Kidney International, Vol. 66 (2004), pp. 2047–2053

Screening for depression in hemodialysis patients: Associations with diagnosis, treatment, and outcomes in the DOPPS

ANTONIO ALBERTO LOPES, JUSTIN M. ALBERT, ERIC W. YOUNG, SUDTIDA SATAYATHUM, RONALD L. PISONI, VITTORIO E. ANDREUCCI, DONNA L. MAPES, NANCY A. MASON, SHUNICHI FUKUHARA, BJÖRN WIKSTRÖM, AKIRA SAITO, and FRIEDRICH K. PORT

Department of Medicine, Federal University of Bahia, Bahia, Brazil; University Renal Research and Education Association, Ann Arbor, Michigan; Division of Nephrology, University of Michigan and Veterans Administration Medical Center, Ann Arbor, Michigan; Universita Federico II, Naples, Italy; Amgen, Inc., Thousand Oaks, California; College of Pharmacy, University of Michigan, Ann Arbor, Michigan; Tokai University School of Medicine, Isehara, Kanagawa, Japan; and Institutionen for Medicinska Vetenskaper, Medicin Akademiska Sjukhuset, Uppsala, Sweden

Screening for depression in hemodialysis patients: Associations with diagnosis, treatment, and outcomes in the DOPPS.

Background. Depressive symptoms and depression are the most frequent psychologic problems reported by hemodialysis patients. We assessed the prevalence of depressive symptoms and physician-diagnosed depression, their variations by country, and associations with treatment by antidepressants among hemodialysis patients. We also assessed whether depressive symptoms were independently associated with mortality, hospitalization, and dialysis withdrawal.

Methods. The sample was represented by 9382 hemodialysis patients randomly selected from dialysis centers of 12 countries enrolled in the Dialysis Outcomes and Practice Patterns Study (DOPPS II). Depressive symptoms were assessed by the short version of the Center for Epidemiological Studies Depression Screening Index (CES-D), using ≥10 CES-D score as the cut-off value.

Results. Overall prevalence of physician-diagnosed depression was 13.9%, and percentage of CES-D score ≥10 43.0%. While the smallest prevalence of physician-diagnosed depression was observed in Japan (2.0%) and France (10.6%), the percentage of CES-D score ≥10 in these counties was similar to the whole sample. Patients on antidepressants also varied by country, 34.9% and 17.3% among those with physician-diagnosed depression and CES-D scores ≥10, respectively. In Cox models adjusted for several comorbidities, CES-D scores ≥10 were associated with significantly higher relative risks (RR) of death (RR = 1.42; 95% CI = 1.29 to 1.57), hospitalization (RR = 1.12; 95% CI = 1.03 to 1.22), and dialysis withdrawal (RR = 1.55; 95% CI = 1.29 to 1.85).

Conclusion. The data suggest that depression is underdiagnosed and undertreated among hemodialysis patients. CES-D can help identify hemodialysis patients who are at higher risk of death and hospitalization. Interventions should target these patients with the goal to improve survival and reduce hospitalizations.

Key words: depression, dialysis, end-stage renal disease, hospitalization, mortality.

Received for publication January 29, 2004
and in revised form May 14, 2004
Accepted for publication May 27, 2004

Depressive symptoms and depression are major public health problems and the most frequent psychologic problems reported among end-stage renal disease (ESRD) patients being treated by hemodialysis [1–4]. Despite these findings, depression may remain underrecognized and undertreated, particularly among ESRD patients [5–7]. A systematic assessment of depression in hemodialysis patients would supply information about patients' feelings of well being. Existing data suggest that screening for depression may help identify patients at higher risk for death and hospitalization [8, 9].

The Beck Depression Inventory is considered to be the standard instrument for assessing symptoms of depression and screening for clinical depression [10]. However, several other research instruments have also been used to assess symptoms of depression, including the Center for Epidemiological Studies Depression Screening Index (CES-D). Previous studies have demonstrated that both the complete and short (10 items) versions of the CES-D are accurate, practical instruments for assessing depressive symptoms among the general population and among patients with different chronic diseases [11–14]. For the short version of the CES-D, a score of ≥10 has been considered as indicating probable depression. The CES-D has also been validated against the Beck Depression Inventory and shown to have predictive power for death and other clinical outcomes in healthy individuals and in patients with different diseases [11, 15–18]. There is a lack of studies, however, that assess the validity of the CES-D among ESRD patients.

In a large sample of hemodialysis patients from 12 countries, we assessed symptoms of depression by using the short version of the CES-D. We verified whether the percentage of patients with CES-D score ≥10 varied by country of treatment and whether the country-specific estimates of CES-D score ≥10 correlated with the prevalence of physician-diagnosed depression and prescription of antidepressants. Additionally, we verified whether symptoms of depression and physican-diagnosed depression were independently associated with mortality, hospitalization, and withdrawal from dialysis.

