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Patient-reported cognitive functioning and daily functioning in chronic dialysis patients

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Abstract

Background—Subjective cognitive impairment negatively affects daily functioning, health-related quality of life, and healthcare consumption and is predictive of future cognitive decline in many patient populations. However, no subjective measures of multidimensional cognitive functioning have been evaluated for dialysis patients. Our purposes were to examine (1) the association between patient-reported (subjective) cognitive functioning and objective cognitive functioning and (2) the relationships between subjective and objective cognitive functioning and everyday functioning of dialysis patients.

Methods—We used baseline data from an on-going longitudinal observational study of trajectories in dialysis patients' multidimensional quality of life. 135 patients completed a telephone-based neuropsychological battery (BTACT, a measure of objective cognitive functioning), a measure of subjective cognitive functioning (PAOFI), and measures of everyday functioning (ADLs and IADLs).

Results—After controlling for age and education, there was a modest correlation ($r = 0.33$, $p > 0.001$) between subjective and objective cognitive functioning. Multivariate logistic regression models showed subjective, but not objective, cognitive functioning was a significant predictor of both ADLs and IADLs.

Conclusions—The findings suggest the potential clinical value of subjective measures of cognitive functioning, not to replace objective measures or diagnostic tests, but rather to optimize the meaningfulness of clinical assessment and management.

Keywords

Cognitive functioning; daily functioning; dialysis

Over the past decades, the number of studies documenting cognitive impairment among dialysis patients has increased. These studies report the prevalence of cognitive

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impairment,[1–3] the relationship between neuropsychological functioning and test timing and dialysis modality,[4–6] and risk factors for cognitive impairment.[1, 7–10] The clinical implications of cognitive impairment in the dialysis population, such as its association with low protein catabolic rate, increased technician time caring for patient after dialysis, and increased hospital days, have also been reported.[11]

However, there are two areas in this field that have received little attention. First, the impact of neuropsychological functioning on dialysis patients' everyday functioning has been inferred but rarely examined. A recent study reported the prevalence of patient-reported stroke symptoms among dialysis patients and their association with cognitive and functional impairment.[12] The study showed significant associations between stroke symptoms and both cognitive and functional impairment, but the contribution of cognitive impairment itself to functional status was not reported.

Second, although the utility of patient self-reports of cognitive functioning remains contentious in patient populations such as people with stroke, post-chemotherapy, multiple sclerosis, and psychiatric illness,[13–18] subjective measures have been developed and tested for those populations. Skepticism over self-reports exists because patients' ability to accurately assess their own cognitive functioning may be compromised if they are severely cognitively impaired. Also, there is a possibility that the impact of cognitive deficits in daily functioning may be exaggerated or underestimated and that social desirability may influence responses.[13, 15] For these reasons, subjective measures are rarely administered in clinical practice, and patients' complaints about cognitive functioning are often disregarded if they are not matched with objective measures.[15]

However, studies have shown that subjective cognitive impairment negatively affects daily functioning, health-related quality of life, and healthcare consumption and is predictive of future cognitive decline in other populations.[19–23] Nevertheless, no subjective measures of multidimensional cognitive functioning have been evaluated for dialysis patients. This lack of information is critical because of the importance of assessing patients' experience with cognitive impairment in order to provide them with meaningful clinical management. To date, two studies[7, 24] have assessed the validity of the three cognitive function items of the Kidney Disease Quality of Life measure.[25] The investigators compared those three items with neuropsychological test results to determine if the items could be useful as a screening tool, but the results were inconclusive.

Addressing these gaps is an important step toward developing interventions that can target the cognitive difficulties experienced by patients and reduce their impact on daily functioning. Therefore, the purposes of this study were to examine (1) the association between patient-reported cognitive functioning and objective cognitive functioning and (2) the relationships between subjective and objective functioning and everyday functioning of dialysis patients.

