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COGNITIVE-COMMUNICATIVE ASPECTS OF LANGUAGE FUNCTIONING IN OLDER ADULTS: BULGARIAN APPLICATION OF THE SCCAN

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Abstract

Objective: This study evaluates the clinical applicability of the adapted Bulgarian Scales of Cognitive and Communicative Ability for Neurorehabilitation (SCCAN) for differentiating cognitively healthy older adults from patients with Alzheimer's disease (AD).

Methods: Fifty-two participants (31 cognitively healthy, 21 diagnosed with AD) completed the Bulgarian SCCAN and the Mini-Mental State Examination (MMSE). Data analysis included descriptive statistics and Mann–Whitney U tests to examine between-group differences.

Results: Significant differences ($p < .05$) were identified across all SCCAN subtests, particularly in *memory, verbal expression, attention*, and *orientation*. The SCCAN demonstrated strong sensitivity to cognitive-communicative deficits and high consistency with MMSE scores.

Conclusions: The findings confirm the validity and clinical usefulness of the Bulgarian SCCAN. This instrument provides detailed cognitive-communicative profiling. It can effectively support diagnostic and therapeutic decision-making processes for older adults with neurodegenerative conditions.

Keywords: cognitive-communicative disorders; language functioning; Alzheimer's disease; SCCAN, MMSE

Introduction

As people age, many experience changes in cognitive and language functioning. These changes may range from typical aging to more pronounced impairments associated with neurodegenerative diseases such as AD. Communication is a

complex process that depends on the interaction of multiple cognitive abilities – most notably attention, memory, and executive functions. These abilities support the mechanisms of language comprehension and expression. Therefore, difficulties in communication often reflect not only linguistic deficits but broader cognitive decline as well (Bayles, Tomoeda and McCullough 2020; Taler and Phillips 2008).

Cognitive-communicative disorders have been described and analyzed in detail by several researchers, with significant contributions from Bayles and colleagues (Bayles, Tomoeda and McCullough 2020). These disorders refer to conditions in which communication effectiveness is impaired due to deficits in cognitive functions that underlie language. They typically involve difficulties with *memory, attention, orientation, comprehension*, and *speech planning*. Such impairments are commonly observed in dementia, stroke, and other neurological conditions. In normal aging, some *slowing of information processing* and mild *word-finding difficulties* may occur, but overall communication usually remains intact (Harada, Natelson Love and Triebel 2013).

Clinical diagnosis of cognitive-communicative disorders requires an integrated approach that considers both language and cognition. Standard cognitive screening tools such as the MMSE have limited sensitivity to early language and communication deficits (Tsoi et al. 2015), which highlights the need for comprehensive instruments that are designed to assess both domains simultaneously.

The SCCAN is one such tool, developed to evaluate cognitive and language skills within a unified framework. It includes eight domains: *memory, verbal expression, writing, orientation, auditory comprehension, reading comprehension, attention*, and *problem solving*. Although its reliability and validity have been well established in English-speaking populations (Milman et al. 2008), no studies to date have examined its application in Bulgaria. To address this gap, the present study uses a culturally and linguistically adapted Bulgarian version of SCCAN.

The aim of the study is to analyze cognitive-communicative aspects of language functioning in older adults through the administration of the Bulgarian version of SCCAN. The focus is on comparing healthy participants with individuals diagnosed with AD, in order to identify domain-specific deficits and explore the tool's clinical utility.

Methodology

This observational, cross-sectional study was conducted between 2023 and 2025 at the Neurology Department of University Hospital "St. George" in Plovdiv, Bulgaria. Written informed consent was received from all participants prior to testing. The research complied with the Declaration of Helsinki (World Medical Association 2013). The Ethics Committee of the Medical University of Plovdiv formally approved the analysis and the publishing of the data collected (Protocol No. 4/10.04.2025; Decision R-KNE-20/16.07.2025).

