Published in final edited form as:

Clin Neuropsychol. 2013 October ; 27(7): 1121–1130. doi:10.1080/13854046.2013.809794.

Demographic corrections for the modified Telephone Screening for Cognitive Status

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Abstract

Despite the growing use of the modified Telephone Interview for Cognitive Status (mTICS) as a cognitive screening instrument, it does not yet have demographic corrections. Demographic data, mTICS, and a neuropsychological battery were collected from 274 community dwelling older adults with intact cognition or mild cognitive impairments. Age, education, premorbid intellect, and depression were correlated with mTICS scores. Using regression equations, age and education significantly predicted mTICS total score, and depression and premorbid intellect further enhanced this prediction. These results were comparable when only examining the 153 cognitively intact subjects. By using these corrections, clinicians and researchers can more accurately predict an individual's cognitive status with this telephone screening measure.

Introduction

The modified Telephone Interview for Cognitive Status (mTICS) (Welsh, Breitner et al. 1993) is a popular screening instrument that can quickly assess an individual's cognitive status. This 14-item measure purports to assess global cognition with a total score ranging from 0 – 50, with higher scores indicating better cognition. By tapping attention, orientation, language, and learning and memory, the mTICS is similar to other screening measures such as the Mini Mental Status Examination, but it can be administered over the telephone. It is different from its predecessor, the TICS, primarily in its addition of a delayed recall trial, which was dropped in the original version because it was too difficult for patients with Alzheimer's disease (Brandt, Spencer et al. 1988). As such, the mTICS is more memory-laden, with 20 of its possible 50 points coming on learning and memory items, so this measure may be a useful tool for identifying cases with a primary amnesic profile (e.g., amnesic Mild Cognitive Impairment [MCI] and early Alzheimer's disease).

The diagnostic utility of both the mTICS and the TICS have been examined in older cohorts, with mixed results. For example, Manly et al. (2011) found that the TICS had high diagnostic validity in identifying cases of dementia, but poorer ability to discriminate MCI and cognitively intact elders. Similarly, others have reported that these telephone screening measures do not adequately identify milder forms of late life cognitive decline (Yaari, Fleisher et al. 2006; Knopman, Roberts et al. 2010). Conversely, Beeri et al. (2003) found that the mTICS did adequately identify MCI, especially when they controlled for age and education in the analyses. Others have also shown the benefits of either the mTICS or TICS in MCI (Graff-Radford, Ferman et al. 2006; Cook, Marsiske et al. 2009; Seo, Lee et al. 2011; Lee, Richardson et al. 2012). The mTICS has also been shown to correlate with other screening measures (de Jager, Budge et al. 2003) and more comprehensive assessments of cognitive functioning (Crooks, Petitti et al. 2006; Duff, Beglinger et al. 2009; van den Berg,

Ruis et al. 2012). Some have suggested that the mTICS might be used as a screening measure for clinical trials on patients with cognitive impairments (Lines, McCarroll et al. 2003; Graff-Radford, Ferman et al. 2006). Telephone screening may also serve as a cost-effective method for identifying appropriate subjects for community-based research (e.g., preselecting individuals without cognitive decline).

One potential limitation associated with the mTICS is its lack of normative data with demographic corrections. Several studies have acknowledged the inverse correlation between age and mTICS total score (de Jager, Budge et al. 2003; Lines, McCarroll et al. 2003; Duff, Beglinger et al. 2009). Similarly, education and intellect have been associated with performance on the mTICS (Plassman, Welsh et al. 1995; de Jager, Budge et al. 2003; Potter, Helms et al. 2008). Correcting for demographic variables is a common practice in neuropsychology (Ivnik, Malec et al. 1996; Ivnik, Smith et al. 1997; Steinberg and Bieliauskas 2005), and failing to do so could lead to interpretive errors.

