Published in final edited form as:

J Geriatr Psychiatry Neurol. 2009 June ; 22(2): 103–109. doi:10.1177/0891988708328214.

The Use of the Modified Telephone Interview for Cognitive Status (TICS-M) in the Detection of Amnestic Mild Cognitive Impairment

Sarah E. Cook, M.S.¹, Michael Marsiske, Ph.D.¹, and Karin J. M. McCoy, Ph.D.²

¹Department of Clinical and Health Psychology, University of Florida

²Department of Neurosurgery, University of Texas Health Science Center at San Antonio

Abstract

Many screening tools for detecting cognitive decline require in-person assessment, which is often not cost effective or feasible for those with physical limitations. The Modified Telephone Interview for Cognitive Status (TICS-M) has been used for screening dementia, but little is known about its usefulness in detecting amnestic Mild Cognitive Impairment (aMCI). Community-dwelling participants (mean age= 74.9, mean education= 16.1 years) were administered the TICS-M during initial screening and subsequently given a multi-domain neuropsychological battery. Participants were classified by consensus panel as normal older adult (noMCI, N= 54) or aMCI (N= 17) based on neuropsychological performance and Clinical Dementia Rating Scale interview, but independent of TICS-M score. There was a significant difference between groups in TICS-M score ($t = 8.04$, $p < 0.01$, noMCI range 32–43, mean [SD]= 37.4 [2.5], aMCI range 25–37, mean [SD]= 31.2 [3.5]). Discriminant function analysis revealed that TICS-M alone correctly classified 85.9% of participants into their respective diagnostic classification (sensitivity= 82.4%, specificity= 87.0%). Receiver operating characteristics analysis resulted in cutoff score of 34 that optimized sensitivity and specificity of aMCI classification. The TICS-M is a brief, cost-effective screening measure for identifying those with and without aMCI.

Keywords

Mild cognitive impairment; ROC analysis; telephone assessment

The goal of this paper is to investigate the sensitivity and specificity of a widely-used telephone interview for late-life cognitive assessment (the modified Telephone Interview for Cognitive Status; TICS-M 1) in the detection of amnestic Mild Cognitive Impairment (aMCI). The present study seeks to extend previous research by adding to the small corpus of research 2 that suggests that the TICS-M may be a useful screening instrument not only for dementia (the original purpose of the TICS), but also for aMCI. The study also extends prior work by examining a community-dwelling population (i.e., not clinically referred), to examine the utility of the TICS-M as a screening tool in a community volunteer sample.

Address correspondence to Sarah Cook or Michael Marsiske, Department of Clinical and Health Psychology, PO Box 100165, Gainesville, FL 32610-0165, cookse@phhp.ufl.edu or marsiske@phhp.ufl.edu.

The authors herein report no financial conflicts of interest.

This article is based on a poster presented at the 34th Annual Meeting of the International Neuropsychological Society, Boston, MA. Thanks are expressed to Adrienne T. Aiken Morgan and Amber Kilian for their help in conducting this research.

Most screening tools to detect cognitive impairment require in-person assessment (e.g., Mini-Mental Status Exam 3, Mattis Dementia Rating Scale 4, etc.). However, this method may not always be cost-effective or feasible for older adults who may be frail or have physical limitations. Furthermore, the need for in-person assessment can limit the ability of population-based studies to cognitively screen large numbers of adults. To overcome these barriers, the Telephone Interview for Cognitive Status (TICS) 5 was developed. The TICS has some similarities to the Mini-Mental Status Exam 3, in that it includes questions regarding orientation, repetition, and naming; however, the measure has been subsequently modified (TICS-M) 1 to include a more comprehensive memory assessment, including both immediate and delayed recall of a 10-item non-semantically related word list, to increase the probability of identifying dementia. The TICS-M was included in the present study to determine how well this telephone approach detects aMCI in a non-clinically referred sample.

Individuals with MCI are at an increased risk for the development of Alzheimer's Disease (AD), with an annual conversion rate to AD of 6 to 25% compared to less than 4% of the general population 6, which has led to investigations of early identification and pharmacological and behavioral interventions to help delay the progression of MCI to AD. There are multiple presentations of MCI (e.g., single impairment in a cognitive domain other than memory, multiple domains impaired 7). The present study focused solely on the amnesic type (aMCI). aMCI patients show a mild memory deficit beyond what is expected for their age (e.g., perform ≥ 1.5 SD below age and education corrected norms) while other cognitive domains (e.g., working memory or language abilities) are within normal limits. In this study, we also examined the Clinical Dementia Rating Scale 8 (CDR), to ascertain whether individuals and their proxy informants verified cognitive impairments and declining function in everyday contexts. Criteria for aMCI also require the individual express a subjective memory complaint, exhibit intact activities of daily living (ADLs; i.e., bathing, dressing; operationalized with Personal Care subscale of the CDR 8 in this study), and to not meet the criteria for dementia 6.

