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Validation of the modified Telephone Interview for Cognitive Status in amnestic Mild Cognitive Impairment and intact elders

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Abstract

Although the modified Telephone Interview for Cognitive Status (mTICS) is frequently used as a screening measure of cognition in dementia and aging studies, it has not been validated in individuals with milder cognitive impairments. The current study compared two groups (amnestic Mild Cognitive Impairment [n=61] and cognitively intact elders [n=62]) on the mTICS and used regression models to predict baseline scores on standardized memory tests using baseline mTICS scores. Baseline mTICS scores were also used to predict one-year follow-up scores on memory tests in a subsample (n=91). Large group differences ($p<0.01$) were found between the amnestic individuals and their healthy peers on the mTICS total score, two factor scores, and 3 of 14 individual items. Baseline mTICS scores predicted between 22 – 43% of baseline memory composite scores and 21 – 28% of one-year memory composite scores. Overall, these results provide additional validation of the mTICS as a valuable screening instrument for cognition in individuals with milder cognitive impairments.

Keywords

modified Telephone Interview for Cognitive Status; Mild Cognitive Impairment; screening cognition

Introduction

Screening for cognitive impairment in older adults remains a challenging but important practice for clinicians and researchers working with geriatric patients. Clinical office visits, mental status examinations, and neuropsychological evaluations can be costly and time-consuming. Additionally, accessibility to these services may be limited in rural areas. Many existing procedures are also impractical for quickly evaluating the large numbers of participants needed for clinical research trials (e.g., Phase III trials of cognitive enhancing medications). Therefore, the need for brief and accurate cognitive screening instruments is necessary for furthering geriatric clinical work. Such measures will likely be in greater demand to separate patients with no cognitive impairments from those with milder cognitive impairments and dementia (1).

One measure that might fill this important gap in the literature is the modified Telephone Interview for Cognitive Status (mTICS) (2,3). The mTICS has several distinct advantages: 1) it taps multiple cognitive domains known to be affected in dementia (e.g., memory, orientation, language), 2) it is strongly correlated with the Mini Mental Status Examination, the most widely used bedside screening of cognitive functioning, and perhaps most importantly, 3) it can be administered over the telephone, as well as in person. The mTICS has already been utilized in

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several large scale studies where brief screenings of cognition were necessary. For example, Gallo and Breitner (4) screened over 12,000 individuals with the mTICS and identified scores below 28 as indicative of Alzheimer's disease. Rankin and colleagues (5) have also used the mTICS to screen for cognitive functioning in nearly 2,000 individuals with visual impairments. More relevantly, Yaari and colleagues (6) used the mTICS to screen nearly 5,000 individuals for amnestic Mild Cognitive Impairment (aMCI).

Despite considerable use of the mTICS, its validation has been limited. To date, Crooks et al. (7) completed the most comprehensive validation study of the mTICS by comparing the total score on this 14-item scale to a wide range of neuropsychological tests (e.g., California Verbal Learning Test, Trail Making Test, Controlled Oral Word Association Test). Modest correlations (r's 0.21 – 0.28) were observed between the total score on the mTICS and three of the five cognitive domains (verbal memory, visual memory, attention) in their sample of non-demented older adults. Despite finding evidence of convergent validity for the mTICS, this study had several important limitations (e.g., only females were included, time interval between administration of mTICS and neuropsychological battery varied between 2 – 28 weeks, mTICS was given twice and practice effects were not considered). This study also focused on the total score of the mTICS, rather than individual items or factor scores (8). Other quasi-validation studies of the mTICS have also suffered from a variety of limitations (e.g., limited cognitive comparison measures (5,8–11), exclusion of participants who performed too well or too poorly (1,8,12), and poorly defined cognitive impairments (12)).