Therefore, the purpose of the current study was to examine demographic and other clinical influences on the mTICS and create corrected normative data for this measure. To add to the clinical utility of these findings, some examples of the application of these normative data will be provided. Based on existing research, it was expected that age and education would be related to mTICS scores, and that normative data would need to include these variables. Although there is little mTICS-specific data to generate hypotheses on other clinical variables, it is also suspected that depression and premorbid intellect would be related to scores on this cognitive screening measure.

Methods

Procedures

The research protocol and all study procedures were approved by the participating universities' Institutional Review Board prior to study commencement.

Recruitment and Screening

Potential participants were recruited from senior centers and independent living facilities to prospectively study memory changes in later life. They called our office and were screened over the telephone for cognitive functioning with the mTICS. As noted earlier, the mTICS is a measure of global cognition that assesses attention (e.g., counting backwards, serial 7's), orientation (e.g., participant's name, telephone number, month, date, year, season, day of the week), language (e.g., naming, repetition of phrases, identifying opposites), and learning and memory (e.g., immediate and delayed recall of a 10-item word list). Individuals with mTICS scores <19 were excluded from the study at this point, as this suggests frank dementia (Lines, McCarroll et al. 2003). All other individuals were invited to participate in the study, and were scheduled for an in-person visit as described below.

In-Person Visit

During an in-person visit, participants completed a brief clinical interview, which collected relevant demographic information, presence of memory complaints, report of activities of daily living, and medical and psychiatric history. Participants' self reports were corroborated via collateral source (e.g., family member, spouse, close friend). The 30-item Geriatric Depression Scale (GDS) was administered to assess depressive symptoms. The Wide Range Achievement Test-4 (WRAT-4) Reading subtest, which has participants read progressively more challenging irregular words, was used to estimate premorbid intellect (Johnstone, Callahan et al. 1996; Ball, Hart et al. 2007). The Repeatable Battery for the Assessment of Neuropsychological Status was used to characterize current cognitive functioning.

Additional tests of memory (Hopkins Verbal Learning Test – Revised Delayed Recall, Brief Visuospatial Memory Test – Revised Delayed Recall), language (Controlled Oral Word Association Test, semantic fluency), processing speed (Trail Making Test Part A, Symbol Digit Modalities Test), and executive functioning (Trail Making Test Part B) were also administered to help characterize subjects' cognitive status.

Based on information gathered during this in-person visit, participants with significant history of major neurological (e.g., dementia, traumatic brain injury, stroke) or psychiatric illness (e.g., Bipolar Disorder, Schizophrenia), dementia (using the telephone and in-person cognitive screening battery) or current depression (GDS >15) were excluded. All assessments were performed by trained research assistants.

Subject Classification

Participants were classified as either MCI or intact using existing MCI criteria (Petersen, Doody et al. 2001; Winblad, Palmer et al. 2004), and these methods were more fully described in a prior publication (Duff, Beglinger et al. 2008). Individuals were classified as amnesic MCI if: 1) they complained of memory problems, 2) their performance on a composite of three delayed recall tasks (Hopkins Verbal Learning Test – Revised Delayed Recall, Brief Visuospatial Memory Test – Revised Delayed Recall, Repeatable Battery for the Assessment of Neuropsychological Status Delayed Memory Index) fell significantly below expectations (i.e., approximately 1.5 SDs below an estimate of premorbid intellect [WRAT-4 Reading]), and 3) they denied any significant impairments in daily activities (e.g., managing medications or finances, driving, performing household chores). Classification of individuals as cognitively intact was similar to MCI except these individuals had performances on the delayed recall tasks that were more commensurate with expectations (e.g., less than 1.5 SDs below premorbid intellect). This was largely a psychometric classification scheme, which did not involve a consensus conference.