Participants

A total of 52 older adults took part in the study, including 21 individuals diagnosed with AD and 31 neurologically healthy controls. Participants were recruited consecutively from neurology inpatient and outpatient settings. Inclusion criteria were: late middle-aged and older adults (57 years and above), with preserved vision and hearing, basic literacy, and the capacity to understand instructions.

The diagnosis of AD was established according to internationally accepted criteria, including those of the NIA-AA workgroups (McKhann et al. 2011), the International Working Group IWG-2 (Dubois et al. 2014), and the DSM-5 (American Psychiatric Association 2013). All AD participants had a documented history of progressive cognitive decline for at least one year, neuropsychological evidence of impairment (performance ≥ 2 SD below norms in at least one domain), and imaging results (CT or MRI) excluding alternative causes. None of the participants were undergoing cognitive, psychological, or language rehabilitation at the time of testing.

Education was documented in years of formal schooling. The control group had significantly higher education levels (mean ± SD: 13.5 ± 2.2) compared to the AD group (12.0 ± 2.5), as indicated by a Mann–Whitney U test ($U = 223.5$, $p = .031$). This difference was considered in the interpretation of results. Occupation, handedness, and bilingualism were not formally assessed. All participants self-identified as native Bulgarian speakers and were presumed right-handed based on clinical observation.

Demographic characteristics of the two groups are summarized in Table 1.

Table 1. Demographic characteristics of the study groups

Group	n	Age (years) (mean ± SD)	Range	M/F	Education (years) (mean ± SD)
AD	21	72.6 ± 7.6	58–84	11/10	12.0 ± 2.5
Controls	31	66.8 ± 5.6	57–78	9/22	13.5 ± 2.2

Note. M = male; F = female.

Instruments

Each participant completed two assessments: (1) the Bulgarian adaptation of the SCCAN, which evaluates eight domains (oral expression, orientation, memory, auditory comprehension, reading comprehension, writing, attention, and problem solving); and (2) the MMSE, used as a screening measure of global cognitive functioning.

All SCCAN and MMSE scores were recorded as raw values, as normative data for the Bulgarian SCCAN are still under development. Cultural adaptation of SCCAN followed international standards (Beaton et al., 2000), including forward –

backward translation and expert review. Context-specific modifications were made (e.g., U.S.-specific items were replaced with Bulgarian equivalents).

Procedure

Testing was conducted in a quiet, well-lit room by the first author, a neurologist with training in speech-language pathology. Sessions lasted 35–45 minutes and included breaks if necessary. Clinical information was reviewed to verify diagnoses. Data were anonymized and handled in accordance with current data protection standards.

Data Analysis

Data were processed using IBM SPSS Statistics, version 22. Descriptive statistics (means, standard deviations) were calculated for all variables. Normality of distribution was assessed using the Shapiro-Wilk test, which indicated that non-parametric methods were appropriate. Between-group comparisons were conducted using the Mann – Whitney U test. Statistical significance was set at $p < .05$ (two-tailed).

Results

1. Descriptive Statistics

Results from the SCCAN and MMSE assessments for the control group (n = 31) and the AD group (n = 21) are summarized in Table 2. All scores are presented as raw values, with maximum possible scores differing across subtests.

The mean SCCAN total score in controls was 85.58 ± 8.55, while in the AD group it was substantially lower at 50.38 ± 11.94, indicating marked impairment. The most pronounced deficits in the AD group were observed in *memory* (3.86 ± 1.15), *verbal expression* (10.24 ± 3.86), and *attention* (8.05 ± 2.75). *Writing* showed the smallest difference, with relatively preserved performance in both groups.

MMSE scores also differed significantly: controls averaged 29.16 ± 1.10, while the AD group scored 18.81 ± 3.47 on average, consistent with global cognitive decline.

