Alabama Brief Cognitive Screener:
Utility of a New Cognitive Screening Instrument in a Memory Disorders Clinic

Marissa C. Natelson Love, MD[a,b]; Giovanna Pilonieta, DDS, MPH[a,*]; and David S. Geldmacher, MD[a]

ABSTRACT

Objective: We assessed the clinical utility of the Alabama Brief Cognitive Screener (ABCs), an alternative to the Mini-Mental State Examination (MMSE), for cognitive screening in a new electronic medical record. Other available nonproprietary instruments were determined to be more tuned to milder deficits than the MMSE.

Methods: The ABCs was administered as part of routine clinical assessment in the University of Alabama at Birmingham memory disorders clinics from April 30, 2012, to April 30, 2015. Outpatients (N = 1,589) with clinician diagnoses (*ICD-9-CM*) of memory loss, mild cognitive impairment, neurodegenerative cognitive impairment, Alzheimer's dementia, or dementia not otherwise specified were included in the analysis. Memory disorder clinicians used multiple sources of information for assignment of diagnoses, including interviews with patients and caregivers, the ABCs, figure copy, semantic fluencies, phonemic fluencies, ratings of daily function, imaging, laboratory tests, and medical records.

Results: Scoring distribution by diagnosis was mild cognitive impairment (n = 310): mean (SD) = 25.47 (3.37), median = 26; Alzheimer's dementia (n = 208): mean (SD) = 16.42 (6.33), median = 17; cerebral degeneration (n = 371): mean (SD) = 20.61 (5.90), median = 21; memory loss (n = 583): mean (SD) = 24.90 (5.09), median = 27; and dementia (n = 117): mean (SD) = 15.18 (6.34), median = 15. Mean ABCs scores differed by diagnosis (Wilcoxon signed-ranks $Z = 483.5$, $P < .001$). This finding was consistent with a meta-analysis of MMSE performance between groups.

Conclusions: ABCs scores vary appropriately by diagnosis and resemble MMSE scoring distributions. The ABCs provides a nonproprietary alternative to the MMSE to assess the severity of cognitive deficits.

Prim Care Companion CNS Disord 2019;21(2):18m02336

To cite: Natelson Love MC, Pilonieta G, Geldmacher DS. Alabama Brief Cognitive Screener: utility of a new cognitive screening instrument in a memory disorders clinic. *Prim Care Companion CNS Disord.* 2019;21(2):18m02336.

To share: https://doi.org/10.4088/PCC.18m02336

[a]Department of Neurology, University of Alabama at Birmingham, Birmingham, Alabama

[b]Department of Neurology, Birmingham Veterans Affairs Medical Center, Birmingham, Alabama

**Corresponding author:* Giovanna Pilonieta, DDS, MPH, Department of Neurology, University of Alabama at Birmingham, Ste 640, Sparks Center, 1720 7th Ave South, Birmingham, AL 35294-0017 (gpilonieta@uabmc.edu).

Assessment of cognition is an established element of both primary care and specialty medical practice. Guidelines call for structured assessment of cognition among older adults with standardized instruments[1] and for annual assessment of cognition for people with dementia using reliable, validated tests.[2] Quantitative tests of cognition are also recommended for initial assessment of suspected dementia in primary care settings.[3]

The Mini-Mental State Examination (MMSE)[4] has become the most widely used of these tests.[5] Originally developed as a means to rapidly measure cognitive function among psychiatric patients, its ease of use and face validity led to widespread adoption. The MMSE's authors have acknowledged that it was developed as a standardized administration of well-known cognitive assessment elements and that the instrument has shortcomings.[6] However, the MMSE's clinical utility is unquestionable, and an extensive body of literature has defined its performance across a wide variety of health states, diseases, cultures, and languages.