METHODS

The analyzed data are from the second phase of the Dialysis Outcomes and Practice Patterns Study (DOPPS II), an international, prospective, observational study of hemodialysis practice patterns and their associated outcomes [19], ongoing in 12 countries: Australia, Belgium, Canada, France, Germany, Italy, Japan, New Zealand, Spain, Sweden, the United Kingdom, and the United States. Nationally representative samples of dialysis facilities were recruited in each country. Within each participating facility, study patients were randomly selected. Institutional review boards in each country approved the study, and informed patient consent was obtained in accordance with local requirements. The present study includes data from all 12 participating countries, with a total sample size of 9382 hemodialysis patients.

The main analyses were restricted to the prevalent cross-section of 6987 patients with information on depression diagnosis. Baseline data regarding years since ESRD onset, sociodemographic factors, comorbidities, laboratory values, and dialysis dose by equilibrated Kt/V (eKt/V) were collected at patient entry into the study. Each patient's medical record was assessed for physician-diagnosed depression within the past 12 months. This information was recorded on the DOPPS medical questionnaire along with the listed name, dosage, and frequency of any medication(s) prescribed for each patient on or before entry into the study. Patients also completed the short, 10-item version of the CES-D for depressive symptoms in the past week [20]. Each response item is coded on a scale of 0 to 3 points; a CES-D score ranging from 0 to 30 is calculated by summing the score of each item. Higher scores indicate greater depressive symptoms. For comparison purposes, the cut-off value of ≥10 for symptoms of depression was used [20].

Statistical methods

We examined the distribution of mean CES-D scores by country and by percentages of patients with scores ≥10, with physician-diagnosed depression, and prescribed antidepressants. Logistic regression was used to estimate adjusted associations between baseline patient characteristics and depression. Models accounted for clustering effects and were adjusted for age, sex, black race, years on dialysis, serum albumin, hemoglobin, eKt/V, 12 summary comorbid conditions, and country.

Cox regression models were used to estimate the relative risk of the three patient outcomes under study—time to first hospitalization following study entry, time to death due to any cause, and time to dialysis withdrawal as reported by the dialysis facility (without taking into account the duration in survival time after withdrawal)—in relation to both physician-diagnosed depression and symptoms of depression indicated by CES-D score ≥10, adjusted for demographic variables, serum albumin, hemoglobin, eKt/V, comorbid indicators, years on dialysis, and stratified by country of residence [21]. All statistical analyses were performed with SAS software, version 8 (SAS Institute, Cary, NC, USA).

RESULTS

Prevalence of depression and symptoms of depression

In the analysis restricted to subjects who responded to the CES-D survey ($N = 6987$), physician-diagnosed depression was reported in the medical records of 13.9% of them (Table 1). The smallest prevalence was observed in Japan (2.0%) and the highest in Sweden (19.8%) and the United States (21.7%). For other countries, the prevalence varied from 10.6% (France) to 18.2% (Belgium). In an analysis of the total sample of patients (i.e., without restriction to patients who responded the CES-D questions), the prevalence of physician-diagnosed depression was only slightly higher (15.2%), and no modification was observed in the rank of prevalence across countries.

Overall (Table 1), the percentage of patients with CES-D score ≥10 (43.0%) was approximately three times higher than the prevalence of physician-diagnosed depression (13.9%). In contrast to physician-diagnosed depression, the prevalence of CES-D score ≥10 observed in Japan (40.0%) was similar to the overall prevalence for the whole DOPPS (43.0%) and 20 times higher than the prevalence of physician-diagnosed depression in Japanese patients (2.0%). The smallest ratios of physician-diagnosed depression to CES-D ≥10, 1.8 and 2.0 were observed for patients treated in the United States and Sweden, respectively. Italy had the highest percentage of patients with CES-D score ≥10 (62.3%), aproximately 4.0 times higher than the prevalence of physician-diagnosed depression (15.5%). For countries other than Italy and Japan, the percentage of patients with CES-D score ≥10 varied from 39.2% among those treated in the United States to 47.3% among those treated in Germany.

