanese patients. For example, dialysis practice patterns and the organization of medical care in Japan might result in patients spending more time dealing with their kidney disease. However, culturally mediated differences in the perception and description of that time could also ac-

Table 2. Unadjusted and adjusted health-related quality of life (HRQOL) scores

	Euro-DOPPS		Japan		United States	
HRQOL Measure	Unadjusted	Adjusted[a]	Unadjusted	Adjusted[a]	Unadjusted	Adjusted[a]
SF-36						
Physical functioning	46.9	45.0	65.3[b]	60.3[b]	40.8[b]	42.7[c]
Role (physical)	34.4	37.2	48.7[b]	46.5[b]	31.7	37.6
Bodily pain	57.9	56.4	64.6[b]	61.4[c]	59.0	57.1
General health	36.9	36.1	43.4[b]	40.7[b]	40.2[b]	41.0[b]
Physical component summary	35.5	34.7	41.8[b]	40.0[b]	33.1[b]	33.4[c]
Vitality	41.9	42.4	53.0[b]	50.8[b]	42.9	43.4
Social functioning	62.1	62.2	70.1[b]	69.2[b]	62.1	63.5
Role (emotional)	46.1	49.1	53.6[c]	48.7	51.8[c]	58.0[b]
Mental health	59.9	60.8	63.5[c]	61.8	67.3[b]	68.2[b]
Mental component summary	43.2	44.1	44.8[c]	44.0	46.6[b]	47.6[b]
KDQOL						
Symptoms, problems	69.9	70.4	75.8[b]	73.8[c]	71.1	72.5[c]
Effects	57.3	57.9	67.7[b]	66.7[b]	62.5[b]	63.1[b]
Burden	35.4	36.8	28.6[b]	27.6[b]	40.8[b]	42.4[b]
Work status	25.2	28.5	44.8[b]	33.0[c]	20.0[b]	27.0
Cognitive functioning	73.6	74.3	81.7[b]	80.0[b]	77.2[b]	78.0[b]
Quality social	77.0	77.2	60.9[b]	60.6[b]	75.9	76.0
Sexual functioning	67.7	66.7	65.2	63.3	60.7[c]	60.5[c]
Sleep	57.1	58.1	63.2[b]	61.2[c]	58.3	59.9[c]
Social support	73.0	73.0	72.4	72.0	73.1	74.1
Staff encouragement	82.8	80.5	78.5[b]	79.3	80.6[c]	78.0[c]
Satisfaction	71.3	68.9	77.1[b]	76.2[b]	70.5	69.2
Average KDQOL	62.4	62.7	65.5[b]	63.3	62.9	63.7

[a] Adjusted for patient characteristics in Table 1
[b] $P < 0.0001$ vs. Euro-DOPPS
[c] $P < 0.05$ vs. Euro-DOPPS

Table 3. Means of norm-based scores (differences, in standard deviation units, from general-population data)

	Euro-DOPPS		Japan		United States	
HRQOL Measure	Unadjusted	Adjusted[a]	Unadjusted	Adjusted[a]	Unadjusted	Adjusted[a]
Physical functioning	−1.52	−1.65	−1.13[b]	−1.34[b]	−1.52	−1.48[c]
Role (physical)	−1.22	−1.14	−1.04[c]	−1.05	−1.16	−0.98[c]
Bodily pain	−0.57	−0.63	−0.43[c]	−0.52	−0.46[c]	−0.56
General health	−1.31	−1.37	−0.95[b]	−1.06[b]	−1.29	−1.27[c]
Vitality	−0.95	−0.94	−0.62[b]	−0.71[b]	−0.77[b]	−0.76[c]
Social functioning	−0.97	−0.97	−0.79[c]	−0.80[c]	−0.83[c]	−0.76[c]
Role (emotional)	−1.20	−1.12	−0.83[b]	−0.96[c]	−0.80[b]	−0.61[b]
Mental health	−0.63	−0.57	−0.50[c]	−0.57	−0.46[b]	−0.41[c]

[a] Adjusted for patient characteristics in Table 1
[b] $P < 0.0001$ vs. Euro-DOPPS
[c] $P < 0.05$ vs. Euro-DOPPS

count for the greater reported burden. Disentangling an "actual" burden of kidney disease by some objective measure (for example, the number of hours spent on disease-related activities) from patients' experience of such a burden is inherently difficult. Nonetheless, the questions in the "burden" scale of the KDQOL are clearly focused on subjective factors, that is, on patients' evaluation of the consequences of their disease. We therefore believe that the greater burden reported by Japanese patients should raise clinicians' awareness of subjective responses to physical disease and of potential culturally mediated differences in those responses [23–27].