Alternative instruments such as the Saint Louis University Mental Status (SLUMS) examination[7] and the Montreal Cognitive Assessment (MoCA)[8] have been developed. They have proved to be useful, valid tests.[8–10] On the whole, they are somewhat more difficult than the MMSE, resulting in different scores and diagnostic categories in equivalent samples.[11] The greater difficulty has made these tools useful to detect conditions characterized by less severe cognitive deficits such as mild cognitive impairment, which had not been defined when the MMSE was published.[10,12]

Although widely used in both clinical and research settings for over 2 decades, and freely available through the internet, the MMSE's copyright changed hands in 2000. The new rights holder became aggressive in protecting their copyright and actively suppressed presumptive violations.[13] With impending implementation of a new electronic medical records system at our institution, a need existed for a psychometrically valid and neuropsychologically sound alternative to the MMSE that would (1) perform similarly in primary care and neurologic populations, (2) not violate the MMSE copyright, and (3) be readily adaptable for implementation in the electronic medical record.

METHODS

We examined the structure of available brief cognitive instruments assessed in the Dementia Working Group's development of quality standards for dementia care[2] ranging from very brief tests like the Mini-Cog[14] and Six-Item Screener[15] to standard screeners like the MMSE, MoCA, and SLUMS, as well

Clinical Points

- Although the Mini-Mental State Examination (MMSE) has been the gold-standard brief cognitive assessment, copyright and licensing issues limit its use.
- The Alabama Brief Cognitive screener was designed to match MMSE performance, as established alternative cognitive screeners do not provide the same level of difficulty as the MMSE.

as extended batteries like the Modified Mini-Mental State (3MS)[16] and the Florida Mental Status Exam.[17] The Severe MMSE,[18] Blessed Orientation-Memory-Concentration Test,[19] and Short Portable Mental Status Questionnaire[20] were also reviewed.

Common themes identified across most or all of these tests were verbal recall immediately and after brief delay (usually of 3–5 words), orientation to time and place, calculation, naming, repetition, and figure drawing or copying. Since one goal of the new instrument was to mimic MMSE scoring distributions, we attempted to select items of similar difficulty while addressing some of the potentially problematic MMSE items such as the difficulty associated with the alternative items of serial 7 subtractions and spelling *world* backward, the challenges of knowing the county for people traveling long distances for evaluation, and the idiomatic, agrammatic phrase "no ifs, ands, or buts," which is unfamiliar to many patients.

In addition to the themes observed in existing screening examinations, we intended for the new instrument to meet documentation requirements of the 1997 Documentation Guidelines for Evaluation and Management Services from the US Centers for Medicare and Medicaid Services (Table 1).[21] Additionally, since cognitive testing can be construed as a procedure, we chose to include 2 personal identifiers (name and year of birth) as scored items, which is consistent with the Joint Commission on Accreditation of Healthcare Organizations National Patient Safety Goals.[22] These items also previously appeared in the severe impairment MMSE adaptation developed at our institution.[18]

A draft 30-item instrument was developed by one of the authors (D.S.G.) and reviewed for face validity and consensus by the faculty of the University of Alabama at Birmingham (UAB) Divisions of Memory Disorders and Behavioral Neurology and Neuropsychology. Minor revisions and suggestions were incorporated. The instrument was named the Alabama Brief Cognitive screener (ABCs). An immediate clinical need for a nonproprietary instrument to be incorporated in the electronic medical record led to implementation with plans to assess validity and reliability based on its performance in the clinical setting. This process closely parallels the initial implementation of the MMSE.[4,6] The implemented version of the ABCs is depicted in Figure 1.

The ABCs was administered as part of the routine clinical assessment in the UAB memory disorders clinics from April 30, 2012, to April 30, 2015. The UAB memory disorders clinics serve as the sole neurology-based referral center for dementia and related disorders in the state of Alabama and portions of the surrounding states, representing a service area encompassing over 5 million individuals. The majority of ABCs testing was conducted by a licensed practical nurse trained on administration of the instrument and with more than 5 years' experience in the administration of brief cognitive tests. Administration of the ABCs takes approximately 5–7 minutes. Approval for post hoc chart review was obtained from the institutional review board. All study procedures were adherent to the Helsinki principles.