Table 1. Mean Center for Epidemiological Studies Depression Screening Index (CES-D) scores, prevalence of depression, and percentage of patients prescribed antidepressants, according to physician diagnosis and CES-D score, by country

Country	Prevalence of physician-diagnosed depression %	Prevalence of CES-D score ≥10 %	Mean ± SD CES-D score	Ratio of CES-D ≥10 to depression by physician diagnosis	Antidepressant prescription %	
					Among those with physician-diagnosed depression	Among those with CES-D score ≥10
Australia/New Zealand	17.4 (75/430)	40.2 (173/430)	8.9 ± 5.7	2.3	36.0 (27/75)	16.9 (29/172)
Belgium	18.2 (81/445)	42.3 (188/445)	9.3 ± 5.9	2.3	37.0 (30/81)	17.1 (32/187)
Canada	15.9 (68/428)	42.8 (183/428)	9.0 ± 6.2	2.7	44.1 (30/68)	18.0 (33/183)
France	10.6 (44/416)	43.5 (181/416)	9.4 ± 6.2	4.1	40.9 (18/44)	14.5 (26/179)
Germany	13.3 (66/495)	47.3 (234/495)	9.9 ± 5.9	3.6	18.2 (12/66)	8.6 (20/234)
Italy	15.5 (85/547)	62.3 (341/547)	11.7 ± 6.0	4.0	8.2 (7/85)	2.7 (9/333)
Japan	2.0 (29/1473)	40.0 (589/1473)	9.0 ± 5.2	20.0	[a]	[a]
Spain	14.5 (82/555)	42.2 (233/552)	9.2 ± 6.6	2.9	27.5 (22/80)	12.0 (27/225)
Sweden	19.8 (89/449)	39.4 (177/449)	8.4 ± 5.4	2.0	52.8 (47/89)	28.8 (51/177)
United Kingdom	15.5 (70/452)	40.9 (185/452)	8.7 ± 5.5	2.6	37.1 (26/70)	18.4 (34/185)
United States	21.7 (282/1300)	39.2 (519/1300)	8.7 ± 5.6	1.8	38.9 (105/270)	28.9 (151/510)
Total	13.9 (969/6987)	43.0 (3003/6987)	9.2 ± 5.8	3.1	34.9 (324/928)	17.3 (412/2385)

Restricted to a prevalent cross-section of patients with information on physician-diagnosed depression and who had completed a CES-D instrument ($N = 6987$).
[a]DOPPS II data on medication were unavailable for Japan. In the DOPPS I, antidepressant prescription in Japan was noted overall for <1% of prevalent patients in 1999. Comparable percentages were 6% for Europe and 17% for the United States.

Prescription of antidepressants

Data on antidepressants at the time of the DOPPS II analysis were available for all countries except Japan. Data collected in 1999 for the first phase of DOPPS (DOPPS I), however, show that less than 1% of hemodialysis patients in Japan were prescribed antidepressants. In DOPPS II, among patients with physician-diagnosed depression and CES-D scores ≥10, 34.9% and 17.3%, respectively, were prescribed antidepressants (Table 1). Sweden had the highest percentage of patients with physician-diagnosed depression prescribed antidepressants (52.8%), and, together with the United States, had the highest percentage of patients with CES-D ≥10 being prescribed antidepressants (approximately 29%). A very low percentage of patients prescribed antidepressants was observed among patients treated in Italy, both among those with physician-diagnosed depression (8.2%) and those with CES-D score ≥10 (2.7%).

Among the prevalent cross-section of patients, excluding Japan, with information on diagnosis of depression and a completed CES-D instrument, the percentages of patients with CES-D scores 0 to 4, 5 to 9, 10 to 14, and 15 to 30 were 23%, 33%, 24%, and 20%, respectively. Figure 1 shows that, for patients in the category 0 to 4, 8.4% had physician-diagnosed depression and 7.6% were prescribed antidepressant medications; 13.9% had either a reported diagnosis of depression or were prescribed antidepressant medication. For patients with CES-D scores ≥15, 32.3% had physician-diagnosed depression and 20.8% were prescribed antidepressants; 39.7% had either physician-diagnosed depression or were prescribed antidepressants. Of the 65 patients with CES-D scores ≥25, 53.9% had physician-diagnosed depression or were prescribed antidepressants (data not shown in Fig. 1).

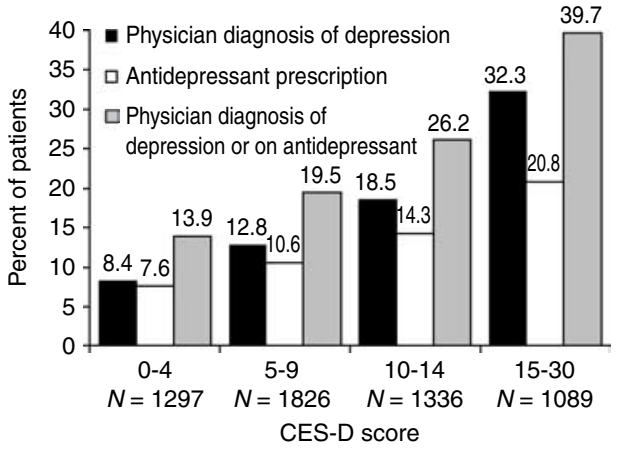

Fig. 1. Percentages of patients with physician-diagnosed depression and prescribed antidepressants, by Center for Epidemiological Studies Depression Screening Index (CES-D) score. Restricted to a prevalent cross-section of patients with information on depression diagnosis and who had completed a CES-D instrument (excluding Japan, for which data on medications were unavailable) ($N = 5548$).