Preliminary research of the use of the TICS-M in detecting MCI 9 has shown that in the course of recruitment for a population-based study, approximately 50% of individuals with TICS-M scores between 19–38 who were later assessed in the clinic met criteria for aMCI. However, the authors did not specify what score or range of scores was most indicative of aMCI. A study by Graff-Radford and colleagues 2 used a cutoff for MCI of 29 on the TICS-M; while this cutoff showed 86% sensitivity, it only had 63% specificity of detecting MCI, with only 12 of the 20 cognitively impaired participants below this cutoff score. Furthermore, the sample used in the Graff-Radford et al. study was lower educated and older than most studies of cognitive aging and thus may not be representative of the greater older population.

Therefore, the present study sought to determine the sensitivity and specificity (and positive and negative predictive value) for detecting aMCI with the TICS-M within a non-clinically referred community-based volunteer sample. Given the selective nature of the sample, the current data set does not meet the standards of a normative sample (i.e., to provide TICS-M cutoff scores for various age/sex/education groups). Finally, we investigated the utility of using receiver operating characteristics (ROC) analysis to identify cutoffs for this sample.

Methods

Participants

Participants were 71 community-dwelling older adults age 65 and over (N = 79). Table 1 shows the demographic characteristics of the sample. They were initially recruited to

participate in a larger study 10. Participants were recruited in multiple ways, including articles in a local senior newspaper, advertisements in the community, and from the participant pools of other local aging investigators. The recruitment strategies specifically targeted community-dwelling persons with memory concerns, resulting in a high proportion of individuals with self-reported memory problems but without a prior diagnosis of a dementia. In this sample, 54 were judged to be cognitively normal (noMCI) and 17 were judged to have aMCI (see Procedures below for determination of status; these numbers are different than another paper from the same study ¹¹ due to missing TICS-M data). The exclusion criteria for participation included self-reported (1) history of neurological disease (i.e., Parkinson's disease, Alzheimer's disease, or epilepsy), (2) history of drug or alcohol abuse, (3) history of psychiatric hospitalization, (4) current cancer treatment, or (5) stroke or heart attack within the last year. Institutional Review Board approval was obtained and informed consent was completed before each participant began the study procedures.

Measures

The Modified Telephone Interview for Cognitive Status (TICS-M)—The TICS-M is a brief, 13-item test of cognitive functioning with scores ranging from 0 to 50. Questions of orientation, repetition, naming, and calculations are some of the items covered. Additionally, a 10-item non-semantically related word list is recalled both immediately and after a delay of about 5 minutes filled with distractor questions. Past research has demonstrated that the TICS-M is as reliable and valid as face-to-face administration and has a sensitivity of 94% and specificity of 100% for distinguishing normal controls from demented individuals ⁵. There is also little evidence of ceiling effects ¹² or practice effects ¹³. While varying cutoff scores for dementia have been published (ranging from 27–30, 14–1), little is known about its usefulness in detecting MCI ¹⁵. ⁶

Neuropsychological Battery—Participants were individually administered a 2.5-hour multi-cognitive domain neuropsychological battery to determine level of cognitive functioning. Detailed assessment of memory, including both verbal and visual memory, was necessary in order to determine if participants met the impaired memory criteria for aMCI (operationalized as at least 1.5 standard deviations below published normative means, adjusted for age and education ⁶). The domains of attention, working memory, speed of processing, and language were also assessed in order to exclude persons with other or multiple impaired domains. The following measures were used in the study for determining cognitive status: Hopkins Verbal Learning Test-Revised ¹⁶, Rivermead Behavioural Memory Test Paragraph Recall Subtest ¹⁷, Brief Visuospatial Memory Test ¹⁸, Mini-Mental Status Exam ¹⁹, North American Adult Reading Test ²⁰, Boston Naming Test ²¹, Controlled Oral Word Association Test ²², Trailmaking Test Parts A and B ²³, Everyday Problems Test ²⁴, Geriatric Depression Scale ²⁵, Center for Epidemiological Studies-Depression Scale ²⁶, and Memory Functioning Questionnaire ²⁷.