Table 1. Higher Integrative Functions Identified in 1997 Evaluation and Management Guidelines for the Neurologic Examination[21]

- Orientation to time, place, and person
- Recent and remote memory
- Attention span and concentration
- Language (eg, naming objects, repeating phrases, spontaneous speech)
- Fund of knowledge (eg, awareness of current events, past history, vocabulary)

Patients from 5 academic neurologists and 2 nurse practitioners with specialty practices in cognitive and behavioral neurology were included. Patients with clinician diagnoses of memory loss (*ICD-9-CM* 780.93), mild cognitive impairment (331.83), neurodegenerative cognitive impairment (331.9), Alzheimer's dementia (331.0), or dementia not otherwise specified (NOS, 294.8) were included in the analysis.

Operationally, memory disorder clinicians used multiple sources of information for assignment of diagnoses, including interviews with patients and caregivers, the ABCs, figure copy, word list generation (semantic and phonemic fluencies), ratings of daily function, imaging, laboratory tests, and medical records. All of these factors were used for diagnostic assignments when available at the time of the visit. Clinical criteria for mild cognitive impairment[23] and Alzheimer's disease[24] were employed. "Memory loss" was typically used as a diagnosis when a patient had memory symptoms or impairments insufficient to meet criteria for mild cognitive impairment or dementia. "Neurodegenerative cognitive impairment" was generally used at initial visits when patients had evidence for meaningful cognitive impairment, but criteria for a specific disorder were not met (eg, prior records, laboratory tests or imaging were pending at the time of the visit). "Dementia NOS" was used when dementia was clearly present, but the clinician could not classify the patient to any more specific category often because of severity or unavailable history regarding the onset and early symptoms or multiple contributing causes.

Statistical analysis was performed by using t and χ^2 tests to compare the associations between diagnosis, age, and sex. Independent sample t test and Wilcoxon-Kruskal-Wallis rank sum were used to analyze performance for the ABCs across the diagnoses. These statistical analyses were performed using SAS (version 9.3) software (SAS Institute, Cary, North Carolina).

Figure 1. Alabama Brief Cognitive Screener[a,b]

Alabama Brief Cognitive screener (ABCs)		Instructions and Scoring	Record Specific Answer (optional)	**Scoring:** 1 if correct, 0 if incorrect
Item	*What is your full name?*			
1	First and Last name	Score correct only when given name and surname are included and match the medical record. Examiner MAY prompt if only one name is provided initially.		
2	What year were you born?	Only correct year is needed.		
3	Who is the current president of the United States?	Only surname is required.		
	Repeat these words:			
4	Tiger	Score only the number repeated on the 1st attempt. MAY give 2 attempts.		
5	Hope			
6	Daisy			
	Draw the face of a clock, put the numbers on it, and draw the hands so it reads 11:10			
7	Circle	Examiner MAY clarify the time *(Ten past eleven, ten after eleven)* and MAY remind subject of the next step (eg, now put the numbers on…).		
8	Numbers			
9	Hands			
	Tell me the three words I asked you to repeat a little while ago			
10	Tiger	NO hints or clues are permitted.		
11	Hope			
12	Daisy			
	Count backwards from 40 by 4's			
13	36	*Examiner MAY clarify instructions as needed for the subject to understand. *Once subject has started, do NOT prompt or remind subject at intermediate subtractions. *Score each subtraction independently (eg, 36- 32-**30**-26-22, would score 4 points).		
14	32			
15	28			
16	24			
17	20			
	Tell me:			
18	Today's date	Replies must be exactly correct. Do NOT give credit for +/- 1.		
19	The day of week			
20	The month			
21	The year			
22	What this building is called	Either Facility name or the specific building name IS acceptable.		
23	What city we are in			
24	What state we are in			
	Tell me what this thing is called:			
25	Whole object: Coat/Jacket	Any reply that includes coat, jacket, or smock IS acceptable (Shirt/Blouse is an alternative if coat/jacket is not available)		
26	Part of object: Sleeve	"Arm" is NOT acceptable. Subject MAY be cued with *"My arm is in it, what do we call the part that covers the arm?"*		
	Repeat this sentence			
27	"If she were here, I would go"	*"If she WAS here, I would go"* IS acceptable.		
	Follow these instructions: "Before pointing to the door, point to the ceiling"			
28	Points to ceiling	Do NOT give additional prompting if subject completes only one step.		
29	Points to door			
30	Does both in correct order			
TOTAL SCORE:				