Patient characteristics by physician-diagnosed depression and CES-D score

Table 2 shows that several baseline patient characteristics were significantly associated with physician-diagnosed depression and CES-D scores ≥10. As compared with ages 18 to 44 years (15.9%), the unadjusted prevalence of physician-diagnosed depression was significantly lower for ages ≥75 years (12.6%). After logistic regression adjustments for all patient characteristics listed in Table 2, for years on dialysis and country, significantly lower odds of physician-diagnosed depression were observed for both age groups 63 to 74 years and ≥75 years, as compared with the age group 18 to 44 years. The percentage of patients with CES-D score ≥10 was

Table 2. Prevalence of physician-diagnosed depression and Center for Epidemiological Studies Depression Screening Index (CES-D) scores ≥10 and their associations with baseline patient characteristics

Characteristic	Physician-diagnosed depression		CES-D Score ≥10	
	Prevalence %	AOR	Prevalence %	AOR
Age				
18 to 44 years	15.9	1.00	40.3	1.00
45 to 62 years	14.1	0.82	41.0	0.94
63 to 74 years	14.6	0.72[a]	44.8[a]	0.89
75 years or older	12.6[a]	0.57[b]	44.0	0.84
Male (vs. female)	12.9 vs. 15.9[a]	0.75[a]	40.3 vs. 46.0[b]	0.85[a]
Socioeconomic factors				
Live alone (vs. not alone)	16.3 vs. 13.7[a]	1.07	45.5 vs. 42.2[a]	1.10
Married (vs. not married)	12.7 vs. 16.3[b]	0.84	41.2 vs. 45.1[a]	0.91
Finished high school (vs. did not finish)	13.7 vs. 14.5	1.29[a]	40.1 vs. 47.0[b]	0.80[a]
Some college (vs. no college)	14.8 vs. 14.1	1.15	31.5 vs. 44.4[b]	0.73[a]
Employed, ages <60 (vs. not)	10.6 vs. 14.8[b]	0.70[a]	28.6 vs. 45.5[b]	0.56[b]
Comorbidities				
Coronary artery disease (yes vs. no)	15.2 vs. 13.3[a]	0.93	44.7 vs. 41.2[a]	1.01
Congestive heart failure (yes vs. no)	18.8 vs. 12.3[b]	1.43[b]	47.4 vs. 41.0[b]	1.18[a]
Other cardiac disease (yes vs. no)	15.8 vs. 13.3[a]	1.09	45.5 vs. 41.3[a]	1.04
Hypertension (yes vs. no)	14.5 vs. 12.7[a]	1.10	42.4 vs. 44.0	0.92
Cerebrovascular disease (yes vs. no)	19.1 vs. 13.1[b]	1.28[a]	45.7 vs. 42.2[a]	0.96
Peripheral vascular disease (yes vs. no)	18.9 vs. 12.5[b]	1.43[b]	49.7 vs. 40.4[b]	1.35[b]
Diabetes mellitus (yes vs. no)	16.4 vs. 13.0[a]	1.11	46.1 vs. 41.2[a]	1.12[a]
Lung disease (yes vs. no)	18.1 vs. 13.6[a]	1.26[a]	49.1 vs. 42.0[a]	1.19[a]
Cancer, excluding skin cancer (yes vs. no)	18.1 vs. 13.4[a]	1.50[b]	41.9 vs. 43.0	0.95
HIV/AIDS (yes vs. no)	12.7 vs. 15.5	0.72	39.1 vs. 44.5	0.77
Gastrointestinal bleeding (yes vs. no)	21.1 vs. 13.7[a]	1.45[a]	50.7 vs. 42.3[a]	1.32[a]
Neurologic disease (yes vs. no)	24.0 vs. 13.1[b]	1.84[b]	51.1 vs. 41.9[b]	1.32[a]
Serum albumin *g/dL*, by quartile				
≥4.0	12.4	1.00	38.6	1.00
3.7 to 3.99	13.5	1.02	38.9	0.93
3.4 to 3.69	14.4	1.05	45.4[a]	1.18[a]
<3.4	17.5[a]	1.28[a]	48.1[b]	1.25[a]
Hemoglobin *g/dL*				
≥11.0	14.5	1.00	41.1	1.00
9 to 10.99	14.0	0.94	36.9[a]	1.15[a]
<9.0	12.6	0.80	37.6	1.05
Equilibrated Kt/V (≥1.2 vs. <1.2)	14.0 vs. 13.7	1.03	42.7 vs. 42.2	0.98

