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Symptom dimensions of anxiety and depression in patients receiving peritoneal dialysis compared to haemodialysis

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Abstract

Background: Differences in symptom burden, treatment satisfaction and autonomy between patients receiving peritoneal dialysis and haemodialysis could be reflected by a difference in symptom dimensions of anxiety and depression. The aim of this study is to assess differences in prevalence and symptom dimensions of anxiety and depression between patients receiving peritoneal dialysis and haemodialysis.

Methods: Baseline data from the Depression Related Factors and Outcomes in Dialysis Patients With Various Ethnicities and Races Study were used. Symptoms of anxiety and depression were measured with the Beck Anxiety Inventory and Beck Depression Inventory– second edition. Linear and logistic regression models were used to compare anxiety and depression total scores and somatic and subjective/cognitive symptom dimension scores between patients receiving peritoneal dialysis and haemodialysis, adjusted for potential confounders.

Results: In total, 84 patients receiving peritoneal dialysis and 601 patients receiving haemodialysis were included. Clinically significant symptoms of anxiety and depression were present in respectively 22% and 43% of the patients, with no differences between dialysis modality. Both modalities scored high on the somatic symptom dimensions and on individual somatic items. Almost all patients reported symptoms related to loss of energy and sleep.

Conclusion: No differences in symptom dimensions of anxiety and depression were found between patients receiving peritoneal dialysis and haemodialysis. The high prevalence of somatic symptom dimensions in both groups underscores the possible interaction between somatic and psychiatric symptoms in dialysis patients and the need for early recognition and treatment of symptoms of anxiety and depression regardless of treatment modalities.

Keywords

Anxiety, depression, haemodialysis, peritoneal dialysis, symptom dimensions

Introduction

In the dialysis population, symptoms of anxiety and depression are highly common with a prevalence range of 27% to 53% for anxiety and 29% to 42% for depression.[1–3] These symptoms are associated with impaired quality of life, treatment non-adherence and adverse clinical outcomes such as hospitalisation and mortality.[3–6] Despite the high burden and negative consequences, symptoms of anxiety and depression in patients receiving dialysis are often not recognised and treated.[7,8] Several factors have been associated with anxiety and depression, including physiological, psychological and dialysis-related factors.[9] However, the impact of dialysis modality on symptoms of anxiety and depression remains unclear.[9,10]

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In general, patients receiving peritoneal dialysis (PD) report lower burden of kidney disease, are more satisfied with treatment, have greater opportunities for control and autonomy and report that dialysis has less impact on daily life than patients receiving haemodialysis (HD).[6, 11] On the other hand, patients receiving PD experience a greater burden of daily commitment compared to the intermittent nature of HD.[10,12] The choice for either treatment modality is influenced by comorbidities, such as the ability to tolerate volume shifts related to cardiac condition, socioeconomic factors, such as the home situation of the patient, and patient's preferences.[13] Despite these differences, quality of life is found to be comparable between patients receiving PD and HD.[6,10,12] Studies comparing patients receiving PD and HD on symptoms of anxiety are scarce, with one study finding higher anxiety scores in patients receiving HD,[12] and one study finding comparable rates of anxiety in patients receiving HD and PD.[10] A recent meta-analysis found that there was limited and deficient quality evidence on the association between dialysis modalities and depression for any conclusions to be made.[14]

Symptoms of anxiety and depression can overlap with each other and with symptoms of chronic kidney failure and dialysis therapy itself.[3] The complex interplay between biological, psychological and social factors makes it difficult to isolate psychiatric symptoms from symptoms of the somatic disease and dialysis.[15] For instance, symptoms like fatigue and difficulty concentrating can be caused by depression and anxiety or by dialysis related disorders like anaemia or uremia.[1] The difference in symptom burden, treatment satisfaction and autonomy between patients receiving PD and HD could be reflected by a difference in symptom dimensions and symptom profile of anxiety and depression between these modalities. Constructs of symptom dimensions that are described in the literature are a somatic and subjective symptom dimension for anxiety and a somatic and cognitive symptom dimension for depression.[16–19] More insight in the differences of anxiety and depression between dialysis modalities on a symptom dimension and individual symptom level may lead to better understanding of various clinical presentations of these common psychiatric symptoms in specific subgroups and may enhance personalised care in dialysis patients.

The aim of this study is to assess the differences in prevalence, somatic and subjective/cognitive symptom dimensions and individual symptoms of anxiety and depression between patients receiving PD and HD.