Optional extended memory scoring (not scored as part of ABC)				
Do you recall any of those three words I asked you to remember before?				
Free recall				
	Tiger	Score 3 points per correct answer.		
	Hope			
	Daisy			
Semantic Cues				
	It was a kind of animal	Test only items not correct on free recall. Score 2 points per correct answer.		
	It was a kind of feeling or emotion			
	It was a kind of flower			
Pick from the list				
	Lion, Tiger, Bear	Test only items not correct with semantic cues. Score 1 point per correct answer.		
	Hope, Love, Joy			
	Tulip, Rose, Daisy			
EXTENDED MEMORY SCORE (range 0-9):				

[a]This form may be reproduced for clinical use.
[b]This product is not intended to diagnose, treat, cure, or prevent any disease.

Table 2. Demographic Characteristics of the Cohort by Diagnosis

Characteristic	Memory Loss (n = 583)	Mild Cognitive Impairment (n = 310)	Cerebral Degeneration (n = 371)	Alzheimer's Dementia (n = 208)	Dementia (n = 117)
Age, mean (SD), y	67.50 (12.6)	72.99[a] (8.5)	73.55[a,b] (9.9)	75.66[a] (9.3)	75.59[a] (8.8)
Sex, female, n (%)	355 (61)	184 (59.4)	232 (62.5)	125 (60.1)	57 (48.7)

[a]Significant difference compared to memory loss ($P < .001$).
[b]Significant difference compared to mild cognitive impairment ($P < .001$).

Table 3. Alabama Brief Cognitive Screener (ABCs) Scores by Diagnosis

Diagnosis	n	Mean Score	Median	SD
Memory loss	583	24.90[a,b,c]	27	5.09
Mild cognitive impairment	310	25.47[a,b,c]	26	3.37
Cerebral degeneration	371	20.6[b,c,d,e]	21	5.90
Alzheimer dementia	208	16.42[a,d,e]	17	6.33
Dementia	117	15.18[a,d,e]	15	6.34

[a]Significant difference compared to cerebral degeneration ($P < .001$).
[b]Significant difference compared to Alzheimer's dementia ($P < .001$).
[c]Significant difference compared to dementia ($P < .001$).
[d]Significant difference compared to memory loss ($P < .001$).
[e]Significant difference compared to mild cognitive impairment ($P < .001$).

RESULTS

Data were available from 1,589 individuals (953 [60%] women, 636 [40%] men; mean age of 71.65 years) (Table 2). Age varied by diagnostic category (analysis of variance F=37.89, $P < .001$), with memory loss patients having a mean age of 67.5 years, while the other 4 groups' mean age ranged from 73.0 (mild cognitive impairment) to 75.7 (Alzheimer's dementia). Mean ABCs scores differed by diagnosis (Wilcoxon signed-ranks $Z = 483.5$, $P < .001$). This result was consistent with performance of the MMSE in a meta-analysis of MMSE in Alzheimer's disease by Han and colleagues.[25]

Scoring distributions by diagnosis are reported in Table 3. As intended from the construction of the instrument, patients with the diagnoses of mild cognitive impairment had higher mean scores than those with Alzheimer's-type and unspecified dementia. ($P < .001$). Additionally, those with unspecified memory loss achieved higher scores than the dementia groups ($P < .001$). Patients with dementia had the lowest ABCs score (15.18 ± 6.3).

DISCUSSION

ABCs scores vary appropriately by diagnosis. This finding is similar to the performance of the MMSE shown by Benson and colleagues[26] between individuals with normal cognition, mild cognitive impairment, and Alzheimer's dementia. A meta-analysis[25] of MMSE in Alzheimer's disease reported a mean score among 3,260 subjects of 16.08 out of 30. Our sample of 208 subjects had a mean ABCs score of 16.42. The mean MMSE score in mild cognitive impairment among 1,376 subjects was 26.78,[25] while our sample of 310 subjects had a mean ABCs score of 25.47. This result suggests that the ABCs and MMSE scores have similar distributions in these clinical populations.