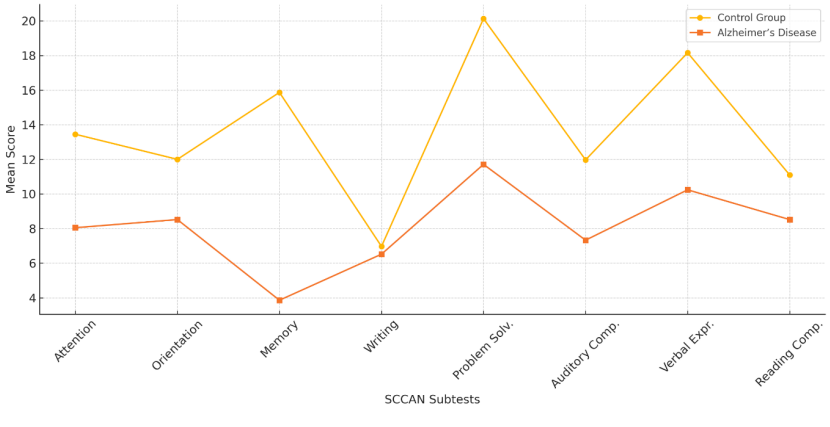
The two groups differed significantly in educational attainment (controls: 13.5 ± 2.2 years; AD: 12.0 ± 2.5 years), as confirmed by a Mann–Whitney U test ($U = 223.5$, $p = .031$). This difference was accounted for when interpreting results. Sex distribution (controls: 9 M/22 F; AD: 11 M/10 F) did not significantly differ between groups ($\chi^2 = 1.98$, $p = .159$).

Table 2. Mean Scores on SCCAN and MMSE by Group

Subtest	Max Score	Control Group Mean (SD)	AD Group Mean (SD)
Attention	16	13.45 (2.75)	8.05 (2.75)
Orientation	12	12.00 (0.00)	8.52 (2.58)
Memory	19	15.87 (3.20)	3.86 (1.15)
Writing	7	6.97 (0.18)	6.52 (0.98)
Problem Solving	23	20.13 (3.90)	11.71 (4.56)
Auditory Comprehension	13	11.97 (1.45)	7.33 (1.93)
Verbal Expression	19	18.16 (2.35)	10.24 (3.86)
Reading Comprehension	12	11.10 (1.30)	8.52 (2.06)
SCCAN Total	94	85.58 (8.55)	50.38 (11.94)
MMSE	30	29.16 (1.10)	18.81 (3.47)

2. Comparative Analysis

Descriptive differences between the AD and control groups across SCCAN subtests are presented in Figure 1. The most pronounced differences appear in *memory, verbal expression, attention, orientation,* and *problem solving*. These descriptive profiles illustrate the overall pattern of cognitive-communicative deficits in AD compared to healthy controls.



Note: Raw mean scores; maximum possible scores differ across subtests (see Table 2). Statistical comparisons are provided in Table 3

Figure 1. Mean SCCAN subtest scores for the control group and the Alzheimer's disease group

To formally test these differences, the non-parametric Mann – Whitney U test was applied to each SCCAN subtest, the total SCCAN, and the MMSE. All comparisons were statistically significant ($p < .05$), including the *writing* subtest ($p = .021$). The largest group contrasts were observed in *memory, verbal expression,* and *attention* – domains that reflect key cognitive-communicative functions. The SCCAN total score also differed markedly ($U = 643.0$, $p < .001$), confirming the instrument's sensitivity to cognitive decline.

Similarly, MMSE scores were significantly lower in the AD group ($U = 650.5$, $p < .001$), consistent with global cognitive impairment. Detailed Mann–Whitney U results are summarized in Table 3.