MATERIALS AND METHODS

Design and participants

We used the baseline data from an ongoing longitudinal observational study on trajectories of dialysis patients' multidimensional quality of life (NCT01530945). The study protocol was approved by the Institutional Review Board at the University of North Carolina at Chapel Hill and by the Office of Clinical Trials at the participating dialysis organizations. From April 2012 to September 2013, participants were recruited from 6 outpatient dialysis clinics in North Carolina. Eligible participants were 18 years or older, had been receiving maintenance dialysis for at least 1 month, and were able to speak English fluently. Participants were excluded if they had hearing impairment, were too ill to participate or were unable to provide informed consent (determined by > 3 errors on a gross cognitive screening test, the 10-item Short Portable Mental Status Questionnaire [26]) or documented advanced dementia.

Of 185 eligible potential participants (of 258 who were screened), 152 (82.2%) consented. Of those, ten subsequently withdrew, five were found to be ineligible, and one died before baseline completion, resulting in a sample size of 135. Those who declined participation were slightly older (64.42 [10.43]), more likely White (n=13, 39.4%), roughly half were male (n=16, 48.5%), and few were receiving peritoneal dialysis (n=3, 9.1%). Decliners were receiving dialysis for a longer period time, 56.48 (51.45) months, compared to those who joined study (51.10 [61.38]).

Instruments and data collection procedures

All data collection was completed by trained data collectors using a standardized script. For hemodialysis patients, data were collected on a non-dialysis day to avoid the impact of dialysis sessions on self-reports.[27] We chose to use telephone-based data collection because the longitudinal study involves multidimensional quality of life assessments repeated monthly over 12 months, making in-person data collection at the clinic too burdensome for participants.

Objective cognitive functioning—We used the Brief Test of Adult Cognition by Telephone (BTACT) neuropsychological battery that includes tasks based on laboratory research and modified versions of well-documented psychometric tests adapted for telephone administration.[28, 29] The battery includes six tests: (1) episodic verbal memory assessed using immediate recall of a 15-unrelated word list of the Rey Auditory-Verbal Learning Test;[30] (2) working memory span measured by backward digit span;[31] (3) language/verbal fluency and executive functioning by category fluency-animal;[32] (4) inductive reasoning or fluid intelligence assessed with number series completion;[33] (5) processing speed assessed with a backward counting task;[34, 35] and (6) verbal memory-delayed assessed using short-delayed recall of the 15-word list.

The battery requires less than 20 minutes to administer, including providing instructions at the beginning to be in quiet surroundings, not to write down anything during the test, and to close their eyes to facilitate concentration. The BTACT has been tested both in person and via telephone with no significant effect of mode of testing,[29] similar to previous study findings of telephone vs. in-person testing.[35, 36] In addition to the six individual subtest scores, we computed BTACT composite scores by averaging the standardized scores for subtests.[37] The internal consistency α for the composite was 0.78, slightly lower than 0.82 reported by Tun and Lechman.[29]

Subjective cognitive functioning—The Patient's Assessment of Own Functioning Inventory (PAOFI) is a 33-item multidimensional measure that asks participants to rate how often they experience difficulty in four areas: memory, language/communication, sensory-motor ability, and executive function with response options from 0 ("almost never") to 5 ("almost always").[38] Both the four subscales and total scores (the sum of the four subscales) were used in analysis. PAOFI is a widely used questionnaire to assess perceived multidimensional cognitive functioning in various populations.[13, 14] After reverse coding, higher scores indicate better perceived cognitive function. Construct validity has been demonstrated by comparing neuropsychiatric patients with healthy controls [38] and comparing the PAOFI scores with neuropsychological tests in cancer patients.[39] The internal consistency reported in previous studies ranged from 0.80 to 0.88. The overall Cronbach's α in this study was 0.87.