Restricted to a prevalent cross-section of patients with information on depression diagnosis and who completed a CES-D instrument ($N = 6987$).
AOR is odds ratio adjusted for all other variables listed, additionally controlled for country and accounted for effects of facility clustering.
[a] $P < 0.05$; [b] $P < 0.0001$.

significantly higher for patients aged 63 to 74 years (44.8%) than for patients aged 18 to 44 years (40.3%). However, when adjusting for all covariates, no significant association between age and CES-D score was observed. The adjusted odds of both physician-diagnosed depression and CES-D score ≥10 were also significantly higher for females, unemployed patients, patients with lower levels of serum albumin, and those with any of the following comorbidities: congestive heart failure, peripheral vascular disease, lung disease, gastrointestinal bleeding, and neurologic disease. The comorbidities associated with higher odds of physician-diagnosed depression but not with CES-D score ≥10 were cerebrovascular disease and nonskin cancer. Coronary artery disease, other cardiac disease, hypertension, diabetes mellitus, human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), and years on dialysis (not shown in Table 2) were associated with neither physician-diagnosed depression nor CES-D scores ≥10.

Also evaluated by country was the adjusted odds ratio (AOR) of reported diagnosis of depression and CES-D score ≥10, using patients treated in the United States as the referent category. For physician-diagnosed depression, significantly lower adjusted odds were observed for patients treated in Japan (AOR = 0.13, $P < 0.001$), Canada (AOR = 0.49, $P = 0.02$), and France (AOR = 0.51, $P = 0.02$). For CES-D scores ≥10, higher adjusted odds were observed for patients treated in Japan (AOR = 1.27, $P < 0.03$) and Italy (AOR = 2.29, $P < 0.001$).

Associations of depression and CES-D score with hemodialysis outcomes

The secondary focus of the present analysis was to determine whether there were associations between symptoms of depression measured by the CES-D and the primary hemodialysis outcomes of all-cause mortality, first hospitalization after study start, and withdrawal from

dialysis. The sample for these analyses comprised 9382 patients from all 12 DOPPS countries with information on depression diagnosis and a completed CES-D instrument.

In the Cox regression model—adjusted for the covariates listed in Table 2 and for time on dialysis and country of residence—a significantly increased relative risk (RR) of all adverse outcomes associated with CES-D scores ≥10 (compared with lower CES-D scores) was observed, being 42% higher for all-cause mortality (RR = 1.42; 95% CI = 1.29 to 1.57), 12% higher for hospitalization (RR = 1.12; 95% CI = 1.03 to 1.22), and 55% higher for withdrawal from dialysis (RR = 1.55; 95% CI = 1.29 to 1.85). The association between CES-D scores and death remained significant, even after excluding from the analysis death due to dialysis withdrawal.

Figure 2 shows the adjusted RR for associations between CES-D scores and relative risk of all-cause mortality, hospitalization, and withdrawal from dialysis in more detail by different ranges of CES-D scores, using <5 as reference. The adjusted RR of the outcomes increased significantly from the lowest to the highest CES-D score categories (*P* values for each trend ≤0.002). Physician-diagnosed depression (not shown in Fig. 2) was also significantly and independently associated with higher relative risks of death due to any cause (RR = 1.26; 95% CI = 1.10 to 1.43) and withdrawal from dialysis (RR = 1.42; 95% CI = 1.11 to 1.80). By contrast with CES-D scores, physician-diagnosed depression was not associated with hospitalization (RR = 0.97; 95% CI = 0.86 to 1.09).