Methods

Study design

Baseline data was used from the Depression-In-Various-Ethnicities-and-Races-Study (DIVERS). This multicentre observational prospective cohort study included prevalent and incident patients receiving maintenance HD or PD in 10 Dutch dialysis centres from June 2012 till September 2016, as described in detail elsewhere.[20] Patients were included if they were above 18 years old and received dialysis treatment for at least 90 days. Patients were excluded if they were unable to fill in the questionnaire due to impaired cognitive skills or language restrictions. The questionnaires were available in Dutch, English, Turkish and Arabic to improve generalisability. Questionnaires were administered during dialysis sessions. If needed, patients received assistance in filling out the questionnaires. Written informed consent was obtained from all participants before inclusion. The study complies with the rules of the Declaration of Helsinki and was approved by the medical ethics committee of the VU University Medical Center (approval number: 2010/064).

Demographic and clinical characteristics

Demographic and clinical characteristics were collected from electronic patient files and through self-reported questionnaires. Immigrant status was defined by using the country of birth of both the patient and biological parents. Davies comorbidity index was used to define the level of comorbidities, which is based on the presence or absence of seven comorbid conditions, divided in three groups; low, moderate or high comorbidity.[21] The primary cause of kidney disease was classified according to the ERA-EDTA coding system (European Renal Association European Dialysis and Transplant Association) and divided into four groups: kidney vascular disease, diabetes nephropathy, glomerulonephritis and other.

Anxiety and depression

Symptoms of anxiety were measured with the Beck Anxiety Inventory (BAI) and symptoms of depression were measured with the Beck Depression Inventory– second edition (BDI-II).[22,23] Both questionnaires consist of 21 items which rate the severity of common somatic and cognitive symptoms of anxiety and depression from 0 (not at all) to 3 (severely), with a maximum score of 63 and a higher score indicating more severe anxiety or depression. The BAI has been validated in a large variety of cohorts, including somatically ill patients. A cut-off value of ≥ 16 for the BAI was used based on the manual by Beck and Steer, indicating clinically relevant anxiety. The BDI-II has been widely used in patients receiving dialysis and a cut-off value of ≥ 13, as validated in patients receiving dialysis, was used for clinically relevant depression.[24]

Symptom dimensions

There are several constructs of factorial structure or symptom dimensions of the BAI and BDI-II described in the literature in different patient populations.[16–18, 25] However, literature from the dialysis population is scarce.[19] Recently,

our study group identified a somatic and subjective dimension for anxiety (measured with the BAI) and a somatic and cognitive dimension for depression (measured with the BDI-II in the DIVERS cohort.[26, 27] These identified constructs were used to determine differences in symptom dimensions between patients receiving PD and HD in the present study.

Statistical analysis

Standard descriptive statistics were used to present baseline characteristics. Mean differences (MD) in continuous BAI and BDI-II total scores and of symptom dimension scores between patients receiving PD and HD at baseline were analysed with linear regression models. Multivariable analysis was performed sequentially to adjust for potential confounding, as differences in characteristics between the groups could bias the results. The first step included age, sex and ethnicity, the second step included marital state, having children and current employment and the final step included the Davies comorbidity index. Logistic regression models were used to compare the percentage of patients scoring above the predefined cut-off scores for clinically relevant anxiety and depression and the percentages of patients scoring 1 or higher on the different symptom dimensions between patients receiving PD and HD. The prevalence and mean scores of individual BAI and BDI-II items were calculated for patients receiving PD and HD separately.

Missing data

Participants had the option to take part in a non-questionnaire part of the study. These patients gave consent for extracting information from their electronic patient file only without filling out self-reported questionnaires. Participants with no missing items on the BAI and BDI-II were classified as responders and participants with one or more missing items as incomplete responders. To avoid bias, individual missing BAI and BDI-II items were imputed by using multiple imputation techniques (10 repetitions). Complete case sensitivity analysis was performed on responders only. All statistical analysis were performed using SPSS for Windows, version 26 (IBM Corp).

Results

Baseline characteristics

A total of 685 patients receiving dialysis were included of which 84 received PD and 601 received HD therapy. Baseline characteristics for all patients and stratified by dialysis modality are presented in Table 1. Mean age in the total cohort was 64 $\pm$ 15 years, 62% of patients were men and 48% of patients were immigrants. The cohort consisted of 253 (37%) incident patients receiving dialysis and 433 (63%) prevalent patients who had a median dialysis vintage of 13 months (interquartile range [IQR)] = 4–47).