Daily functioning—The Activities of Daily Living (ADL)[40] and Instrumental Activities of Daily Living (IADL) Scales [41] were used. For ADL, participants rate their difficulty in performing seven vital activities (walking across a small room, bathing, grooming, dressing, eating, transferring from bed to chair, and using the toilet) on a scale from 0 ("no difficulty") to 3 ("complete disability"). Summary scores range from 0 to 21. For IADL, participants rate their difficulty in performing seven activities (preparing meals, daily shopping, doing light housekeeping, doing laundry, driving or arranging travel, managing medication, and handling money). Each task of the IADL is scored as 0 ("no difficulty") or 1 ("any difficulty"). Summary scores range from 0 to 7. Participants who needed assistance in any of the 7 ADL and 7 IADL activities (scores ≥ 1) were determined as ADL or IADL impaired, a categorization used in other studies.[12, 42–44]

Potential confounders and covariates—Participants completed a Sociodemographic Profile that asked age, gender, race and ethnicity, marital status, and education. The presence and severity of pain and other symptoms were assessed using the modified Edmonton Symptom Assessment System (ESAS) that has been validated for dialysis patients.[45] Participants rate the severity of each of 10 symptoms (e.g., pain, nausea, fatigue) on a scale ranging from 0 ("no") to 10 ("severe"). Its sensitive to change, a 1-week test-retest (ICC=.70), and construct validity have been demonstrated with dialysis patients.[45] Depressive symptom severity was measured using the Center for Epidemiologic Studies Depression Scale (CES-D) Short Form.[46] Total scores range from 0 to 30. Anxiety symptom severity was measured using the State-Trait Anxiety Inventory (STAI) [47]. Higher scores indicate more severe anxiety symptoms (range 0–80). Reliability and validity of both CES-D and STAI have been well established.[46, 47] Medical records were reviewed to obtain information about comorbid conditions to compute Charlson Comorbidity Index (CCI) scores,[48] and other clinical characteristics and laboratory data.

Data analysis

A Pearson correlation coefficient between each BTACT and PAOFI subscale was calculated. The correlations between the socio-demographic and clinical variables, ESAS, STAI, and CES-D and each of the BTACT and PAOFI subscales were assessed similarly. Any covariate that was significantly correlated with both BTACT and PAOFI was treated as a possible confounder. The null hypothesis of no correlation between each possible pair of BTACT and PAOFI subscales was retested using linear regression models that included the possible confounders as covariates.

To evaluate the association between ADL or IADL and BTACT or PAOFI, the means of BTACT and PAOFI subscale scores were computed for both the unimpaired (ADL and IADL each=0) and impaired (ADL and IADL each >0) groups. The two groups were compared with respect to each subscale using logistic regression. The two groups were also compared with respect to each of the socio-demographic and clinical variables, ESAS, STAI, and CES-D using logistic regression. Any covariate that was associated with both ADL or IADL and BTACT or PAOFI was treated as a possible confounder. The null hypothesis of no association between each of BTACT and PAOFI subscale scores and ADL or IADL was retested using logistic regression models that included the possible confounders as covariates.

RESULTS

Sample Characteristics

All participants were community-dwelling. Participants' socio-demographic and clinical characteristics are presented in Table 1. Sixty participants (44.4%) were 61 years or older, and a majority of the sample were male, African American, and had completed at least high school education. The top 3 primary causes of kidney failure were diabetes (n=68, 50.4%), hypertension (n=34, 25.2%), and glomerulonephritis (n=13, 9.6%). Most participants (n=125, 92.6%) were receiving traditional center-hemodialysis. The median years on dialysis was 3.08, and 35 participants (25.9%) had been on dialysis 12 or fewer months. On average, participants were experiencing 4 moderate to severe symptoms on the ESAS. The most frequently reported moderate to severe symptoms were fatigue (n=85, 63.0%) and pain (n=73, 54.1%). Thirty-eight participants (28.1%) scored > 10 on CES-D-SF, suggesting a high likelihood of depression. The mean (SD) of STAI was 30.79 (9.72).