Therefore, the purpose of the current study was to further examine the validity of the mTICS in three ways. First, we examined the ability of the mTICS to discriminate individuals with aMCI from healthy peers. It was expected that the total score, memory factor, and individual memory items would best discriminate between these two groups. Second, we wanted to see if performances on the mTICS could predict performances on a more comprehensive neuropsychological evaluation at baseline. Third, we also wanted to see if mTICS scores at baseline could predict neuropsychological performances after one year. For these latter two aims, it was hypothesized that the total score of the mTICS, as well as its memory factor and individual memory items, would most strongly predict performances on standardized memory tests in a neuropsychological battery at baseline and one-year follow-up. This information might allow for more efficient telephone screening of potential participants for clinical trials focusing on aMCI.

Methods

Participants and Procedures

One hundred twenty-three community-dwelling older adults (aged 65 years and older) served as participants for this study. The research protocol and all study procedures were approved by the University of Iowa Institutional Review Board. The sample was recruited through local talks and advertisements distributed in the community and at independent living facilities. All participants provided written informed consent for the study and were financially compensated for their time. Participants were initially screened for dementia and cognitive impairment over the telephone using the mTICS. Individuals scoring below 19 on the mTICS were excluded from further participation because their cognitive impairments were suggestive of frank dementia (8). All others were invited for the in-person cognitive screening visit as described below.

During the in-person screening visit, participants completed a brief clinical interview, the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) Form A, Wide Range Achievement Test-3 (WRAT-3) Reading subtest, and the Geriatric Depression Scale. The clinical interview assessed relevant demographic information, medical and psychiatric

history, presence of memory complaints, and report of activities of daily living. A collateral source (e.g., spouse, adult child, close friend) completed a similar interview to corroborate the reports by the participant. Exclusion criteria included significant history of major neurological (e.g., traumatic brain injury, stroke, dementia) or psychiatric illness (e.g., Schizophrenia, Bipolar Disorder), dementia (using the cognitive screening battery) or current depression (either self-report or 30-item Geriatric Depression Scale [GDS] of >12). Either that day or within one week, the following additional cognitive testing was completed: Symbol Digit Modalities Test, Hopkins Verbal Learning Test-Revised (HVLT-R), Brief Visuospatial Memory Test-Revised (BVMT-R), Controlled Oral Word Association Test (COWAT), Animal Fluency, Modified Mini Mental State Examination (3MS) Temporal and Spatial Orientation items, and Trail Making Test Parts A & B. All of these measures were administered and scored as described in their respective test manuals. All assessments were conducted by a trained research assistant or by one of the neuropsychologists (LJB or KD).

Based on the above interview and cognitive testing, participants were classified into two groups, either aMCI or normal comparison (NC) using existing criteria (13) and by expert consensus review (LJB and KD). To be classified as aMCI, participants had to complain of memory problems (i.e., self-reported as yes/no during an interview). These participants had to have objective memory deficits (i.e., age-corrected scores on at least two of the three delayed recall measures [RBANS, HVLT-R, BVMT-R] falling 1.5 standard deviations or more below a premorbid intellectual estimate [WRAT-3 Reading]). This cutoff point of 1.5 standard deviations below average/expectations is a common point used in MCI research. Otherwise, cognition was generally intact (i.e., age-corrected scores on other non-memory measures above 1.5 standard deviations below average). NC participants could have complained of memory problems, but there was no evidence of objective memory deficits (i.e., three delayed recall measures were comparable with premorbid intellectual estimate). No one was classified as demented (i.e., impairments in memory and other cognitive domains), but 61 were classified as aMCI and 62 were classified as NC. The relatively high proportion of aMCI in our sample is likely due to our recruitment sites (i.e., independent living facilities). Demographic information and baseline testing scores for the entire sample and the two subgroups are presented in Table 1. Additional details about the test performances of the two groups are presented elsewhere (14).

A subset of the baseline sample (n = 91) has been re-evaluated after one year with the same cognitive measures to assess change in functioning. Demographic and baseline cognitive performances for this subset are nearly identical to those presented in Table 1, and there were no statistically significant differences (all p's>0.05) between individuals that have been re-evaluated and those that have not.