Anxiety and depression

Mean score of the BAI for all patients was 10.8 (standard deviation (SD) 9.9) with a crude mean difference of 0.2 (95% confidence interval (CI) = −2.4; 2.9) between patients receiving PD and HD (Table 2). Overall, 159 patients (23%) had clinically significant anxiety symptoms (BAI score $\geq$ 16). In the PD group, 19% scored above $\geq$ 16 on the BAI and in the HD group 24% (crude odds ratio (OR) = 0.7, 95% CI = 0.4; 1.4).

Mean BDI-II score of all patients was 12.9 (SD 9.6), crude mean difference between patients receiving PD and HD was 0.1 (95% CI = −2.5; 2.6). In the total cohort, 282 patients (41%) had clinically significant depressive symptoms (BDI-II score $\geq$ 13) (Table 2). Of patients receiving PD, 44% scored above $\geq$ 13 on the BDI-II, for patients receiving HD this was 41% (crude OR = 1.2, 95% CI = 0.7; 2.0).

When confounders were stepwise introduced into the model for the BAI and BDI-II both as continuous scores as well as using the predefined cut-off scores, only minor changes were seen in the regression coefficients and the odds ratios (Table 2). No clinically or statistically significant differences were found in the prevalence and severity of anxiety and depression between patients receiving PD and HD.

Symptom dimensions

Mean score on the somatic symptom dimension of anxiety in patients receiving PD was 7.3 (SD 6.3) and in patients receiving HD 7.5 (SD 6.8) (adjusted mean difference −0.3 (95% CI = −2.1; 1.5) (Table 3). Subjective symptom dimension mean scores were 3.1 (SD 3.1) in patients receiving PD and 3.3 (SD 3.3) in patients receiving HD (adjusted mean difference 0.0 (95% CI = −1.1; 1.1). In both groups, almost all patients (92%) had a score of $\geq$ 1 on the somatic symptom dimension and 70% of patients scored $\geq$ 1 on the subjective symptom dimension, with no difference between the groups.

For depression, mean score on the somatic symptom dimensions in patients receiving PD was 6.8 (SD 3.1) and in patients receiving HD 6.5 (SD 3.6) (adjusted mean difference −0.6 (95%CI = −1.5; 0.3) (Table 3). Mean score of the cognitive symptom dimensions was 6.1 (SD 6.1) in patients receiving PD and 6.3 (SD 6.3) in patients receiving HD (adjusted mean difference 0.3 (95%CI = −1.6; 2.1). Both the somatic symptom dimension (97%) and the cognitive dimension (83%) were scored $\geq$ 1 by the majority of the patients.

Table 1. Baseline characteristics.[a]

Characteristic	All patients ($n = 685$)	PD ($n = 84$)	HD ($n = 601$)
Demographic			
Age, years	64 ± 15	64 ± 14	65 ± 16
Male sex	424 (62%)	53 (63%)	370 (62%)
Immigrant[b]	300 (48%)	33 (46%)	267 (48%)
Country of birth			
European	366 (58%)	42 (58%)	324 (58%)
Sub-Saharan Africa	22 (4%)	0 (0%)	22 (4%)
Northern Africa/Western Africa	54 (9%)	4 (6%)	50 (9%)
Southern Asia/Western Asia	57 (9%)	11 (15%)	46 (8%)
South America/Caribbean	131 (21%)	15 (21%)	116 (21%)
Social			
Married	316 (52%)	40 (56%)	276 (52%)
Has children	474 (78%)	56 (78%)	418 (78%)
Low formal education[c]	220 (36%)	22 (31%)	198 (37%)
Not employed	534 (89%)	57 (80%)	477 (90%)
Kidney and dialysis			
Incident dialysis patients[d]	253 (37%)	27 (32%)	225 (37%)
Vintage of prevalent group, months	13 [4–47]	10 [5–35]	14 [4–47]
Primary kidney disease			
Kidney vascular disease	163 (26%)	18 (25%)	145 (26%)
Diabetic nephropathy	155 (24%)	15 (21%)	140 (25%)
Glomerulonephritis	70 (11%)	12 (17%)	58 (10%)
Other	247 (39%)	27 (38%)	220 (39%)
Kt/V_{urea}	4.0 ± 1.1	2.2 ± 0.7	4.2 ± 1.1
Residual diuresis > 100 mL/24 h	488 (71%)	74 (88%)	414 (69%)
On waiting list for kidney transplantation	203 (30%)	35 (42%)	168 (28%)
Clinical			
Davies comorbidity score			
Low comorbidity	183 (27%)	22 (28%)	161 (27%)
Moderate comorbidity	370 (55%)	51 (64%)	319 (54%)
High comorbidity	119 (18%)	7 (9%)	112 (19%)
Comorbid conditions			
Diabetes mellitus	288 (42%)	29 (35%)	259 (43%)
Cardiovascular disease	541 (79%)	65 (77%)	476 (79%)
Current alcohol use	161 (27%)	27 (39%)	134 (25%)
Current smoking	108 (18%)	11 (16%)	97 (19%)
Laboratory			
Haemoglobin (mmol/L)	7.1 ± 0.8	7.1 ± 0.8	7.1 ± 0.8
Albumin (g/L)	37.0 ± 5.3	35.5 ± 5.0	37.3 ± 5.3
Phosphate (mmol/L)	1.6 ± 0.5	1.6 ± 0.4	1.6 ± 0.5
Parathyroid hormone (pmol/L)	34.1 ± 26.8	32.9 ± 24.2	34.3 ± 27.2
Psychiatric			
History of major depression	27 (4%)	3 (4%)	24 (4%)
Receiving psychological care	24 (4%)	3 (4%)	21 (4%)