Participants

Data from 274 community-dwelling older adults were included in these analyses. Their mean age was 77.4 (7.6) years and their mean education was 15.3 (2.6) years. Most were women (78%) and nearly all were Caucasian. Premorbid intellect was average (WRAT-4 Reading: $M=108.4$ [8.3]), and they were minimally depressed (GDS: $M=4.5$ [3.6]). Using the classification scheme described above, approximately 44% of this sample was classified as amnesic MCI (single or multidomain), with the remaining participants being cognitively intact. Demographic information and test scores for these two groups are presented in Table 1. Comparisons between the intact and MCI participants identified differences on age ($t[272]=-5.2$, $p<0.001$), WRAT-4 Reading ($t[272]=-4.5$, $p<0.001$), and the memory composite ($t[272]=15.8$, $p<0.001$), but not on education ($p=0.78$), gender ($p=0.08$), ethnicity ($p=0.85$), or GDS ($p=0.23$).

Statistical analyses

First, Pearson correlations were examined between mTICS Total score and age, education, depressive symptoms, and premorbid intellect. An independent t-test examined mTICS differences between males and females. Second, a stepwise multiple regression predicted the mTICS Total score from demographic variables identified in the initial analyses (model 1). Third, a second stepwise multiple regression added depressive symptoms and premorbid intellect as possible predictors of mTICS Total (model 2) due to their significant associations. These analyses were run on the total sample ($n=274$) and then on those identified as cognitively intact ($n=153$).

Results

Total sample

Both age and education were significantly related to the mTICS Total score in these participants (age: $r[274]=-0.39$, $p<0.001$; education: $r[274]=0.30$, $p<0.001$). Males and females did not differ in their mTICS Total score ($t[272]=-0.27$, $p=0.79$). Both depression and premorbid intellect were also significantly related to the mTICS Total score (depression: $r[273]=-0.20$, $p=0.001$; premorbid intellect: $r[274]=0.23$, $p<0.001$). Not surprisingly, participants identified as cognitively intact performed significantly better on the mTICS than those identified with MCI ($t[272]=7.17$, $p<0.001$). However, cognitive status was not included in the following regression models, as this would not be known at the time of screening when these corrections would be applied.

In the model 1, age and education were significant predictors of mTICS Total score ($R^2=0.22$, $F[2,271]=37.66$, $p<0.001$). In model 2, depression and premorbid intellect significantly improved the prediction of mTICS Total ($R^2=0.27$, $F[4,268]=24.95$, $p<0.001$). The prediction equations for the two models are presented in Table 2.

Cognitively intact

Age and education were significantly related to the mTICS Total score in these participants (age: $r[153]=-0.33$, $p<0.001$; education: $r[153]=0.36$, $p<0.001$). Males and females did not differ in their mTICS Total score ($t[151]=0.06$, $p=0.95$). Premorbid intellect, but not depression, was significantly related to the mTICS Total score (premorbid intellect: $r[153]=0.48$, $p<0.001$; depression: $r[153]=-0.06$, $p=0.43$).

In the model 1, age and education were significant predictors of mTICS Total score ($R^2=0.21$, $F[2,150]=19.81$, $p<0.001$). In model 2, premorbid intellect significantly improved the prediction of mTICS Total ($R^2=0.27$, $F[3,148]=17.86$, $p<0.001$). The prediction equations for the two models are presented in Table 2.

Discussion

The mTICS is a popular cognitive screening instrument with possible applications in clinical and research settings. However, to our knowledge, there are no normative data that correct for demographic and clinical variables that might skew the scores and interpretation of performance on this measure. The current study, consistent with prior studies (de Jager, Budge et al. 2003; Lines, McCarroll et al. 2003; Duff, Beglinger et al. 2009), found significant associations between mTICS scores and age and education in this community-dwelling cohort of older adults. These results are also consistent with the longstanding use of demographic corrections for many neuropsychological measures, especially with geriatric samples (Ivnik, Malec et al. 1996; Ivnik, Smith et al. 1997). Although these correlations went in the expected directions (e.g., older age and less education associated with lower mTICS scores), the size of these correlations were modest, accounting for between 9 – 15% of the variance. Obviously, other factors must be influencing cognitive status. In the entire sample, an examination of depressive symptoms and premorbid intellect and their influence on the mTICS also yielded small, but statistically significant, associations.