Table 3. Results of the Mann – Whitney U Test (Control vs. Alzheimer's Group)

Subtest	U Value	p Value
Memory	650	< 0.001*
Orientation	46.5	< 0.001*
Verbal Expression	625.5	< 0.001*
Auditory Comprehension	624.5	< 0.001*
Reading Comprehension	554.5	< 0.001*
Writing	427.0	0.02067*
Attention	593.5	< 0.001*
Problem Solving	586.5	< 0.001*
SCCAN Total	643.0	< 0.001*
MMSE	650.5	< 0.001*

Note: An asterisk (*) indicates a statistically significant difference at $p < .05$

3. Interpretation of Cognitive-Communicative Profiles

The findings indicate distinct cognitive-communicative profiles in the two groups. Participants with AD showed a generalized decline, with the most severe impairments observed in *memory, verbal expression*, and *attention*. Additional, though less pronounced, deficits were evident in *orientation, auditory comprehension,* and *problem solving*, reflecting the characteristic neuropsychological pattern of AD.

The SCCAN captures both language-specific and broader cognitive functions. In this study, the AD group demonstrated impairments across both domains, highlighting the utility of SCCAN in detecting communication disorders rooted in cognitive dysfunction.

These differences are not only statistically significant but also clinically meaningful. They define functional profiles that can aid speech-language pathologists in making early diagnoses and developing individualized therapeutic interventions tailored to specific deficits.

These observations provide a clear basis for the discussion of the clinical implications, which follows in the next section.

Discussion

This study evaluated the Bulgarian-adapted SCCAN as a tool for differentiating cognitively healthy older adults from those with AD. The results confirm that the SCCAN effectively captures both global cognitive decline and domain-specific deficits, particularly in *memory, verbal expression*, and *attention*. These findings align with the expected neuropsychological profile of AD and support the clinical utility of SCCAN for comprehensive assessment in this population. Although the control group was younger and had higher education than the AD group, these differences were taken into account when interpreting the findings and do not appear to fully account for the observed deficits.

The mean total SCCAN score in the control group (85.6 points) reflects preserved cognitive functioning, while the considerably lower mean score in the AD group (50.4 points) indicates marked cognitive impairment.

The most pronounced differences were found in domains central to the neuropsychological profile of AD, particularly *episodic memory and language*, together with *attention and orientation* (Weintraub, Wicklund and Salmon 2012; McKhann et al. 2011). Notably, participants with AD achieved an average score of only 3.9 points out of a possible 19 in the *memory* subtest, compared to 15.9 points in the control group. This pattern is consistent with well-established evidence of early hippocampal involvement and deficits in verbal episodic memory in AD (Dubois et al. 2007; Grober et al. 2008). These results confirm that the SCCAN is not only a reliable but also a clinically relevant instrument for identifying cognitive-communicative disorders in adults with neurodegenerative conditions.

Similar results have also been reported in stroke populations, where SCCAN revealed significantly reduced performance in comparison to healthy adults, particularly in the domains of *memory* and *attention* (Jaya, Johnsi Rani and Monish 2017). Our findings are consistent with prior research supporting the diagnostic advantage of tools that integrate both language and cognition, as opposed to assessments that focus solely on global functioning (Milman et al. 2008; Henry et al. 2004).

Analysis of SCCAN subtests revealed distinct profiles. Controls showed consistently high scores across all domains, aligning with typical cognitive aging (Harada et al. 2013). In contrast, the AD group showed a generalized decline, with the most affected areas involving verbal *episodic memory, verbal expression, attention*, and *orientation*.

These findings reflect the vulnerability of the hippocampal and medial temporal regions, which underlie the *memory* impairments, particularly in *verbal episodic memory*, observed in AD (Braak and Braak 1991; Jack et al. 2010; Albert et al. 2011). Impairments in *verbal expression* likely result from combined lexical-semantic and executive dysfunctions, while reduced attentional capacity impacts comprehension, memory, and speech planning (Henry, Crawford and Phillips 2004;

Perry and Hodges 1999). *Orientation* deficits, reflecting disorientation to time, place, and person, are also typical of AD (McKhann et al. 2011).