Objective and subjective assessment of cognitive functioning

When compared with the published BTACT subtest scores of healthy adults (N=84, age range 23–80 years),[29] the mean of immediate wordlist recall was 0.92 SD below the healthy group, backward digit span was 0.84 SD below, category fluency was 0.86 SD below, number series was 1.09 SD below, backward counting was 1.45 SD below, and short-delay wordlist recall was 0.56 SD below the healthy group. Currently there exist no normative data for PAOFI scores.

Among the socio-demographic variables, age was significantly associated with several BTACT subtests: specifically, category fluency (r=−0.28, p=0.001), number series (r=−0.20, p=0.03), backward counting (r=−0.37, p<0.001), and short-delay wordlist recall (r=−0.19, p=0.036). But there was no significant association between age and PAOFI subscale scores. Years of formal education were significantly associated with all BTACT subtests (rs = 0.26 – 0.36, ps <0.01), except immediate wordlist recall, and with all PAOFI subscale scores (rs = 0.21 – 0.34, ps <0.01), except memory. Initial racial differences seen in BTACT composite and PAOFI total scores (Caucasians scored higher than African Americans and others) were attenuated after controlling for years of formal education (Caucasians 13.57 [3.18] vs. African Americans and others 12.32 [2.53], t=2.34, p=0.02). Thus, age and education were treated as possible confounders in the subsequent analysis.

While history of stroke was not associated with BTACT composite or PAOFI total scores, CCI total scores were negatively associated with BTACT immediate and short-delay wordlist recalls and backward counting (|r|s=0.23 – 0.24, ps <0.01), but not with PAOFI total or subscale scores. However, after adjusting for age, these associations were no longer significant. BTACT and PAOFI scores did not differ by any of our other clinical variables, including dialysis modality and vintage and Kt/V. All PAOFI subscale scores, except sensory-motor, were negatively associated with ESAS, STAI, and CES-D-SF (|r|s =0.35 – 0.45, ps <0.001), but no BTACT scores were associated with these variables.

The correlations between the BTACT and PAOFI subscales are shown in Table 2. In unadjusted analyses, there was a significant, but modest correlation of PAOFI-language with BTACT-category fluency, number series, and backward counting (r=0.23–0.33). PAOFI total scores were also correlated with BTACT-category fluency and backward counting (r=0.23–0.25). However, after adjusting for age and education, only language/communication of PAOFI remained significantly associated with backward counting (p<0.001).

Everyday functioning and objective and subjective cognitive functioning

The means (SD) of ADL and IADL were 0.74 (2.01) and 1.07 (1.68), respectively. Thirty participants (22.2%) were determined to be ADL impaired and 51 (37.8%) were IADL impaired. The mean score of each PAOFI subscale was significantly lower in both the ADL-impaired and IADL-impaired groups compared to the non-impaired groups (Table 3). Age, education, race, and CCI scores were not associated with ADL or IADL. Females were more likely to report IADL difficulties (p=0.01). ADL and IADL were both significantly associated with ESAS (p<0.001). IADL was also marginally associated with STAI (p=0.05), and CES-D-SF (p=0.08). On the other hand, ADL and IADL showed no association with BTACT.

Multivariable logistic regression models adjusted for age and education to evaluate the associations between ADL (or IADL). The models for the PAOFI subscales included ESAS as a covariate since ESAS was associated with both ADL/IADL and PAOFI (Table 3). The strength of each association was attenuated after adjusting for these confounding variables, although most of the associations remained statistically significant. However, the language/communication of PAOFI was no longer associated with ADL (p=0.13) and the memory of PAOFI was no longer associated with IADL (p=0.19).