With all of these potential moderating effects of the mTICS, we next sought to develop normative data that corrected for these variables. Regression-based models are one popular method for correcting for demographic variables on a variety of cognitive test scores (Heaton, Grant et al. 1991). Using this method, we found that age and education significantly predicted the Total score on the mTICS (model 1). Additionally, depressive symptoms (as measured by a self-report rating scale) and premorbid intellect (as measured

by a reading test) significantly added to this prediction (model 2). As expected based on the correlations, these two regression models did not entirely capture the mTICS score (e.g., 22 – 27% of the variance accounted for), suggesting that other variables might contribute to this estimation. Although current cognitive classification (MCI vs. intact) was not part of these regression models, it is expected that this variable might account for a significant amount of the unexplained variance. In exploratory analyses with the entire sample, this classification variable always entered models first (i.e., before age, education, WRAT-4 Reading, and GDS), but it did not capture the majority of the unexplained variance (e.g., in model 1, a total of 31% of the variance was explained [vs. 22% without the classification variable]). This may not be so surprising since the two groups did not show very large mean differences on the mTICS (e.g., approximately 4 points). Clearly, other variables (e.g., hearing, fatigue, environmental distractions, anxiety) are affecting mTICS performance. Nonetheless, clinicians and researchers can use these models to more accurately determine the cognitive status of individuals over the telephone by minimizing systematic error.

Initially, we examined the demographic effects of age and education on the mTICS in our entire sample, which included individuals who were cognitively intact and those with MCI. Our rationale for including all individuals was that the cognitive status of the individual patient/participant would not be known prior to screening. However, based on constructive comments from reviewers, we added a second set of analyses that only used the 153 cognitively intact individuals in our sample. Excluding individuals with known/suspected cognitive impairment would be more typical for normative studies. Interestingly, the results between the total sample and the cognitively intact participants were quite comparable. For example, in the model that only included age and education, the R^2 for the total sample was 0.22, whereas the R^2 for the cognitively intact individuals was only slightly smaller (0.21). A more noticeable difference between the groups was seen in the second model, where premorbid intellect and depression were considered. In the total sample, both depression and premorbid intellect significantly improved the prediction of mTICS Total ($R^2=0.27$), whereas in the cognitively intact subjects, only premorbid intellect improved the prediction ($R^2=0.27$). It is unclear why this difference occurred, especially since the intact and MCI subjects did not differ on GDS scores. Obviously, neither premorbid intellect nor depression is a typical “demographic” variable considered in normative studies. Most neuropsychologists might see the value of including an estimate of premorbid intellect, as this could lead to larger discrepancies with current cognitive functioning if some true decline has occurred. Depression, however, is more complicated. Some might argue that controlling for depression could unintentionally exclude patients who are at higher risk for developing cognitive disorders (Diniz, Butters et al. 2013), and thereby make the mTICS less sensitive. Others might suggest that depressive symptoms, common in later life, can modify cognitive performances (Weisenbach, Boore et al. 2012) and contribute unwanted noise to the mTICS scores. Our rationale for including depression was more pedantic. GDS scores were significantly related to mTICS scores, so it seemed to make sense to include them in the prediction models. Future studies might further examine this relationship between mTICS and non-demographic variables as a way to improve these predictions.

A couple examples of the use of these regression models might be beneficial. In the current total sample, the mean age was 77 years, mean education was 15 years, mean GDS score was approximately 5, and mean premorbid intellect was 108. Based on these demographic and clinical variables, model 1 from the total sample would predict an mTICS Total score of 35.41 and model 2 would predict an mTICS score of 35.18, both of which are very close to the mean mTICS score in this sample of 35.1. However, if a 77-year old patient had only 8 years of education, then model 1 would predict an mTICS score of 32.12. An 87-year old patient with 8 years of education would be predicted to have an mTICS score of 29.82 based on model 1. Not only can these models predict performance, but they can provide a frame of