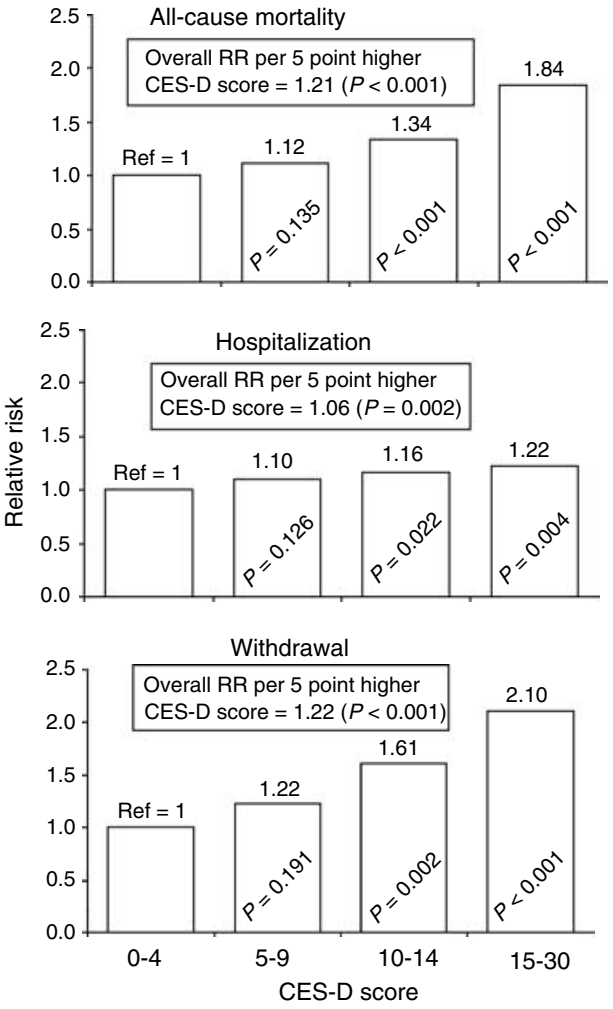

Fig. 2. Adjusted relative risks of all-cause mortality, hospitalization, and withdrawal from dialysis by Center for Epidemiological Studies Depression Screening Index (CES-D) score. All models adjusted for variables in Table 2, years on dialysis, and country of residence (N = 9382).

DISCUSSION

Our results support the validity of the CES-D to identify hemodialysis patients at higher risk of hospitalization, death, and withdrawal from dialysis. It is unlikely that the observed higher risk of adverse outcomes associated with higher scores for depressive symptoms was due to underdialysis or higher prevalence of comorbidities. The data suggest that depression is largely underdiagnosed and undertreated among hemodialysis patients, particularly in certain countries. The large variation across countries in the prevalence of physician-diagnosed depression among hemodialysis patients did not correlate closely with the variation in depressive symptoms assessed by the CES-D instrument. Apparently, in certain countries (e.g., the United States and Sweden), hemodialysis patients with depressive symptoms have been more often diagnosed as depressed than hemodialysis patients in other DOPPS countries.

The high rate of nondiagnosed and nontreated depression suggested by our data—as well as the large variation seen in depression diagnosis, symptoms of depression, and prescription of antidepressants across the DOPPS II countries—could have been related to practice patterns and cultural factors. In support of this possibility, previous studies have shown that physicians in Japan fail to recognize and consequently treat depression more often than physicians in other countries because of a stigma related to mental disorders within Japanese society [22–25]. Consistent with this posited stigma, the present study found that patients treated in Japan had the lowest prevalence of physician-diagnosed depression, despite their higher odds of depressive symptoms (CES-D ≥10) than patients treated in the United States. This finding agrees with previously reported results from the DOPPS, which suggest that the mental health component of self-reported, health-related quality of life is lower for patients treated in Japan than in the United States [22].

Lack of treatment for depression could also explain the higher adjusted odds of symptoms of depression in Italy

than in the United States. It should be noted, however, that absence of information on medical records regarding antidepressant medication does not necessarily mean that patients were not receiving some form of treatment for depression. We cannot rule out the possibility that some patients may have been receiving treatment for depression, including psychotherapy, without informing the dialysis health care team members of that treatment. Another potential source of bias was the time interval used to assess the diagnosis of depression by the physician (past 12 months), longer than the time interval used to assess symptoms of depression with the CES-D (past week). The difference in the time interval for assessing these variables could have biased our results by reducing the gap between percentages of patients with symptoms of depression versus those with diagnosis of depression. Thus, the actual difference between the prevalence of CES-D scores $\geq$10 and physician-diagnosed depression may possibly have been even larger than the one described in this study.

Despite the higher prevalence of comorbidities in older hemodialysis patients, the prevalence of physician-diagnosed depression showed a tendency to decrease with age. This finding may reflect a better adjustment to the psychologic burden of dialysis by the elderly hemodialysis patients, but it may also reflect a higher rate of nondiagnosed depression among the elderly. Several comorbidities that were found to be associated with physician-diagnosed depression and CES-D score $\geq$10 have also been associated in hemodialysis patients with poorer health-related quality of life and higher risk of death [26–28]. Our data call attention to the finding that certain comorbidities, such as congestive heart failure, peripheral vascular disease, gastrointestinal bleeding, and neurologic diseases, strongly affected depressive symptoms, a finding that could be related to the severity of the complication and its associated disability. It is likely that, for a fraction of patients, these comorbidities more strongly associated with depressive symptoms were caused by such comorbid conditions as hypertension, coronary heart disease, and diabetes mellitus, which were not associated with CES-D or which became more weakly associated after adjustments for the whole set of covariates had been made. It is also interesting to note that even though nonskin cancer was strongly associated with physician-diagnosed depression, it was not associated with CES-D score. This suggests that knowing that a hemodialysis patient has cancer may influence physicians to establish the diagnosis of depression.