(continued)

Individual symptoms

Table 4 describes the prevalence and severity of individual items of the BAI in patients receiving PD and HD. Of the somatic anxiety symptoms, more than half of both patients receiving PD and HD experience faintness (PD 64% and HD 53%), dizziness or lightheadedness (55% and 53%) and unsteadiness (51% and 53%), but patients receiving PD more often experience abdominal discomfort (45% vs 33%) and patients receiving HD experience more numbness or tingling (49% vs 42%). The most severe and prevalent subjective anxiety symptoms in both patients receiving PD and HD were nervousness (44% and 42%),

Table 2. Differences in BAI and BDI-II scores and prevalence of clinically significant symptoms of anxiety and depression between HD and PD patients at baseline (crude and multivariable linear and logistics regression model).

	All patients ($n = 685$)	PD ($n = 84$)	HD ($n = 601$)	MD (95%CI)/OR (95%CI)[a]	p
Anxiety (BAI)					
Mean ± SD	10.8 ± 9.9	10.4 ± 9.0	10.8 ± 10.0		
1. Univariable/crude				0.2 (−2.4; 2.9)	0.87
2. + Age, sex, ethnicity				0.1 (−2.5; 2.8)	0.91
3. + Social characteristics				−0.2 (−2.8; 2.4)	0.86
4. Comorbidity				−0.4 (−2.9; 2.2)	0.80
BAI ≥ 16[a]	159 (23%)	16 (19%)	142 (24%)		
1. Univariable/crude				0.7 (0.4; 1.4)	0.35
2. + Age, sex, ethnicity				0.7 (0.4; 1.4)	0.35
3. + Social characteristics				0.8 (0.4; 1.5)	0.45
4. + Comorbidity				0.8 (0.4; 1.6)	0.58
Depression (BDI-II)					
Mean ± SD	12.9 ± 9.6	12.9 ± 8.7	12.9 ± 9.7		
1. Univariable/crude				0.1 (−2.5; 2.6)	0.97
2. + Age, sex, ethnicity				0.0 (−2.5; 2.5)	0.99
3. + Social characteristics				−0.2 (−2.7; 2.3)	0.86
4. + Comorbidity				−0.3 (−2.8; 2.2)	0.79
BDI-II ≥ 13[a]	282 (41%)	37 (44%)	244 (41%)		
1. Univariable/crude				1.2 (0.7; 2.0)	0.54
2. + Age, sex, ethnicity				1.2 (0.7; 2.0)	0.51
3. + Social characteristics				1.2 (0.7; 2.1)	0.47
4. + Comorbidity				1.2 (0.7; 2.1)	0.46

HD: haemodialysis; PD: peritoneal dialysis; BAI: Beck Anxiety Inventory; BDI-II: Beck Depression Inventory– second edition; MD: mean difference; OR: odds ratio.

[a]Logistic regression was used for the pre-defined cut-off values and results are presented as OR.