Deficits were also evident in *auditory and reading comprehension*. These results are consistent with prior evidence that receptive language functions are vulnerable in AD, especially when attentional and memory resources are reduced. Such impairments affect the ability to follow spoken discourse and to extract meaning from written text, which in turn compromises communication in everyday contexts (Henry, Crawford and Phillips 2004; Taler et al. 2008). Moreover, reduced performance in *problem solving* tasks indicates executive dysfunction, likely related to the involvement of frontal networks in addition to medial temporal pathology (Perry and Hodges 1999). Together, these findings highlight that SCCAN not only identifies *memory and expressive language deficits*, but also provides valuable insight into receptive and executive domains that are equally important for functional communication.

Despite measurable group differences in the *writing* subtest, relative functional performance was preserved in both groups. This may be due to the more automated nature of writing tasks and their lesser reliance on verbal memory. Similar observations have been reported in other studies involving individuals with mild-to-moderate dementia (De Vita et al. 2021).

The differences between groups were both statistically and clinically significant, highlighting SCCAN's sensitivity for initial dementia assessment. The observed profiles show marked reductions in *memory, verbal expression, attention*, and *orientation.* This profile reflects early hippocampal involvement and informs both diagnostic and therapeutic decisions.

In cognitive impairments with a communicative component, early and precise identification of the affected domains is critical for effective therapy. The SCCAN has the advantage of assessing both linguistic and non-linguistic cognitive functions simultaneously. This approach is particularly recommended in the clinical practice of speech-language pathologists and neuropsychologists working with older patients (Bayles, Tomoeda and McCullough 2020; Taler et al. 2008).

The functional cognitive-communicative profiles that SCCAN can outline help clinicians tailor therapeutic goals and choose appropriate communication support strategies. For example, when deficits in *attention* and *working memory* predominate, therapy can focus on short instructions and visual cues. When linguistic deficits dominate, therapy may emphasize lexical enrichment, syntactic organization, and strategies to compensate for word-finding difficulties (Kempler and Goral 2008; Murray 2000).

The SCCAN and MMSE showed good agreement, both distinguishing AD patients from healthy controls. However, SCCAN demonstrated greater sensitivity to domain-specific cognitive-communicative deficits, while MMSE primarily reflects global impairment. The SCCAN's ability to assess

language, cognition, and functional communication makes it more informative for clinical decision-making and therapy planning (Milman et al. 2008; Wind et al. 1997).

Another advantage of the SCCAN is its modular design, which allows analysis of an individual's strengths and weaknesses. This is especially valuable for developing individualized therapy plans. In contrast, the MMSE provides only a global score and cannot identify specific affected domains (Wind et al. 1997).

The results confirm that MMSE and SCCAN complement each other in clinical practice, with SCCAN offering more detailed information for diagnosis and intervention. The results, obtained from well-defined and homogeneous groups, support its reliability while acknowledging variability due to disease heterogeneity. It is important to note that the observed differences between groups might also reflect, to some extent, differences in age, education, and sex distribution, although these factors were accounted for in the analysis and are unlikely to fully explain the marked cognitive-communicative deficits in the AD group. All participants were monolingual Bulgarian speakers, and none were receiving therapy at the time of assessment, which reduces potential confounding. Future studies should further explore the impact of these demographic variables, as well as bilingualism and prior rehabilitation, on SCCAN performance. Future research in diverse populations and settings is needed to further validate and adapt the tool to Bulgarian clinical practice.

Conclusion

This study demonstrated that the Bulgarian version of the SCCAN is an effective and sensitive instrument for assessing cognitive-communicative functioning. It reliably distinguishes cognitively healthy older adults from individuals with Alzheimer's disease. By evaluating memory, attention, language expression, and other key domains, the SCCAN provides a detailed profile of strengths and weaknesses. Such profiling is valuable both for early screening and for guiding therapeutic interventions. The findings highlight the importance of comprehensive assessment of cognitive and language difficulties in older adults. The SCCAN can therefore support diagnostic decision-making as well as the work of speech-language pathologists and other professionals involved in the care of individuals with cognitive decline.

NOTES

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