DISCUSSION

Recent studies reporting that the prevalence of cognitive impairment among dialysis patients is as high as 60% [1, 2, 11, 49, 50] have alarmed the renal community and promoted early detection of cognitive impairment and identification of those at high risk for future cognitive impairment. While how early or how often such assessment and monitoring should be done and who should be doing it in practice are yet to be determined, studies of cognitive impairment among dialysis patients have relied exclusively on objective neuropsychological tests. Although these tests are thought to reliably measure cognitive functioning, their ability to predict individuals' real-world functioning has been found to be limited.[51, 52] That is, the presence of cognitive deficit in certain cognitive domains or a global screening test alone does not necessarily translate to impairment in daily functioning. This is because carrying out everyday tasks or activities is a complex function that depends not only on cognitive capacity but also on environmental factors and psychosocial resources of the individual.[52] It is possible that some of the activities assessed by the ADLs might rely more on physical rather than neuropsychological functioning. However, it would be extremely challenging, if not possible, to discern which activity is more affected by physical versus neuropsychological function given the close relationships between physical and neuropsychological functioning.

Our data showed a modest correlation between subjective and objective cognitive functioning measures and that subjective, but not objective, cognitive functioning is a significant predictor of daily functioning. While it may seem obvious, one should recall that objective tests and subjective measures of cognitive functioning may be measuring related, but not the same, constructs. Neuropsychological tests measure cognitive resources or capacity (e.g., processing speed, working memory) in a controlled environment whereas a patient-report is self-reflection of the need for cognitive resources to perform mental tasks in the real world that may have been compromised with illness and/or aging.[52, 53] This means that the association between the two types of measurement is expected to be rather moderate.[54] Our findings may shed light on the potential value of subjective measures to optimize clinical assessment and management without replacing objective or diagnostic tests. However, use of self-reports is not recommended for those with Alzheimer's disease or specific right-hemisphere cerebral infarctions because of anosognosia.[52]

Our study has several limitations. The study was cross-sectional and thus the impact of cognitive functioning on daily functioning over time could not be assessed. This longitudinal examination is currently underway. Our sample was limited with respect to the small number of PD patients, limited variance in cognitive functioning by excluding potential participants based on the cognitive screening test at enrollment, and uncertainty in representing the U.S. dialysis population. Particularly, our sample included a higher percentage of African Americans than is found in the U.S. population, a distribution that resulted because the African American population in the ESRD Network 6 is significantly larger than in the U.S. general population.[55] We included participants (n = 4) whose medical records documented the presence of dementia, but not advanced dementia, to help maximize the variability in cognitive functioning as long as they were able to pass the cognitive screening test. Given the lack of recognition and documentation of cognitive impairment among dialysis patients, there could have been more patients with mild dementia in the study sample.

Controlling confounding variables in our study was data-driven and there might be other confounding variables not measured in this study. Although telephone-based cognitive testing has proven its comparability with in-person testing in the laboratory, cognitive testing by phone is limited to auditory stimuli and tasks, whereas in-person testing can assess cognitive skills, including spatial skills, using visual or tactile modalities. Although we rule out hearing problems, minor hearing problems could be exacerbated over the telephone.[56–58] Further, distractions to the participants and variations in the quality of the telephone connection could contribute to measurement error. Thus, it is possible that the lack of association between objective and subjective measures might be due to the mode of data collection. However, previous studies of other patient populations using face-to-face assessment found similar associations between objective and subjective measures.[15, 39, 59]

Despite these limitations, the study findings point to the importance of assessing patients' subjective cognitive functioning, not as a stand-alone screening tool but to optimize clinical assessment and management. It is, in fact, subjective complaints of memory deficits that commonly bring people to clinics for cognitive evaluation.[60, 61] Future studies in this area may include developing strategies to integrate subjective and objective cognitive assessment in practice and evaluating their effects on improving clinical management of dialysis patients with cognitive impairment.