As indicated in Table 2, Japanese patients had higher scores for social functioning and the lowest scores for quality of social interaction. These apparently paradoxic findings indicate the need of assessing different aspects of HRQOL for a better understanding of how the well-being of hemodialysis patients is affected in different regions. "Social functioning," an HRQOL subscale of the SF-36, assesses patients' judgments about the extent to which physical health or emotional problems interfere with their social activities. "Quality of social interaction," an HRQOL subscale of the KDQOL-SF, assesses more directly patients' attitudes or behaviors in relation to people around them, such as the tendencies toward isolation or irritability. In addition to different practice patterns in the hemodialysis treatment itself, cultural differences may also play a role in the variations observed across continents.

Other noteworthy results from our study were the

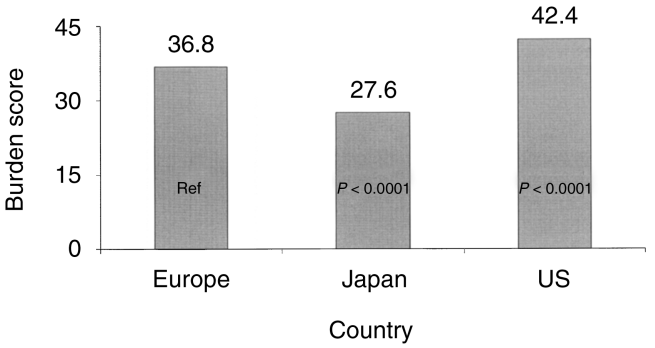

Fig. 1. Burden scores on three continents.

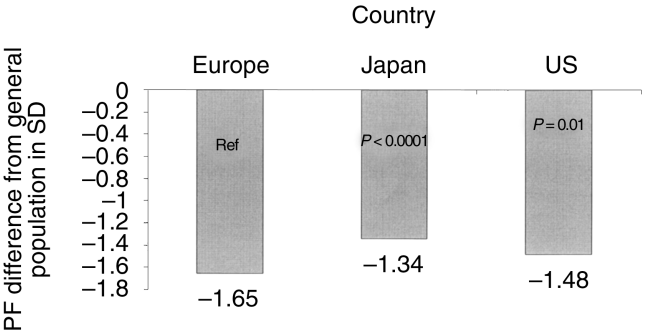

Fig. 2. Physical functioning (PF) score differences from general population in standard deviations.

differences in scores on the physical functioning scale of the SF-36. The items making up this scale are designed to measure patients' self-reported limitations in running, climbing stairs, walking, putting on clothes, or bathing on their own. According to their patient questionnaire responses, Japanese hemodialysis patients were considerably more able to perform these activities than were hemodialysis patients in the United States and the Euro-DOPPS countries (Fig. 2). Before attempting to interpret or explain these differences, we have to consider methodologic factors that could account for the large difference in scores.

One possibility for the wide difference is that the different versions of the SF-36 used in this study are not conceptually equivalent. However, in the IQOLA project, considerable effort was directed at adapting the SF-36 for each country in which it was to be used. The goals of linguistic, semantic, and conceptual equivalence were rigorously pursued, and the translated versions were tested and compared [24–27]. Another possibility is that differences in age, gender, and cultural norms influenced the HRQOL data, but we believe that norm-based scoring (Table 3) minimized any differences in SF-36 scores that might have been caused by those demographic and cultural factors.

An important result of this study is that Japanese patients reported both a high level of physical functioning and a great burden of kidney disease. As described above, the physical functioning scale measures physical abilities, but for the "burden" scale patients are asked whether their kidney disease interferes with life, takes too much of their time, makes them feel frustrated, or makes them feel like a burden on their families. Patients with normal physical abilities may still feel that their disease imposes a great burden.