reference for how similar an observed performance is compared to a predicted performance. By dividing the difference of observed mTICS minus predicted mTICS by the standard error of the estimate of the regression model in Table 2, a z-score is calculated for each patient that shows how many standard deviation units he/she is away from his/her predicted score. For example, if our 87-year old with 8 years of education actually gets a 35 on the mTICS, then his observed mTICS score is 1.18 standard deviation units above expectations based on his age and education (i.e., $[35 - 29.82]/4.37 = 1.18$). Our 77-year old with 8 years of education with an observed mTICS score of 35 would fall 0.66 standard deviation units above expectations (i.e., $[35 - 32.12]/4.37 = 0.66$). Considering these projections on a group level, the participants characterized as cognitively intact had observed mTICS scores that were 0.30 standard deviation units above their predicted scores, whereas those characterized as MCI had observed scores that were 0.40 standard deviation units below their predicted scores ($t[272]=5.83$, $p<0.001$, $d=0.78$). The interested reader can contact the corresponding author to obtain an Excel spreadsheet that will perform these calculations.

Despite the appeal of these demographic and clinical corrections, there are some limitations that deserve mention. First, the current sample was relatively homogeneous, especially in terms of demographic variables. Therefore, the generalizability of these findings to those outside the demographic composition of this sample (e.g., 65 – 96 years old, 8 – 22 years of education, mostly women, nearly all Caucasian) is unknown. Future studies might examine the utility of these normative data in more diverse samples. Second, the clinical variables examined in these regression models were also limited. Individuals with GDS scores >15 were excluded from this study, which obviously limits the applicability of these findings to those with more severe levels of depression. Future studies might include a broader range of depression scores, as well as other psychiatric symptoms, to more accurately examine their relationships to the mTICS. Similarly, the premorbid estimates of intellect in this cohort ranged from 81 – 145, which also suggests that these predictions might not work well in patients with possible intellectual disabilities. Third, this sample was recruited from the community, so it is not clear how valid these results would be in a purely clinical setting. For example, we excluded scores <19 on the mTICS that would indicate frank dementia. Fourth, there are a number of weaknesses inherent to telephone assessment, including that items are restricted to auditory domain, limited control over environmental factors, and the potential impact of a hearing deficit. For example, Beeri et al. (2003) found that the mTICS was more sensitive if hearing loss was controlled for. In the current study, we did not screen for hearing loss in our participants. Similarly, we did not assess for environmental factors, such as a loud television in the background or a potential participant referring to a calendar when asked for the date. These factors could have affected the validity of the cognitive assessment and our overall findings. Finally, despite the potential benefits of the mTICS, it may come at some costs, including poorer sensitivity of memory impairments. For example, on average, the subjects characterized as MCI had observed scores that were 0.40 standard deviation units below their predicted scores, which is a smaller difference than typically seen in the diagnosis of MCI (e.g., approximately 1.5 standard deviations below expectations). Even with these limitations, the current results would appear to further validate the mTICS as a valuable screening measure of cognitive status in older adults.

Acknowledgments

The project described was supported by research grants from the National Institutes on Aging: K23 AG028417 (KD). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute on Aging or the National Institutes of Health.