The Clinical Dementia Rating Scale—The CDR 8, a measure of overall cognitive impairment severity, was used to measure (a) the cognitive and daily functioning of the participants, including activities of daily living, and (b) to assess, based on proxy informant report and self-report, performance in real-world contexts as well as recent noticeable changes in cognition. The CDR and neuropsychological battery were both important sources of information in the consensus conference, which will be described below. This scale is a semi-structured interview of an informant who knows the participant well, usually a spouse or child. The participant also answers questions of orientation, judgment, and memory. The CDR contains 6 scales (Memory, Orientation, Judgment/ Problem Solving, Home/ Hobbies, Community Affairs, and Personal Care), which are each rated by the interviewer on a scale from 0 (No Dementia) to 3 (Severe Dementia). An algorithm is then used to produce an

overall score from 0 to 3, with a score of 0.5 indicative of MCI or very mild dementia. A validation study¹⁶ determined that clinical research criteria of AD, including CDR score, was indicative of AD pathology at autopsy. In this study, participants had a CDR of 0 (N = 43) or 0.5 (N = 22). Six participants were missing informant CDR data; in all cases, based on self-report and neuropsychological performance, these cases were classified as noMCI. Further analysis revealed that 41 participants with CDR = 0 were classified as noMCI while 14 participants with CDR = 0.5 were classified as aMCI. Only two participants subsequently classified as aMCI had a CDR = 0 and eight participants classified as noMCI had a CDR = 0.5. Thus, there was substantial dependency between CDR status and MCI status ($\chi^2(1) = 27.3, p < 0.001$).

Procedures

All enrolled participants were assessed between November 2002 and November 2003. Assessment consisted of a 15-minute initial telephone interview, which assessed inclusion/exclusion criteria, and the TICS-M was administered. The participants were asked to turn off their TV's or radios and to move any papers, newspapers, or pencils away from where they were. While they were asked to do these in order to have an optimal testing situation, it is unknown to what degree they complied with this request since they were in their homes. No inclusions or exclusions were made on the basis of the TICS-M score. Within two weeks of the telephone interview, and after completing informed consent, enrolled participants were administered the aforementioned neuropsychological battery in our laboratory. The CDR interview was ascertained either in person (if the informant accompanied the participant to the visit) or over the telephone within two weeks by an examiner without knowledge of the participants' neuropsychological performance. Following the assessment and interview, participant cognitive status was classified in a consensus conference.

Consensus conference—Participants were classified as noMCI or aMCI by a consensus conference consisting of five individuals (1 neuropsychology Ph.D., 1 developmental/gerontology Ph.D., and 3 neuropsychology graduate students). It is important to note that aMCI status was identified independently and without knowledge of TICS-M score. Each case was presented to the consensus members with information about demographics (identity masked) and all available neuropsychological assessment data, as well as summary scores and detailed notes from the CDR. Special attention was paid to participants scoring more than 1.5 standard deviations below age-corrected normative means on *at least one* verbal or visual memory variable. Mild impairments based on normative standards in other cognitive domains (e.g., executive tasks, language) were noted, since a goal was to exclude persons with impairments in domains other than memory. Four persons were excluded from the larger study for having such multiple impairments since the sample was weighted toward amnesic impairment only. In addition, the CDR (with attention paid to those scoring a 0.5) and a composite score representing subjective complaints from the Memory Functioning Questionnaire²⁷ (with attention paid to participants rating themselves at least 1 standard deviation below the sample mean) were also considered in the judgment. All of these variables were chosen to reflect the spirit of the Petersen criteria for MCI 6. No *exact* algorithm was used in classifying participants to allow for rater judgment, which was then validated and replicated through consensus. If all members of the consensus panel agreed on group placement, that placement prevailed. If at least one member disagreed, a discussion would take place about how the participant fit the criteria, and then a revote took place. At this point, the majority vote stood. As indicated above, the current study had 54 individuals identified as noMCI and 17 identified as aMCI.

Statistical Analyses

Demographic comparisons between groups were conducted with Bonferroni corrected one-way ANOVAs for continuous variables and Chi-square analysis for dichotomous variables. Discriminant function analysis with jackknifed classification (where each case is classified using a discriminant function based on all cases except the given case, providing a more realistic estimate of the ability of predictors to separate groups; 28) was used to determine sensitivity and specificity of the TICS-M for the detection of aMCI. Despite the relatively low number of participants, sample size was adequate to conduct this one-predictor discriminant function analysis 28. Secondly, the TICS-M performance over a range of potential cutoff thresholds was examined with Receiver Operating Characteristics (ROC) analysis 29. ROC creates a visual display pairing specificity and sensitivity values over the range of possible cutoff scores.