The results reported here regarding the associations of depressive symptoms with hospitalization and mortality in hemodialysis patients are consistent with previous observations from the DOPPS I [8]. An analysis of the DOPPS I data used two simple questions from the Medical Outcomes Study Short Form-36 Health Survey (MOS SF-36) to assess symptoms of depression. Patients were asked to indicate how much of their time over the previous four weeks they had felt "so down in the dumps that nothing could cheer him/her up" or "downhearted and blue." The six possible responses to these questions were (*1*) none of the time, (*2*) a little of the time, (*3*) some of the time, (*4*) a good bit of the time, (*5*) most of the time, and (*6*) all the time. Patients who responded with "a good bit" or more (scores $\geq$4) to either of these two questions had a significantly higher risk of hospitalization and death. We performed a post hoc analysis to verify whether there was any relationship between the CES-D and SF-36 instruments regarding the assessment of depressive symptoms.

Because the "so down in the dumps" question was not included in the DOPPS II analysis, we could only compare the scores of the CES-D instrument with the scores of the "downhearted and blue" question. With the Spearman correlation coefficient (ρ), we found a positive correlation between the two measures of depressive symptoms that was more pronounced when they were treated as continuous variable ($\rho = 0.58$, $P < 0.0001$). In multivariate Cox models, we observed that the fraction of the risk of hospitalization explained by the short form of the CES-D instrument was similar to the fraction explained by the "downhearted and blue" question. For mortality, the fraction of the risk explained by the CES-D instrument was only slightly higher than the fraction explained by the "downhearted and blue" question. These data suggest that the two measures of depressive symptoms are correlated and have similar capacity to predict mortality and hospitalization among hemodialysis patients. It seems plausible to assume that the CES-D instrument and the "down in the dumps" question are also related, considering the high agreement between the two SF-36 questions used for symptoms of depression [8]. Moreover, both SF-36 questions as well as the CES-D have shown good agreement with the Beck Depression Inventory [15, 16, 29]. However, experience with these two SF-36 questions as tools to predict outcomes is still incipient. Thus, the choice of the SF-36 versus the short-version of the CES-D to assess depressive symptoms with the objective of identifying hemodialyis patients at higher risk for death and hospitalization may depend upon which criterion is considered the most relevant: the feasibility (which favors the simple questions of the SF-36 instrument) or the credibility of a well-validated and largely tested instrument (which favors use of the CES-D instrument).

CONCLUSION

Results from the present study indicate that depression is highly prevalent among hemodialysis patients but is likely underdiagnosed and undertreated. In fact, the

lower prevalence of physician-diagnosed depression and prescription of antidepressants in some countries conflicts with the country-specific scores of CES-D indicating depressive symptoms. Research targeted at the dialysis centers of those countries may bring about an understanding of the reasons for these findings. Higher scores indicating symptoms of depression are significantly and independently associated with higher risk of all-cause death, hospitalization, and withdrawal from dialysis. The systematic use of screening instruments for depressive symptoms may help medical personnel identify hemodialysis patients who need special care in order to improve their quality of life, reduce hospitalization, and increase survival.

ACKNOWLEDGMENTS

The DOPPS is supported by research grants from Amgen, Inc., and Kirin Brewery, Ltd., without restrictions on publications. The authors would like to thank Tom Bowden for his editorial assistance with this manuscript.

Reprint requests to Friedrich K. Port, M.D., M.S., University Renal Research and Education Association, 315 W. Huron, Suite 260, Ann Arbor, MI 48103.
E-mail: dopps@urrea.org