Table 3. Differences in symptom dimensions scores of the BAI and BDI-II s between HD and PD patients at baseline (crude model and multivariable linear and logistic regression model).[a]

	All patients ($n = 685$)	PD ($n = 84$)	HD ($n = 601$)	MD (95%CI)/OR (95%CI)[b]	p
Anxiety (BAI)					
Somatic dimension					
Mean ± SD	7.5 ± 6.8	7.3 ± 6.3	7.5 ± 6.8		
1. Univariable/crude				0.4 (−1.8; 1.9)	0.97
2. + Age, sex, ethnicity				0.0 (−1.8; 1.8)	0.98
3. + Social characteristics				−0.3 (−2.1; 1.5)	0.77
4. + Comorbidity				−0.3 (−2.1; 1.5)	0.71
Prevalence (% ≥ 1)[c]	631 (92%)	75 (89%)	555 (92%)		
1. Univariable/crude				0.7 (0.3; 1.5)	0.31
2. + Age, sex, ethnicity				0.7 (0.3; 1.5)	0.33
3. + Social characteristics				0.7 (0.3; 1.6)	0.37
4. + Comorbidity				0.6 (0.3; 1.5)	0.30
Subjective dimension					
Mean ± SD	3.3 ± 3.3	3.1 ± 3.1	3.3 ± 3.3		
1. Univariable/crude				0.2 (−0.9; 1.3)	0.75
2. + Age, sex, ethnicity				0.2 (−0.9; 1.2)	0.76
3. + Social characteristics				0.0 (−1.0; 1.1)	0.95
4. + Comorbidity				0.0 (−1.1; 1.1)	0.97
Prevalence (% ≥ 1)[c]	478 (70%)	58 (69%)	421 (70%)		
1. Univariable/crude				1.0 (0.6; 1.8)	0.95
2. + Age, sex, ethnicity				1.0 (0.6; 1.8)	0.91
3. + Social characteristics				1.1 (0.6; 1.9)	0.86
4. + Comorbidity				1.1 (0.6; 1.9)	0.86
Depression (BDI-II)					
Somatic dimension					
Mean ± SD	6.6 ± 3.5	6.8 ± 3.1	6.5 ± 3.5		

(continued)

Table 3. (continued)

	All patients ($n = 685$)	PD ($n = 84$)	HD ($n = 601$)	MD (95%CI)/OR (95%CI)[b]	p
1. Univariable/crude				−0.4 (−1.3; 0.5)	0.37
2. + Age, sex, ethnicity				−0.5 (1.4; 0.4)	0.30
3. + Social characteristics				−0.5 (−1.5; 0.4)	0.24
4. + Comorbidity				−0.6 (−1.5; 0.3)	0.21
Prevalence (% ≥ 1)[c]	664 (97%)	83 (99%)	580 (97%)		
1. Univariable/crude				2.7 (0.3; 20.1)	0.35
2. + Age, sex, ethnicity				2.7 (0.4; 20.5)	0.34
3. + Social characteristics				2.9 (0.4; 22.4)	0.31
4. + Comorbidity				2.8 (0.4; 21.8)	0.33
Cognitive dimension					
Mean ± SD	6.3 ± 6.3	6.1 ± 6.1	6.3 ± 6.3		
1. Univariable/crude				0.5 (−1.4; 2.4)	0.63
2. + Age, sex, ethnicity				0.5 (1.4; 2.3)	0.63
3. + Social characteristics				0.3 (−1.5; 2.2)	0.73
4. + Comorbidity				0.3 (−1.6; 2.1)	0.79
Prevalence (% ≥ 1)[c]	574 (83%)	74 (88%)	500 (83%)		
1. Univariable/crude				1.3 (0.6; 2.8)	0.47
2. + Age, sex, ethnicity				1.3 (0.6; 2.8)	0.45
3. + Social characteristics				1.3 (0.6; 2.8)	0.47

(continued)

Table 4. Prevalence and mean score of BAI items in PD and HD patients in this cohort.[a]