Results

There was a significant difference between groups in TICS-M score ($t = 8.04$, $p < 0.01$, noMCI range 32–43, mean [SD] = 37.4 [2.5], aMCI range 25–37, mean [SD] = 31.2 [3.5]). Discriminant function analysis revealed that the TICS-M alone was quite sensitive (82.4%) and specific (87.0%) to detecting aMCI in this sample with an overall 85.9% correct classification.

Receiver operating characteristic (ROC) analysis was then used to determine a possible cutoff score for the TICS-M total score that detected aMCI in the current selected sample. As displayed in Figure 1, the most appropriate cutoff score based on the ROC is between 33 and 34 (AUC = 93.3%, $\pm$ SE 3.2%), based on the tradeoff of sensitivity or specificity. Table 2 supports the ROC findings and displays sensitivity, specificity, and the positive and negative predictive values of various cutoff scores.

Discussion

The goal of this study was to determine how well the TICS-M could identify aMCI in a non-clinically referred sample of older adults. The findings of this study indicate that the TICS-M alone detected aMCI in this sample, as independently verified via a neurodiagnostic battery and consensus conference, with 86% correct classification. While the TICS-M should only be considered a screening tool and not diagnostic of cognitive impairment, the ROC results suggested that, in this positively selected community-based volunteer sample, a score of 34 or lower could alert a clinician to conduct further testing to determine aMCI status. However, the TICS-M cutoff in this sample (34) was higher than that proposed in the study by Graff-Radford² (29). Our sample differed in two ways from the Graff-Radford sample: it was comprised of community-based volunteers, and it was younger. As a descriptive exploration, we divided our sample into two age groups, age < 75 and ≥ 75 . Sensitivity and specificity and area under the curve (AUC) were uniformly high for both groups (< 75 : sensitivity = 83%, specificity = 83%, AUC = 92.5% $\pm$ SE 5.4%; ≥ 75 : sensitivity = 82%, specificity = 84%, AUC = 93.6% $\pm$ SE 3.8%), but the suggested TICS-M cutoffs varied (< 75 : cutoff = 36; ≥ 75 : cutoff = 33). These findings strongly suggest the need for a large, heterogeneous sample to identify different cutoffs for different demographic subgroups. Relative to the Graff-Radford study, the current investigation also had better *discriminability* suggesting that, at least in relatively homogeneous samples, the TICS-M can offer very good separation of amnestically impaired from non-impaired individuals.

There are several limitations to this study that must be noted. First, the sample was a highly educated and select group of older adults in that they agreed to take part in a larger study 10. A second limitation of the study is the absence of a medical or neurological examination to

rule out other potential causes of memory problems, such as a vitamin B deficiency or untreated hypothyroidism. Also, it is not known how hearing impairment may have affected the participants' performance on the TICS-M, as this study did not include objective data of hearing acuity. Prior research has suggested that the correlation between TICS-M and the MMSE (administered in-person) is lower in those with hearing impairment than older adults without.³⁰ However, in the present sample, correlations between TICS-M score and three hearing-related items obtained (self-rated hearing loss, the use of hearing aids, and the need for people to repeat sentences frequently) were non-significant (range 0.04 – 0.11). Lastly, the sample size was relatively small for a study of this type.

Future research must further verify the usefulness of the TICS-M to identify MCI, particularly in light of growing attention⁷ to subgroups of MCI. This study focused only on the amnesic subtype, so it is not clear that the TICS-M would do as well with other MCI subtypes. Furthermore, under the assumption that the long-term goal would be to provide screening cutoffs that are appropriate for different age groups and education levels, there is a strong need for norming studies with larger and more heterogeneous samples, such as that done for the CAMDEX³¹. The basis for doing this has been established since the TICS-M has been used in the national HRS/AHEAD³² study and in its allied ADAMS dementia study³³ to investigate its usefulness in large sample studies. Additionally, previous research³⁴ has identified that primacy and recency effects of the TICS-M word list was more useful in detecting early AD than the traditional score; these effects should be investigated in aMCI to determine if they detect impairment above and beyond the traditional scoring method. Given the strong ability of the TICS-M to detect amnesic MCI in this sample, future work must also examine whether other screening tools work as well as the TICS-M, or can supplement the TICS-M in boosting classification accuracy. If the TICS-M continues to perform well as a screening tool for amnesic MCI, the simplicity and brevity of the measure, coupled with the ability for non-experts to administer it, suggests that the TICS-M could be relatively easily integrated into telephone protocols or primary care settings.