References

- Ball JD, Hart RP, et al. Comparative utility of Barona Formulae, WTAR demographic algorithms, and WRAT-3 reading for estimating premorbid ability in a diverse research sample. *Clin Neuropsychol*. 2007; 21(3):422–33. [PubMed: 17455028]
- Beeri MS, Werner P, et al. Validation of the modified telephone interview for cognitive status (TICS-m) in Hebrew. *Int J Geriatr Psychiatry*. 2003; 18(5):381–6. [PubMed: 12766912]
- Brandt J, Spencer M, et al. The telephone interview for cognitive status. *Neuropsychiatry Neuropsychol Behav Neurol*. 1988; 1:111–117.
- Cook SE, Marsiske M, et al. The use of the Modified Telephone Interview for Cognitive Status (TICS-M) in the detection of amnesic mild cognitive impairment. *J Geriatr Psychiatry Neurol*. 2009; 22(2):103–9. [PubMed: 19417219]
- Crooks VC, Petitti DB, et al. Cognitive domains associated with performance on the Telephone Interview for Cognitive Status-modified. *American Journal of Alzheimer's Disease and Other Dementias*. 2006; 21(1):45–53.
- de Jager CA, Budge MM, et al. Utility of TICS-M for the assessment of cognitive function in older adults. *Int J Geriatr Psychiatry*. 2003; 18(4):318–24. [PubMed: 12673608]
- Diniz BS, Butters MA, et al. Late-life depression and risk of vascular dementia and Alzheimer's disease: systematic review and meta-analysis of community-based cohort studies. *Br J Psychiatry*. 2013; 202:329–35. [PubMed: 23637108]
- Duff K, Beglinger L, et al. Short-term practice effects in amnesic mild cognitive impairment: implications for diagnosis and treatment. *Int Psychogeriatr*. 2008; 20(5):986–99. [PubMed: 18405398]
- Duff K, Beglinger LJ, et al. Validation of the modified telephone interview for cognitive status in amnesic mild cognitive impairment and intact elders. *Alzheimer Disease and Associated Disorders*. 2009; 23(1):38–43. [PubMed: 18695589]
- Duff K, Beglinger LJ, et al. Validation of the modified telephone interview for cognitive status in amnesic mild cognitive impairment and intact elders. *Alzheimer Dis Assoc Disord*. 2009; 23(1):38–43. [PubMed: 18695589]
- Graff-Radford NR, Ferman TJ, 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(2):101–4. [PubMed: 16772745]
- Heaton, RK.; Grant, I., et al. Comprehensive Norms for an Expanded Halstead-Reitan Battery: Demographic Corrections, Research Findings, and Clinical Applications. Psychological Assessment Resources; Odessa, FL: 1991.
- Ivnik RJ, Malec JF, et al. Neuropsychological tests' norms above age 55: COWAT, BNT, MAE Token, WRAT-R Reading, AMNART, STROOP, TMT, and JLO. *Clinical Neuropsychologist*. 1996; 10(3):262–278.
- Ivnik RJ, Smith GE, et al. Free and cued selective reminding test: MOANS norms. *Journal of Clinical and Experimental Neuropsychology*. 1997; 19(5):676–691. [PubMed: 9408798]
- Johnstone B, Callahan CD, et al. The comparability of the WRAT-R reading test and NAART as estimates of premorbid intelligence in neurologically impaired patients. *Arch Clin Neuropsychol*. 1996; 11(6):513–9. [PubMed: 14588456]
- Knopman DS, Roberts RO, et al. Validation of the telephone interview for cognitive status-modified in subjects with normal cognition, mild cognitive impairment, or dementia. *Neuroepidemiology*. 2010; 34(1):34–42. [PubMed: 19893327]
- Lee HB, Richardson AK, et al. Race and cognitive decline among community-dwelling elders with mild cognitive impairment: findings from the Memory and Medical Care Study. *Aging Ment Health*. 2012; 16(3):372–7. [PubMed: 21999809]
- Lines CR, McCarroll KA, et al. Telephone screening for amnesic mild cognitive impairment. *Neurology*. 2003; 60(2):261–6. [PubMed: 12552041]
- Manly JJ, Schupf N, et al. Telephone-based identification of mild cognitive impairment and dementia in a multicultural cohort. *Arch Neurol*. 2011; 68(5):607–14. [PubMed: 21555635]