Symptoms scored in the BAI, listed by decreasing prevalence in PD	% of PD patients with this symptom (marker for prevalence) ($n = 84$)	Mean ± SD (marker for severity)	% of HD patients with this symptom (marker for prevalence) ($n = 601$)	Mean ± SD (marker for severity)
Somatic dimension[b]				
Faintness	64%	0.85 ± 60.9	53%	0.77 ± 0.88
Dizziness or lightheaded	55%	0.77 ± 0.84	53%	0.78 ± 0.91
Unsteadiness	51%	0.70 ± 0.80	53%	0.81 ± 0.94
Stomach pains or abdominal discomfort	45%	0.64 ± 0.80	33%	0.50 ± 0.83
Wobbly legs	43%	0.63 ± 0.83	40%	0.62 ± 0.90
Numbness or tingling	42%	0.63 ± 0.90	49%	0.79 ± 0.96
Heart pounding or racing	40%	0.63 ± 0.85	40%	0.55 ± 0.79
Feeling hot	36%	0.51 ± 0.78	36%	0.54 ± 0.81
Shaking hands	36%	0.52 ± 0.79	33%	0.47 ± 0.77
Difficulty with breathing	36%	0.47 ± 0.70	30%	0.39 ± 0.67
Trembling	31%	0.39 ± 0.62	30%	0.41 ± 0.72
Sweating (not due to feeling warm)	23%	0.35 ± 0.70	25%	0.40 ± 0.79
Hot or flushed face	23%	0.27 ± 0.51	24%	0.35 ± 0.69
Chocking sensation	12%	0.14 ± 0.39	17%	0.27 ± 0.66
Subjective dimension[b]				
Nervous	44%	0.62 ± 0.80	42%	0.59 ± 0.82
Unable to relax	43%	0.54 ± 0.70	40%	0.62 ± 0.90
Fear of the worst happening	42%	0.63 ± 0.88	39%	0.64 ± 0.94
Fear of losing control	37%	0.46 ± 0.65	27%	0.42 ± 0.78
Scared	27%	0.36 ± 0.64	27%	0.41 ± 0.79
Fear of dying	23%	0.38 ± 0.80	25%	0.42 ± 0.82

(continued)

Table 5. Prevalence and mean score of BDI-II items in PD and HD patients in this cohort.[a]

Symptoms scored in the BDI-II, listed by decreasing prevalence in PD	% of PD patients with this symptom (marker for prevalence) ($n = 84$)	Mean ± SD (marker for severity)	% of HD patients with this symptom (marker for prevalence) ($n = 601$)	Mean ± SD (marker for severity)
Somatic dimension[b]				
Loss of energy	94%	1.47 ± 0.79	89%	1.37 ± 0.82
Fatigue	94%	1.38 ± 0.76	84%	1.27 ± 0.87
Changes in sleeping	83%	1.25 ± 0.84	73%	1.10 ± 0.90
Loss of libido	77%	1.36 ± 1.03	70%	1.36 ± 1.16
Change in appetite	65%	0.88 ± 0.79	60%	0.83 ± 0.82
Concentration	44%	0.57 ± 0.69	47%	0.620 ± 0.76
Cognitive dimension[b]				
Loss of pleasure	61%	0.79 ± 0.75	53%	0.73 ± 0.82
Pessimism	40%	0.62 ± 0.92	47%	0.76 ± 0.97
Irritability	40%	0.45 ± 0.56	34%	0.47 ± 0.74
Agitation	39%	0.51 ± 0.73	32%	0.42 ± 0.70
Crying	38%	0.60 ± 0.90	30%	0.47 ± 0.84
Self-dislike	36%	0.46 ± 0.65	28%	0.39 ± 0.70
Loss of interest	32%	0.43 ± 0.71	35%	0.49 ± 0.78
Indecisiveness	32%	0.51 ± 0.87	33%	0.50 ± 0.82
Self-criticalness	31%	0.43 ± 0.73	31%	0.44 ± 0.76
Sadness	26%	0.31 ± 0.58	27%	0.40 ± 0.75
Guilt	20%	0.27 ± 0.59	16%	0.23 ± 0.59
Worthlessness	19%	0.26 ± 0.61	28%	0.39 ± 0.70
Sense of failure	15%	0.30 ± 0.74	19%	0.34 ± 0.76
Punishment	14%	0.35 ± 0.93	14%	0.29 ± 0.82
Suicidal ideas	5%	0.07 ± 0.31	11%	0.15 ± 0.48

HD: haemodialysis; PD: peritoneal dialysis; BAI: Beck Anxiety Inventory; SD: standard deviation.
[a]Presence of symptoms are scored as yes when the score is ≥ 1 (including mild, moderate and severe).
[b]According to the Schouten model of somatic-cognitive symptoms for the BDI-II.[26]

being unable to relax (43% and 40%) and fear of the worst happening (42% and 39%).

Almost all patients reported to experience the somatic depressive symptoms loss of energy (PD 94% and HD 89%), fatigue (94% and 84%) and changes in sleeping (83% and 73%) (Table 5). Concerning cognitive depressive symptoms, more than half of the patients experience loss of pleasure (61% and 53%) and almost one third of patients experience loss of interest (32% and 35%) and feelings of sadness or a depressed mood (26% and 27%).