Measure of Interest

The mTICS is a 14 item instrument that assesses global cognition, with an emphasis on learning and memory. The total score ranges 0 – 50, with higher scores indicating better cognition. Similar to other cognitive screening measures like the Mini Mental State Examination, the mTICS assesses orientation (e.g., participant's name, telephone number, month date, year, season, day of the week), attention (e.g., counting backwards, serial sevens), and language (e.g., naming, phrase repetition, following simple commands). This measure also emphasizes new learning and memory with immediate recall of a 10-item word list and a delayed recall of that same word list after approximately 5 minutes. Given the total score on this measure is weighted to memory, this instrument might be particularly useful in identifying cases of early dementia and aMCI. In addition to the total score, three factors (language/attention, orientation, memory) have been previously identified within the mTICS (8), which might serve as good summary or outcome measures. Unfortunately, these mTICS factor scores have not been

validated. Total scores, factor scores, and individual items for the mTICS are presented in Table 2.

Statistical Analyses

Three sets of analyses were conducted to address the three aims of the study. First, to compare the aMCI and NC groups on the mTICS, the two groups were compared on demographic variables (age, education, gender) and some clinical measures (WRAT-3 Reading, GDS) with independent t-tests or chi-square analyses. Only age was significantly different between the groups ($t[121=-4.1, p<0.01]$), so this variable was used as a covariate in the following analyses. The total score on the mTICS satisfied assumptions for ANOVA models (e.g., normally distributed, homogeneity of variances), but the three factor scores and the fourteen individual items of the mTICS did not. Therefore, nonparametric statistics were utilized for those scores. To assess overall group differences on the mTICS, an initial ANCOVA compared the aMCI and NC groups on the total score of the mTICS. To see if the two groups differed on the three factor scores, three separate rank ANCOVAs (15) compared the groups. Finally, to see if the groups differed on the individual items of the mTICS, these items were compared with individual rank ANCOVAs (15).

The second aim of the study (i.e., using baseline mTICS scores to predict baseline cognitive functioning) was achieved with stepwise multiple regression. In each regression model, a baseline memory composite score was used as the criterion variable. The baseline memory composite score was calculated by creating z-scores for each age-corrected standard scores for the baseline memory measures: RBANS Delayed Memory Index, BVMT-R Delayed Recall, and HVLT-R Delayed Recall. These three z-scores were then averaged as the baseline memory composite. In the first regression model, the mTICS total score was the predictor variable. In the second set of models, the three mTICS factor scores were examined separately as predictor variables. In the third set of models, the fourteen individual mTICS items were examined separately as predictor variables. In the latter two sets of regression models, the factor scores and individual items of the mTICS were examined separately due to small to moderate correlations between the factors (0.16 – 0.37) and individuals items (−0.07 –0.70).

The third aim of the study (i.e., using baseline mTICS scores to predict one-year cognitive functioning) was examined with methods very similar to the second aim, except in these regression models, a one-year memory composite score was the criterion variable. The one-year memory composite score was calculated in the same manner as the baseline memory composite score, except z-scores from the one-year age-corrected standard scores for the three memory tests were averaged. Both aMCI and NC data was used for these regression models to increase the variability of cognitive performances. Age, education, and gender were also included as possible predictor variables in all the models, as these demographic variables can affect cognitive functioning. SPSS 15.0 for Windows was used for all statistical analyses. Due to the multiple comparisons, an alpha value of $p<0.01$ was utilized.

Results

Comparing aMCI and NC on mTICS

After controlling for age differences between the groups, the total score on the mTICS was significantly different between them ($F[2,120]=20.1$, $p<0.001$, partial $eta^2=0.14$), with aMCI participants scoring below NC participants. Group differences were also present on the factor scores of the mTICS, with individuals with aMCI scoring significantly below individuals with NC on the memory factor ($F[1,121]=18.4$, $p<0.001$, partial $eta^2=0.13$) and language/attention factor ($F[1,121]=17.4$, $p<0.001$, partial $eta^2=0.13$), but not the orientation factor ($p=0.78$). Finally, when all the individual items of the mTICS were compared, group differences were

again present, but only on three items: immediate recall of the 10 words (p=0.003, partial eta^2=0.07), serial 7's (p<0.001, partial eta^2=0.10), and delayed recall of the 10 words (p<0.001, partial eta^2=0.15). For these individual items, the aMCI group performed significantly poorer than the NC group. All other items were not significantly different between the groups (p>0.05).