After adjustment for age, gender, and comorbid conditions (Table 3), the magnitude of the differences was much smaller, but the physical functioning scores of the Japanese patients were still significantly higher. The difference between patients in Japan and the general population of Japan was smaller than the corresponding differences between patients and general population in the United States and Europe.

International differences in HRQOL scores take on additional importance when considered in light of HRQOL's demonstrated association with mortality risk. In a previous DOPPS study, lower scores in several measures of HRQOL, particularly PCS, were found to be strongly associated with higher risk of death in Japan, Europe, and the United States [7]. Differences in HRQOL may in part explain the poorer survival observed for hemodialysis patients treated in the United States than for patients treated in Japan and Europe.

We adjusted for all of the patient characteristics in Table 1 to find the adjusted HRQOL scores. Table 1 indicates that Japanese hemodialysis patients have lower mean hematocrit levels, longer average length of time on hemodialysis, higher prevalence of complications from hemodialysis, and higher socioeconomic status. These variables are likely determinants of physical functioning scores. For example, the distributions of hematocrit levels and complications of ESRD would tend to make the differences between countries larger in the analysis. International differences in erythropoietin use might also account for some of the differences in hematocrit and physical functioning, and this topic is now being studied through analysis of DOPPS data. As a primary cause of ESRD, diabetic nephropathy is more common in the United States than in Japan, which could explain the poorer physical functioning in the United States. However, diabetic nephropathy is less prevalent in the Euro-DOPPS countries than in Japan, which seems to lessen its explanatory power. Socioeconomic factors such as annual income and work status might also explain some of the differences in physical functioning scores; more of the United States patients had low incomes and were disabled or not employed. These factors may apply both to unadjusted analyses and to comparisons with the general population. However, the adjusted analyses allow comparisons between countries as if all else were

equal, that is, as if diabetes, employment, and the other factors in Table 1 were the same in Japan, the United States, and the Euro-DOPPS countries. Thus, the adjusted analyses overcome most of the limitations resulting from the differences between continents with regard to the factors listed in Table 1.

Other factors may also contribute to or help explain these international differences. For example, the previously reported international differences in Kt/V, body weight, average hours of dialysis, blood flow, and dialyzer surface area might also be related to the differences in physical functioning and burden scores, although one study in Japan found no such relationship [32]. We also note that international differences in patient compliance have recently been identified using DOPPS data; skipping and shortening dialysis sessions, more common in the United States than in Japan or Europe, is associated with increased risk of mortality and hospitalization, as well as certain patient characteristics [33]. As another example, variations in dialysis facility staffing may contribute to these differences, although they are not analyzed in this paper. Recent analysis of international DOPPS data indicates that a higher percentage of more experienced dialysis facility staff is significantly associated with reduced mortality and other improved outcomes [abstract; Pifer TB et al, *J Am Soc Nephrol* 13: 425A, 2002]. Variations in staffing patterns by country may therefore be another factor contributing to the wide international differences in physical functioning scores.

Some possible limitations of this study must be noted. In the linear model, the independent variables might not have been independent of each other, and their effects might not have been linear. Furthermore, the data came from cross-sectional observations of patients at various times in the course of their disease and treatment. However, since these analyses were adjusted for time on dialysis, time after the onset of ESRD should not have played a role.

We know of no previous study of HRQOL among hemodialysis patients that allows for a proper comparison of patients on these three continents. Our primary goal was to document clearly any differences in HRQOL between patients in the United States, the Euro-DOPPS countries, and Japan, not to dissect these phenomena by mathematically "explaining" all of the variance among scores. By drawing attention to differences among the three groups studied, and by showing that they probably cannot be attributed to differences in comorbid conditions, demographic factors, or socioeconomic status, we hope to have indicated some fruitful areas for future work. With the goal of improving patient-based health outcomes, we believe that the most worthwhile of the many possible future studies will be those that focus on possible differences in the perception of the burden of kidney disease, and on ways to improve the physical functioning of patients in the United States and in Europe by changing clinical practice or health care policy.

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