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Table 1

Sample characteristics (N=135)

	n (%)
Age, M (SD), range	58.36 (12.78) 19 – 90
Male	72 (53.33%)
Race	
White	35 (25.9%)
Black	97 (71.9%)
American Indian	1 (0.7%)
Hispanic	2 (1.5%)
Years of formal education, M (SD)	12.64 (2.76)
< High school	29 (21.5%)
High school	69 (51.1%)
College	31 (23.09%)
Graduate school	6 (4.4%)
Marital status	
Currently married or living with partner	65 (48.2%)
Never married, widowed, separated	70 (51.8%)
Center-hemodialysis	125 (92.6%)
Vascular access type	
Fistula	74 (59.2%)
Graft	28 (22.4%)
Catheter	23 (17.0%)
Peritoneal dialysis	10 (7.4%)
CAPD	6 (60.0%)
CCPD	4 (40.0%)
Months on dialysis	51.10 (61.38)
Diabetes	99 (73.3%)
CHF	51 (37.8%)
Stroke	24 (17.8%)
COPD	30 (22.2%)
Dementia	4 (3.0%)
Depression currently diagnosed	25 (18.5%)
Currently on depression medications	21 (15.6%)
Current smoker	28 (20.7%)
CCI, M (SD), range	7.06 (2.09), 2 – 15
spKt/V (ml/min), M (SD)	1.69 (0.35)
Hemoglobin (g/dl), M (SD)	11.26 (2.21)
Albumin (g/dl), M (SD)	3.86 (0.40)
Creatinine (mg/dl), M (SD)	8.81 (2.83)

	n (%)
BUN (mg/dl), M (SD)	57.41 (19.66)
ESAS, M (SD)	27.04 (17.65)
CES-D-SF, M (SD)	7.41 (4.86)
STAI, M (SD)	30.79 (9.72)

CCI = Charlson Comorbidity Index; ESAS = Edmonton Symptom Assessment System; CES-D-SF = Center for Epidemiologic Studies Depression Scale Short Form; STAI = State-Trait Anxiety Inventory.

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Table 2

Unadjusted and adjusted correlations between objective (BTACT) and subjective (PAOFI) cognitive function

PAOFI / BTACT	Memory	Language	sensory-motor	Executive Function	PAOFI total
Unadjusted					
Word recall	0.08 (0.36)	0.16 (0.15)	−0.02 (0.83)	0.06 (0.51)	0.09 (0.33)
Digit span	0.06 (0.52)	0.14 (0.10)	0.05 (0.57)	0.09 (0.32)	0.11 (0.22)
Category fluency	0.19 (0.03)	**0.23 (<0.01)**	0.10 (0.26)	0.18 (0.03)	**0.23 (<0.001)**
Number series	0.07 (0.44)	**0.28 (<0.01)**	0.10 (0.27)	0.20 (0.03)	0.20 (0.03)
Backward counting	0.13 (0.14)	**0.33 (<0.001)**	0.16 (0.07)	0.20 (0.02)	**0.25 (<0.001)**
Short-delay recall	0.11 (0.20)	0.10 (0.24)	0.01 (0.97)	0.06 (0.47)	0.10 (0.28)
BTACT composite	0.12 (0.20)	0.29 (0.24)	0.17 (0.96)	0.20 (0.47)	0.23 (0.28)
Adjusted					
Word recall	0.08 (0.51)	0.13 (0.45)	−0.02 (0.43)	0.06 (0.94)	0.09 (0.73)
Digit span	0.06 (0.67)	0.14 (0.19)	0.05 (0.74)	0.09 (0.5)	0.11 (0.38)
Category fluency	0.19 (0.05)	0.23 (0.13)	0.10 (0.79)	0.18 (0.22)	0.23 (0.09)
Number series	0.07 (0.76)	0.28 (0.08)	0.10 (0.87)	0.20 (0.21)	0.20 (0.26)
Backward counting	0.13 (0.24)	**0.33 (<0.001)**	0.16 (0.21)	0.20 (0.13)	**0.25 (0.04)**
Short-delay recall	0.11 (0.36)	0.10 (0.96)	0.01 (0.41)	0.06 (0.83)	0.10 (0.91)
BTACT composite	0.12 (0.36)	0.29 (0.96)	0.17 (0.41)	0.20 (0.83)	0.23 (0.91)

BTACT = Brief Test of Adult Cognition by Telephone; PAOFI = Patient’s Assessment of Own Functioning Inventory

Numbers in parenthesis indicate p values.