Acknowledgments

This research was supported in part by the University of Florida Vice President for Research.

References

1. Welsh KA, Breitner JCS, Magruder- Habib KM. Detection of dementia in the elderly using Telephone Screening of Cognitive Status. *Neuropsychiatry Neuropsychol Behav Neurol* 1993;6:103–110.
2. Graff-Radford NR, Ferman TJ, Lucas JA, et al. A cost effective method of identifying and recruiting persons over 80 free of dementia or mild cognitive impairment. *Alzheimer Dis Assoc Disord* 2006;20:101–104. [PubMed: 16772745]
3. 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;12:189–198. [PubMed: 1202204]
4. Mattis, S. *Dementia Rating Scale: Professional Manual*. Odessa, FL: Psychological Assessment Resources, Inc.; 1988.
5. Brandt J, Spencer M, Folstein M. The Telephone Interview for Cognitive Status. *Neuropsychiatry Neuropsychol Behav Neurol* 1988;1:111–117.
6. Petersen RC, Doody R, Kurz A, et al. Current concepts in mild cognitive impairment. *Arch Neurol* 2001;58:1985–1992. [PubMed: 11735772]
7. Petersen RC. Mild cognitive impairment as a diagnostic entity. *J Intern Med* 2004;256:183–194. [PubMed: 15324362]
8. Morris JC. The Clinical Dementia Rating (CDR): Current version and scoring rules. *Neurology* 1993;43:2412–2414. [PubMed: 8232972]

9. Lines CR, McCarroll KA, Lipton RB, et al. Telephone screening for amnesic mild cognitive impairment. *Neurology* 2003;60:261–266. [PubMed: 12552041]
10. McCoy, KJM. Understanding the transition from normal cognitive aging to mild cognitive impairment: Comparing the intraindividual variability in cognitive function. 2004. University of Florida;
11. Cook SE, Marsiske M. Subjective memory beliefs and cognitive performance in normal and mildly impaired older adults. *Aging Ment Health* 2006;10:413–423. [PubMed: 16798634]
12. de Jager CA, Budge MM, Clarke R. Utility of TICS-M for the assessment of cognitive function in older adults. *Int J Geriatr Psychiatry* 2003;18:318–324. [PubMed: 12673608]
13. Plassman BL, Newman TT, Welsh KA, et al. Properties of the telephone interview for cognitive status: Application in epidemiological and longitudinal studies. *Neuropsychiatry Neuropsychol Behav Neurol* 1994;7:235–241.
14. Gallo JJ, Breitner JCS. Alzheimer's disease in the NAS-NRC Registry of ageing twin veterans, IV. Performance characteristics of the two-stage telephone screening procedure for Alzheimer's dementia. *Psychol Med* 1995;25:1211–1220. [PubMed: 8637951]
15. Petersen RC, Smith GE, Waring SC, et al. Mild cognitive impairment: Clinical characterization and outcome. *Arch Neurol* 1999;56:303–308. [PubMed: 10190820]
16. Morris JC, McKeel DW, Fulling K, et al. Validation of clinical diagnostic criteria for Alzheimer's Disease. *Ann Neurol* 1988;24:17–22. [PubMed: 3415196]
17. Brandt, J.; Benedict, RHB. Hopkins Verbal Learning Test-Revised: Professional manual. Odessa, FL: Psychological Assessment Resources; 2001.
18. Wilson, B.; Cockburn, J.; Baddeley, A. The Rivermead Behavioural Memory Test. Bury St. Edmunds, England: Thames Valley Test Company; 1985.
19. Benedict, RHB. Brief Visuospatial Memory Test-Revised. Odessa, FL: Psychological Assessment Resources, Inc.; 1997.
20. Blair JR, Spreen O. Predicting pre-morbid IQ: A revision of the National Adult Reading Test. *Clin Neuropsychol* 1989;3:129–136.
21. Kaplan, EF.; Goodglass, H.; Weintraub, S. The Boston Naming Test. Baltimore, MD: Lippincott; 2001.
22. Benton, A.; Hamsher, K. Multilingual Aphasia Examination. Iowa City, IA: AJA Associates; 1989.
23. Reitan, RM. Trail Making Test: Manual for administration and scoring. Tucson, AZ: Reitan Neuropsychology Lab; 1992.
24. Willis, SL.; Marsiske, M. Manual for the Everyday Problems Test. University Park, PA: Pennsylvania State University; 1993.
25. Yesavage JA. Development and validation of a Geriatric Depression Screening Scale: A preliminary report. *J Psychiatr Res* 1983;17:37–49. [PubMed: 7183759]
26. Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement* 1977;1:385–401.
27. Gilewski MJ, Zelinski EM, Schaie KW. The memory functioning questionnaire for assessment of memory complaints in adulthood and old age. *Psychol Aging* 1990;5:482–490. [PubMed: 2278670]
28. Tabachnick, BG.; Fidell, LS. Using Multivariate Statistics. 5 ed. Boston: Allyn and Bacon; 2007.
29. Murphy JM, Berwick DM, Weinstein MC, et al. Performance of screening and diagnostic tests: Application of receiver operating characteristic analysis. *Arch Gen Psychiatr* 1987;22:550–555. [PubMed: 3579501]
30. Pachana NA, Alpass FM, Blakey JA, et al. A comparison of the MMSE and the TICS-m in hearing-impaired older adults. *Aust J Ageing* 2006;25:89–93.
31. Heinik J, Solomesh I. Validity of the Cambridge Cognitive Examination-Revised new executive function scores in the diagnosis of dementia: Some early findings. *J Geriatr Psychiatry Neurol* 2007;20:22–28. [PubMed: 17341767]
32. Herzog AR, Wallace RB. Measures of cognitive functioning in the AHEAD study. *J Gerontol B Psychol Sci Soc Sci* 1997;52B:37–48. [PubMed: 9215356]