Missing data

Baseline demographic and clinical variables had <5% missing values. The overall percentage of missing items on the BAI was 7.8% and on the BDI was 4.6%. Missing items were similar across all items of the BAI and BDI-II, except for item 21 (loss of interest in sex) of the BDI-II (9.3%) (Supplementary Tables S1 and S2). Of the total cohort, 8% of patients participated in the non-questionnaire part of the study. Complete BAI was available of 508 patients and complete BDI-II of 533 patients. Responders were more likely to be male (66% vs 48%) and to be married (54% vs 40%) than non-responders. No major differences were found in age, ethnicity, having children, current employment status, comorbidities and dialysis modality. Complete case sensitivity analysis showed no major differences compared to the main analysis using multiple imputation.

Discussion

This study assessed the differences in prevalence, somatic and subjective/cognitive symptom dimensions and individual symptoms of anxiety and depression between patients receiving PD and HD. Despite the known difference in symptom burden, treatment satisfaction and autonomy between the two dialysis modalities, clinically relevant symptoms of anxiety and depression were highly prevalent in both patients receiving PD and HD and no differences in prevalence or severity were found between these groups. In both groups, the somatic symptom dimensions of both anxiety and depression were more prevalent and more severe than the subjective anxiety symptom dimension or cognitive depression symptom dimension. The most prevalent somatic symptoms of anxiety and depression in both patients receiving PD and HD were related to faintness, fatigue and loss of energy, which may underscore the interplay between mental and physical health.

Prevalence of anxiety and depression

In our cohort, symptoms of anxiety and depression were highly prevalent in both patients receiving PD and HD.

Anxiety in patients receiving dialysis can be triggered by the activities of attending dialysis or the dialysis treatment itself, for instance by the dialysis machine alarming in HD treatment.[28,29] Depression in patients receiving dialysis can be triggered by grief over the loss of a normal life, an uncertain future with dreading complications and mortality and guilt of burdening family members.[28] A recent study found different perspectives on anxiety and depression between patients receiving PD and HD. Whereas patients receiving HD had major concerns about the lack of control over management, feeling enslaved to a machine, feeling confined to the dialysis schedule and the healthcare system and being concerned about the risk of symptomatic hypotension on dialysis, patients receiving PD, on the other hand, felt vulnerable in being solely responsible for dialysis and protecting independence, felt guilt and self-blame over complications and were particularly concerned about the risk of peritonitis.[28]

Although the dialysis modality related triggers of anxiety and depression seem to differ according to the literature, we did not find a difference in prevalence or symptom dimensions of anxiety and depression between patients receiving PD and HD. A possible explanation for this finding might be that both our groups are very similar in demographic, social and clinical characteristics, making their other risk factors for anxiety and depression, besides dialysis modality, comparable. Previous studies show that patients receiving HD are more likely to be older and to have a history of vascular disease, cardiac disease and cancer compared to patients receiving PD. Indeed, these diseases are barriers to start PD.[30] It is possible that we did not find these differences in patient characteristics between patients receiving PD and HD in our sample because living kidney donation has increased in the Netherlands before and during our study period. Younger patients with less comorbidities who would have been more likely to start PD, might have received a living kidney transplant before initiating dialysis therapy.

Symptom dimensions

Somatic symptoms of anxiety and depression measured by the BAI and BDI-II overlap with symptoms of kidney failure and dialysis therapy, which might be an explanation of the high number of patients scoring on the somatic symptom dimensions of anxiety and depression in our cohort. However, studies have shown that exclusion of somatic symptoms in the BDI-II does not lead to a better screening performance.[31] Also, the associations between the somatic symptom dimensions of anxiety and depression and increased mortality risk in dialysis patients are independent of somatic comorbidities and other clinical variables.[26,27] This underscores that interpretation of these somatic symptoms as being only related to chronic kidney disease and dialysis therapy is short-sighted, as physical and mental health are in complex interaction with each other. Furthermore, the core features of depression from the cognitive symptom dimension, depressed mood and loss of pleasure and interest, and the subjective dimension of anxiety are also present in the majority of patients. It is possible that the high prevalence of somatic symptoms of anxiety and depression might be a cause of the underrecognition of these mental health problems in patients receiving dialysis.