Table 3

Mean (SD) objective (BTACT) and subjective (PAOFI) cognitive function between impaired and non-impaired ADL and IADL groups*

	Non-Impaired			Impaired					
ADL	**M**	**SD**	**n**	**M**	**SD**	**n**	**p value (unadj.)^**	**p value (adj.)§**	**SOR (adj.)¶**
PAOFI total	129.23	18.5	105	112.2	27.68	30	<0.001	**0.01**	0.54
Memory	36.12	6.90	105	31.03	9.97	30	<0.01	**0.04**	0.64
Language	32.66	6.42	105	29.20	7.88	30	0.02	0.13	0.71
Sensory-motor	20.62	4.07	105	17.40	5.35	30	<0.01	**<0.01**	0.51
Executive function	39.83	6.49	105	34.57	9.65	30	<0.01	**0.04**	0.62
BTACT composite	0.04	0.69	88	−0.04	0.69	22	0.63	0.83	0.94
Word recall	5.34	2.11	102	5.32	1.87	28	0.96	0.82	1.05
Digit span	4.26	1.66	105	3.64	0.95	28	0.07	0.09	0.65
Category fluency	15.38	5.19	104	14.40	5.22	30	0.36	0.51	0.86
Number series	1.178	1.39	90	0.83	1.09	24	0.27	0.30	0.74
Backward counting	25.34	11.54	101	24.77	9.29	30	0.80	0.93	1.02
Short-delay recall	2.79	2.37	100	3.07	1.94	29	0.56	0.33	1.24
IADL									
PAOFI total	130.99	17.51	84	116.31	25.41	51	<0.001	**<0.01**	0.50
Memory	36.20	6.51	84	33.00	9.59	51	0.03	0.19	0.77
Language	33.45	6.06	84	29.31	7.45	51	<0.01	**<0.01**	0.53
Sensory-motor	21.23	3.72	84	17.73	5.01	51	<0.001	**<0.001**	0.42
Executive function	40.11	6.07	84	36.27	9.17	51	<0.01	**0.05**	0.65
BTACT composite	0.06	0.68	73	−0.04	0.70	37	0.46	0.65	0.90
Word recall	5.25	1.98	81	5.49	2.19	49	0.51	0.40	1.17
Digit span	4.27	1.69	84	3.88	1.29	49	0.16	0.16	0.76
Category fluency	15.60	5.24	83	14.45	5.08	51	0.21	0.37	0.83
Number series	1.22	1.37	74	0.90	1.26	40	0.23	0.3	0.78
Backward counting	26.7	11.86	82	22.71	9.09	49	0.05	0.09	0.70
Short-delay recall	2.74	2.21	81	3.04	2.41	48	0.47	0.27	1.24

BTACT = Brief Test of Adult Cognition by Telephone; PAOFI = Patient's Assessment of Own Functioning Inventory; ADL = Activities of Daily Living; IADL = Instrumental Activities of Daily Living.

*The total number of patients in BTACT scores is fewer than 135 because some patients declined to complete some BTACT subtests (e.g., number series).

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Higher scores indicate better functioning.

Possible score ranges: BTACT word list recall (0–15), backward digit span (2–8), Category fluency (0-no limit), number series (0–5), backward counting (0–100); PAOFI memory (0–45), language and communication (0–40), sensory-motor (0–25), executive function (0–45).

^P-value for testing the null hypothesis of no difference between the two groups based on a logistic regression model using only the corresponding PAOFI or BTACT subscale score as a covariate.

§P-value for testing the null hypothesis of no difference between the two groups based on a logistic regression model using the corresponding PAOFI or BTACT subscale score, age, and education as covariates. The models for the BTACT subscales also included anxiety as a covariate.

¶The standardized odds ratio (SOR) is the increased (decreased) odds of impairment corresponding to a one-standard deviation increase in the corresponding PAOFI or BTACT subscale.