33. Langa KM, Plassman BL, Wallace RB, et al. The aging, demographics, and memory study: Study design and methods. *Neuroepidemiology* 2005;25:181–191. [PubMed: 16103729]
34. Buschke H, Sliwinski MJ, Kuslansky G, et al. Retention weighted recall improves discrimination of Alzheimer's disease. *J Int Neuropsychol Soc* 2006;12:436–440. [PubMed: 16903137]

ROC

Figure 1. Receiver operating characteristics of the TICS-M with the inflection points marked at the proposed cutoff 33/34.

Table 1

Mean (SD) participant characteristics and differences by group.

	Total Sample (N = 71)	noMCI (N = 54)	aMCI (N = 17)	p-value (df = 69)
Age	74.9 (5.7)	74.3 (5.0)	77.0 (7.4)	0.09
Education	16.14 (2.7)	16.1 (2.6)	16.29 (3.1)	0.79
Race (N, %)				0.77
White	66 (93.0)	50 (92.6)	16 (94.1)	
Non-white	5 (7.0)	4 (7.4)	1 (5.9)	
Sex (N, %)				0.01
Male	31 (43.7)	19 (35.2)	12 (70.6)	
Female	40 (56.3)	35 (64.8)	5 (29.4)	
TICS-M				
Range	25–43	32–43	25–37	
Mean (SD)	36.0 (3.8)	37.4 (2.5)	31.2 (3.5)	< 0.001
MMSE	28.1 (1.7)	28.7 (1.2)	26.4 (2.0)	< 0.001
GDS	3.7 (3.4)	3.6 (3.1)	4.1 (4.2)	0.60

Note: TICS-M: Modified Telephone Interview for Cognitive Status; MMSE: Mini-Mental Status Exam; GDS: Geriatric Depression Scale.

Table 2

Cross-validated sensitivity, specificity, positive predictive value, and negative predictive value for TICS-M cutoff scores.

Cutoff Score	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
26	17.6	100	100	79.4
27	17.6	100	100	79.4
28	17.6	100	100	79.4
29	29.4	100	100	81.8
30	41.2	100	100	84.4
31	47.1	100	100	85.7
32	64.7	96.3	84.6	89.7
33	70.6	92.6	75.0	90.9
34	82.4	87.0	66.7	94.0
35	88.2	81.5	60.0	95.7
36	94.1	68.5	48.5	97.4
37	100	48.1	37.8	100
38	100	33.3	32.1	100
39	100	33.3	32.1	100
40	100	16.7	27.4	100
41	100	9.3	25.8	100
42	100	7.4	25.4	100
43	100	3.7	24.6	100