There are limitations to this study. As a chart review study, no autopsy confirmation of diagnoses was available in this sample. The information used to establish diagnosis most likely varied between clinicians and differed from one patient to another on the basis of availability of family members, medical records, prior imaging, and other variables typically observed in clinical practice. Importantly, ABCs scores themselves were a factor in diagnostic assignment, inserting potential bias into the assigned diagnoses. However, these variables reflect the reality of clinical practice, in which cognitive test scores are an important part of diagnostic assignments. Importantly, the diagnoses in these groups were determined by academic medical center expert providers in cognitive neurology and included other factors such as reported daily function, mood assessments, and cognitive testing outside the ABCs in the determination of diagnosis. The consistency of performance between the ABCs and Han and colleagues' meta-analysis[25] of the MMSE in similar settings indicates that the design goals of the ABCs were met. Future studies should include direct comparison to the MMSE as well as other validated cognitive tests to increase validity. Data are also currently being collected to identify how age and educational attainment influence results, as these variables are typically used in interpreting MMSE scores.

The ABCs shows promise as an easily administered, nonproprietary alternative to the MMSE for use as a screening instrument to both identify and assess severity of cognitive deficits in medical practice. Although the ABCs is copyrighted, it is intended to remain free and available for use in clinical and noncommercial research use. Further characterization of the instrument is underway, including its effectiveness in measuring progression of deficits in patients with neurodegenerative disease and its relationship to instrumental activities of daily living. Primary care physicians play a critical role in the detection, diagnosis, and treatment of people with Alzheimer's disease and other disorders with cognitive symptoms.[27] Data from the ABCs indicate it might prove a worthwhile tool for expansion of dementia assessment in primary care settings.

Submitted: June 1, 2018; accepted November 28, 2019.
Published online: March 14, 2019.
***Potential conflicts of interest*:** None.
Funding/support: None.
Previous presentation: Poster presented at the 2014 International Neuropsychological Society annual meeting; February 12–15, 2014; Seattle, Washington ▪ American Academy of Neurology annual meeting; April 26–May 3, 2014; Philadelphia, Pennsylvania ▪ Alzheimer's Association International Conference; July 18–23, 2015; Washington, DC ▪ American Neurological Association annual meeting; October 16–18, 2016; Baltimore, Maryland.

REFERENCES

1. Cordell CB, Borson S, Boustani M, et al; Medicare Detection of Cognitive Impairment Workgroup. Alzheimer's Association recommendations for operationalizing the detection of cognitive impairment during the Medicare annual wellness visit in a primary care setting. *Alzheimers Dement*. 2013;9(2):141–150.