REFERENCES

1. Kessler RC, Berglund P, Demler O, *et al*: The epidemiology of major depressive disorder: Results from the National Comorbidity Survey Replication (NCS-R). *JAMA* 289:3095–3105, 2003
2. Katon W, Schulberg H: Epidemiology of depression in primary care. *Gen Hosp Psychiatry* 14:237–247, 1992
3. Finkelstein FO, Finkelstein SH: Depression in chronic dialysis patients: Assessment and treatment. *Nephrol Dial Transplant* 15:1911–1913, 2000
4. Kimmel PL: Psychosocial factors in dialysis patients. *Kidney Int* 59:1599–1613, 2001
5. Gelenberg A: Depression is still underrecognized and undertreated. *Arch Intern Med* 159:1657–1658, 1999
6. Kimmel PL: Depression in patients with chronic renal disease: What we know and what we need to know. *J Psychosom Res* 53:951–956, 2002
7. McQuaid JR, Stein MB, Laffaye C, McCahill ME: Depression in a primary care clinic: The prevalence and impact of an unrecognized disorder. *J Affect Disord* 55:1–10, 1999
8. Lopes AA, Bragg J, Young E, *et al*: Depression as a predictor of mortality and hospitalization among hemodialysis patients in the United States and Europe. *Kidney Int* 62:199–207, 2002
9. Kimmel PL, Peterson RA, Weihs KL, *et al*: Multiple measurements of depression predict mortality in a longitudinal study of chronic hemodialysis outpatients. *Kidney Int* 57:2093–2098, 2000
10. Steer RA, Cavalieri TA, Leonard DM, Beck AT: Use of the Beck Depression Inventory for primary care to screen for major depression disorders. *Gen Hosp Psychiatry* 21:106–111, 1999
11. Blumenthal JA, Lett HS, Babyak MA, *et al*: Depression as a risk factor for mortality after coronary artery bypass surgery. *Lancet* 362:604–609, 2003
12. Schulz R, Beach SR, Lind B, *et al*: Involvement in caregiving and adjustment to death of a spouse: Findings from the caregiver health effects study. *JAMA* 285:3123–3129, 2001
13. Weissman MM, Sholomskas D, Pottenger M, *et al*: Assessing depressive symptoms in five psychiatric populations: A validation study. *Am J Epidemiol* 106:203–214, 1977
14. Roberts RE: Reliability of the CES-D scale in different ethnic contexts. *Psychiatry Res* 2:125–134, 1980
15. Kojima M, Furukawa TA, Takahashi H, *et al*: Cross-cultural validation of the Beck Depression Inventory-II in Japan. *Psychiatry Res* 110:291–299, 2002
16. Zich JM, Attkisson CC, Greenfield TK: Screening for depression in primary care clinics: The CES-D and the BDI. *Int J Psychiatry Med* 20:259–277, 1990
17. Wassertheil-Smoller S, Shumaker S, Ockene J, *et al*: Depression and cardiovascular sequelae in postmenopausal women. The Women's Health Initiative (WHI). *Arch Intern Med* 164:289–298, 2004
18. Abramson J, Berger A, Krumholz HM, Vaccarino V: Depression and risk of heart failure among older persons with isolated systolic hypertension. *Arch Intern Med* 161:1725–1730, 2001
19. Young EW, Goodkin DA, Mapes DL, *et al*: The Dialysis Outcomes and Practice Patterns Study (DOPPS): An international hemodialysis study. *Kidney Int* 57 (Suppl 74):S74–S81, 2000
20. Andresen EM, Malmgren JA, Carter WB, Patrick DL: Screening for depression in well older adults: Evaluation of a short form of the CES-D (Center for Epidemiologic Studies Depression Scale). *Am J Prev Med* 10:77–84, 1994
21. Allison PD: *Survival Analysis Using the SAS System: A Practical Guide*, Cary, NC, SAS Institute Inc., 1995
22. Fukuhara S, Lopes AA, Bragg-Gresham JL, *et al*: Health-related quality of life among dialysis patients on three continents: The Dialysis Outcomes and Practice Patterns Study. *Kidney Int* 64:1903–1910, 2003
23. Waza K, Graham AV, Zyzanski SJ, Inoue K: Comparison of symptoms in Japanese and American depressed primary care patients. *Fam Pract* 16:528–533, 1999
24. Mino Y, Aoyama H, Froom J: Depressive disorders in Japanese primary care patients. *Fam Pract* 11:363–367, 1994
25. Froom J, Aoyama H, Hermoni D, *et al*: Depressive disorders in three primary care populations: United States, Israel, Japan. *Fam Pract* 12:274–278, 1995
26. Mapes DL, Lopes AA, Satayathum S, *et al*: Health-related quality of life as a predictor of mortality and hospitalization: The Dialysis Outcomes and Practice Patterns Study (DOPPS). *Kidney Int* 64:339–349, 2003
27. Lopes AA, Bragg-Gresham JL, Satayathum S, *et al*: Health-related quality of life and associated outcomes among hemodialysis patients of different ethnicities in the United States: The Dialysis Outcomes and Practice Patterns Study (DOPPS). *Am J Kidney Dis* 41:605–615, 2003
28. Goodkin DA, Bragg-Gresham JL, Koenig KG, *et al*: Association of comorbid conditions and mortality in hemodialysis patients in Europe, Japan, and the United States: The Dialysis Outcomes and Practice Patterns Study (DOPPS). *J Am Soc Nephrol* 14:3270–3277, 2003
29. Troidle L, Wuerth D, Finkelstein S, *et al*: The BDI and the SF36: Which tool to use to screen for depression? *Adv Perit Dial* 19:159–162, 2003