Individual symptoms

Interestingly, almost all patients in our study cohort reported somatic depressive symptoms related to energy, fatigue and sleep (73–94%). A recent systematic review on the experiences of patients receiving dialysis of sleep underlines the magnitude of sleeping problems and lack of energy in this population.[32] Overwhelming exhaustion can lead to the depletion of the sense of control and capacity to do daily activities due to lack of energy, which might lead to feelings of sadness, guilt and frustration. Sleep disorders are also highly associated with mental health problems and regarded as one of the most important trans-diagnostic processes influencing mental health.[33] Moreover, sleep disorders influence quality of life due to effects on cognitive, emotional and interpersonal functioning[34] and can also have effects on general health.[35] There is an important bidirectional association between sleep quality and health: insomnia can be an important symptom, cause or consequence of depression and anxiety.[36] For example, previous studies over the last decades show that insomnia often precedes and exacerbates depression, results in reduced treatment responses and increases relapse rates of depression.[37,38] As such, it is an important symptom and it is possible that strategies to improve sleep quality might lead to subsequent improvement of anxiety and depression in both patients receiving PD and HD.

Strengths and limitations

The strengths of this study are the relatively large sample size of patients receiving PD and HD, the multicentre nature of the cohort, the use of questionnaires in four languages and the inclusion of a large proportion of ethnic minorities and immigrants, which improves the generalisability of our results. Also, this is the first study to assess differences in symptom dimensions of anxiety and depression in patients receiving dialysis and to compare individual symptoms between dialysis modalities.

Our study has several limitations that should also be taken in mind when interpreting the results. First, we have assessed anxiety and depression by using self-reported screening questionnaires and with the use of cut off scores for indication of a possible diagnosis of anxiety and depression instead of a clinical diagnosis according to Diagnostic and Statistical Manual of Mental Disorders 5.

This might lead to overestimation of the prevalence we found due to overlap in symptoms of depression and

anxiety and side-effects of dialysis therapy and due to over-reporting of somatic symptoms during dialysis sessions compared to off dialysis screening.[1,31] Second, the imbalance in sample size between the HD and PD group may lower our effective sample size. However, this ratio is equal to the percentage of HD and PD in the general dialysis population in the Netherlands. Third, although we used multiple imputation techniques to handle missing data, remaining effect on the validity of the results cannot be excluded. Fourth, although we adjusted for confounding factors in our analysis, it is possible that there is residual confounding between patients receiving PD and HD which might lead to bias in our results. Fifth, there could be a selection bias due to anxiety and depression being related to avoidant coping styles and loss of interest and motivation. Also, we found that female patients and patients who are not married were less likely to respond. However, we have been able to include almost half of the patients who were assessed for eligibility (685 of around 1500 patients). Finally, although both the BAI and BDI-II are linguistically validated in the concerned languages, as far as we know only the English and Dutch versions of the BDI-II are validated in the dialysis population.[31] As there is no published data on the validation of the BAI in patients receiving dialysis, we used a cut-off score for clinical relevant anxiety of $\geq$ 16 on the BAI based on the manual by Beck and Steer.[23]

Conclusion

In conclusion, symptoms of anxiety and depression are highly prevalent in both patients receiving PD and HD. Although dialysis modalities are known to be different in autonomy and therapy burden, we did not find differences in prevalence or symptom dimensions of anxiety and depression between these groups. The somatic symptom dimensions of both anxiety and depression were more prevalent than the subjective or cognitive symptom dimensions in both patients receiving PD and HD, which is possibly related to the high comorbidity level and the impact on general health status in both the PD and HD sample. Almost all patients experienced symptoms related to loss of energy, fatigue and sleep. Our findings underscore the need for early recognition of somatic symptoms that relate to anxiety and depression in patients receiving dialysis, with the purpose to get proper treatment regardless of treatment modality. Future research should focus on effective treatment for symptoms of anxiety and depression as well as preventative interventions in both patients receiving HD and PD.

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Author contributions

EN, RWS, XL, CEHS and BFPB have contributed to the study design and all authors have contributed to the preparation of this manuscript. RWS, PCS, FvI, YFCS, LJV and CEHS included the patients and contributed to data acquisition. EN and XL performed the statistical analysis under supervision of RWS and FWD. EN and XL wrote the first draft of this manuscript; all co-authors critically reviewed and revised the initial draft and approved the final version of the manuscript.

Data availability statement

The data underlying this article cannot be shared publicly for the privacy of individuals that participated in the study. The data will be shared on reasonable request to the corresponding author.

Declaration of conflicting interests

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Supplemental material

Supplemental material for this article is available online.

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