2. Odenheimer G, Borson S, Sanders AE, et al. Quality improvement in neurology: dementia management quality measures. *Neurology*. 2013;81(17):1545–1549.
3. Simmons BB, Hartmann B, Dejoseph D. Evaluation of suspected dementia. *Am Fam Physician*. 2011;84(8):895–902.
4. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12(3):189–198.
5. Tombaugh TN, McIntyre NJ. The Mini-Mental State Examination: a comprehensive review. *J Am Geriatr Soc*. 1992;40(9):922–935.
6. Folstein M. The birth of the MMS. *Current Contents*; 1990:18.
7. Tariq SH, Tumosa N, Chibnall JT, et al. Comparison of the Saint Louis University Mental Status examination and the Mini-Mental State Examination for detecting dementia and mild neurocognitive disorder: a pilot study. *Am J Geriatr Psychiatry*. 2006;14(11):900–910.
8. Nasreddine ZS, Phillips NA, Bédirian V, et al. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. *J Am Geriatr Soc*. 2005;53(4):695–699.
9. Cummings-Vaughn LA, Chavakula NN, Malmstrom TK, et al. Veterans Affairs Saint Louis University Mental Status examination compared with the Montreal Cognitive Assessment and the Short Test of Mental Status. *J Am Geriatr Soc*. 2014;62(7):1341–1346.
10. Smith T, Gildeh N, Holmes C. The Montreal Cognitive Assessment: validity and utility in a memory clinic setting. *Can J Psychiatry*. 2007;52(5):329–332.
11. Howland M, Tatsuoka C, Smyth KA, et al. Detecting change over time: a comparison of the SLUMS examination and the MMSE in older adults at risk for cognitive decline. *CNS Neurosci Ther*. 2016;22(5):413–419.
12. Trzepacz PT, Hochstetler H, Wang S, et al; Alzheimer's Disease Neuroimaging Initiative. Relationship between the Montreal Cognitive Assessment and Mini-Mental State Examination for assessment of mild cognitive impairment in older adults. *BMC Geriatr*. 2015;15(1):107.
13. Newman JC, Feldman R. Copyright and open access at the bedside. *N Engl J Med*. 2011;365(26):2447–2449.
14. Borson S, Scanlan J, Brush M, et al. The Mini-Cog: a cognitive 'vital signs' measure for dementia screening in multi-lingual elderly. *Int J Geriatr Psychiatry*. 2000;15(11):1021–1027.
15. Callahan CM, Unverzagt FW, Hui SL, et al. Six-item screener to identify cognitive impairment among potential subjects for clinical research. *Med Care*. 2002;40(9):771–781.
16. Teng EL, Chui HC. The Modified Mini-Mental State (3MS) Examination. *J Clin Psychiatry*. 1987;48(8):314–318.
17. Doty L, Bowers D, Heilman KM. Florida Mental Status Exam for progressive dementia screening [abstract] *Gerontologist*. 1990;30:20A [special issue].
18. Harrell LE, Marson D, Chatterjee A, et al. The Severe Mini-Mental State Examination: a new neuropsychologic instrument for the bedside assessment of severely impaired patients with Alzheimer disease. *Alzheimer Dis Assoc Disord*. 2000;14(3):168–175.
19. Katzman R, Brown T, Fuld P, et al. Validation of a short Orientation-Memory-Concentration Test of cognitive impairment. *Am J Psychiatry*. 1983;140(6):734–739.
20. Pfeiffer E. A Short Portable Mental Status Questionnaire for the assessment of organic brain deficit in elderly patients. *J Am Geriatr Soc*. 1975;23(10):433–441.
21. Centers for Medicare & Medicaid Services. 1997 Documentation Guidelines for Evaluation and Management Services. https://www.cms.gov/outreach-and-education/medicare-learning-network-mln/mlnedwebguide/downloads/97docguidelines.pdf. Accessed June 21, 2016.
22. JCAHO approves National Patient Safety Goals for 2003. *Jt Comm Perspect*. 2002;22(9):1–3.
23. Winblad B, Palmer K, Kivipelto M, et al. Mild cognitive impairment–beyond controversies, towards a consensus: report of the International Working Group on Mild Cognitive Impairment. *J Intern Med*. 2004;256(3):240–246.
24. American Psychiatric Association. *Diagnostic and Statistical Manual for Mental Disorders*. Fourth Edition, Text Revision. Washington, DC: American Psychiatric Association; 2000.
25. Han L, Cole M, Bellavance F, et al. Tracking cognitive decline in Alzheimer's disease using the Mini-Mental State Examination: a meta-analysis. *Int Psychogeriatr*. 2000;12(2):231–247.
26. Benson AD, Slavin MJ, Tran TT, et al. Screening for early Alzheimer's disease: is there still a role for the Mini-Mental State Examination? *Prim Care Companion J Clin Psychiatry*. 2005;7(2):62–69.
27. Geldmacher DS, Kerwin DR. Practical diagnosis and management of dementia due to Alzheimer's disease in the primary care setting: an evidence-based approach. *Prim Care Companion CNS Disord*. 2013;15(4):PCC.12r01474.