- Petersen RC, Doody R, et al. Current concepts in mild cognitive impairment. *Arch Neurol*. 2001; 58(12):1985–92. [PubMed: 11735772]
- Plassman BL, Welsh KA, et al. Intelligence and education as predictors of cognitive state in late life: A 50-year follow-up. *Neurology*. 1995; 45(8):1446–1450. [PubMed: 7644038]
- Potter GG, Helms MJ, et al. Associations of job demands and intelligence with cognitive performance among men in late life. *Neurology*. 2008; 70(19, Pt 2):1803–1808. [PubMed: 18077796]
- Seo EH, Lee DY, et al. Validity of the telephone interview for cognitive status (TICS) and modified TICS (TICS_m) for mild cognitive impairment (MCI) and dementia screening. *Arch Gerontol Geriatr*. 2011; 52(1):e26–30. [PubMed: 20471701]
- Steinberg B, Bieliauskas L. Introduction to the Special Edition: IQ-Based MOANS Norms for Multiple Neuropsychological Instruments. *The Clinical Neuropsychologist*. 2005; 19(3-4):277–279. [PubMed: 16120533]
- van den Berg E, Ruis C, et al. The Telephone Interview for Cognitive Status (Modified): Relation with a comprehensive neuropsychological assessment. *J Clin Exp Neuropsychol*. 2012
- Weisenbach SL, Boore LA, et al. Depression and cognitive impairment in older adults. *Curr Psychiatry Rep*. 2012; 14(4):280–8. [PubMed: 22622478]
- Welsh K, Breitner J, et al. Detection of dementia in the elderly using Telephone Screening of Cognitive Status. *Neuropsychiatry Neuropsychol Behav Neurol*. 1993; 6:103–110.
- Winblad B, Palmer K, 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):240–6. [PubMed: 15324367]
- Yaari R, Fleisher AS, et al. Utility of the telephone interview for cognitive status for enrollment in clinical trials. *Alzheimer's & Dementia*. 2006; 2:104–109.

Table 1

Demographic and cognitive scores on total sample and individual groups.

	Total sample n=274	Intact n=153	MCI n=121
Age (years)	77.4 (7.6) 65 – 96	75.3 (7.1) 65 – 96	79.9 (7.4) 65 – 94
Education (years)	15.3 (2.6) 8 – 22	15.2 (2.7) 8 – 22	15.3 (2.6) 11 – 20
Gender (% female)	78%	82%	74%
Ethnicity (% Caucasian)	98%	96%	99%
mTICS Total	35.1 (4.9) 20 – 48	36.8 (4.3) 24 – 48	32.9 (4.8) 20 – 45
Memory composite	94.8 (15.1) 53 – 125	103.9 (9.6) 73 – 125	82.7 (12.3) 52 – 106
WRAT-4 Reading	108.4 (8.3) 81 – 145	106.5 (7.7) 81 – 126	110.8 (8.5) 87 – 145
GDS	4.5 (3.6) 0 – 15	4.2 (3.8) 0 – 15	4.8 (3.4) 0 – 15

Note. MCI = Mild Cognitive Impairment. mTICS = modified Telephone Interview of Cognitive Status. WRAT-4 = Wide Range Achievement Test – 4th Edition. GDS = Geriatric Depression Scale. mTICS and GDS are raw scores. Memory composite and WRAT-4 Reading are age-corrected standard scores (M=100, SD = 15). In the cells above, values presented are mean and standard deviation (in parentheses) on the first line and range on second line.

Table 2

Prediction equations for mTICS Total.

Prediction equation based on total sample	SEE
mTICS Total = $46.07 - (\text{age} \times 0.23) + (\text{educ} \times 0.47)$	4.37
mTICS Total = $39.04 - (\text{age} \times 0.26) + (\text{educ} \times 0.28) - (\text{dep} \times 0.20) + (\text{prem} \times 0.12)$	4.22
Prediction equation based on cognitively intact subjects	
mTICS Total = $42.25 - (\text{age} \times 0.17) + (\text{educ} \times 0.50)$	3.84
mTICS Total = $29.71 - (\text{age} \times 0.18) + (\text{educ} \times 0.29) + (\text{prem} \times 0.16)$	3.71

Note. age = years old, educ = years of education, dep = raw score on the 30-item Geriatric Depression Scale, mTICS = modified Telephone Interview of Cognitive Status, prem = standard score on Reading subtest of the Wide Range Achievement Test – 4, SEE = Standard Error of the Estimate of the regression model.