Predicting baseline cognition with mTICS

In an initial stepwise regression model, baseline mTICS total scores significantly predicted baseline memory composite scores (F[1,120]=73.3, p<0.001, R^2=0.38) for all participants. Age significantly added to this model (F[2,119]=44.6, p<0.001, R^2=0.43). In the second set of stepwise regression models, two of the factor scores significantly predicted participants' baseline memory composite scores: 1) mTICS memory and age (F[2,119]=34.9, p<0.001, R^2=0.37) and 2) language/attention and age (F[2,119]=33.4, p<0.001, R^2=0.36). Finally, examining all mTICS items, five items significantly predicted baseline memory composite performance: 1) immediate recall of the 10 words and age (F[2,119]=25.7, p<0.001, R^2=0.30), 2) counting backwards (F[2,119]=18.4, p<0.001, R^2=0.24), 3) serial 7's (F[2,119]=30.3, p<0.001, R^2=0.34), 4) finger tapping (F[2,119]=17.0, p<0.001, R^2=0.22), and 5) delayed recall of the 10 words (F[2,119]=37.2, p<0.001, R^2=0.38). Education and gender did not add to any of these models predicting baseline memory composites. Constant and unstandardized beta weights from these equations are presented in Table 3.

Predicting one-year cognition with mTICS

In an initial stepwise regression model, baseline mTICS total scores and age significantly predicted one-year memory composite scores (F[2,86]=14.5, p<0.001, R^2=0.25) for all participants. In the second set of stepwise regression models, two of the factor scores significantly predicted participants' one-year memory composite scores: 1) mTICS memory and age (F[2,86]=11.6, p<0.001, R^2=0.21) and 2) language/attention and age (F[2,86]=17.1, p<0.001, R^2=0.28). Finally, examining all mTICS items, only two items significantly predicted one-year memory composite performance: 1) serial 7's (F[2,86]=15.4, p<0.001, R^2=0.26), and 2) delayed recall of the 10 words (F[2,86]=13.2, p<0.001, R^2=0.24). Education and gender did not add to any of these models. Constant and unstandardized beta weights from these equations are presented in Table 3.

Discussion

Although the mTICS has been used in several large-scale studies of cognition and aging, it has not been extensively validated in samples with milder impairments (e.g., aMCI). The current study lends additional support for this telephone-based screening measure by finding that mTICS total scores differentiate individuals with aMCI from cognitively intact peers. The mean difference between the two groups equates to a large effect size (partial eta^2=0.14, Cohen's d>0.8), even when controlling for age. Additionally, individuals with aMCI scored significantly lower than their intact peers on two of three mTICS factor scores. Consistent with prior work (8), the memory factor (i.e., immediate and delay recall trials of 10 words) differentiated these groups. The current study also found that the language/attention factor separated these groups, which may suggest that memory is not the only domain affected in aMCI (16,17). Finally, when the individual items of the mTICS were considered, only three discriminated these groups; the aMCI group performed worse than the intact group on the immediate and delayed recall of 10 words and serial 7's tasks. Overall, our findings are generally consistent with Lines et al. (8), who also found that the memory factor best discriminated aMCI from healthier peers.

The current results, however, are only partially consistent with the other large study of aMCI by Yaari et al. (6). In their study, delayed recall of the 10-item list was strongly related to aMCI

status. The other items identified by Yaari and colleagues (6) were orientation items (e.g., month, date, season, current president). Since neither the orientation factor nor any of the orientation items were significantly related to the baseline memory composite in the present study, some comment is necessary. First, Yaari et al. (6) were predicting aMCI status (present/absent), whereas the current study predicted performance on a battery of memory tests. It is possible that subtle orientation difficulties might better capture the "disorder" of aMCI versus the "symptom of the disorder" (i.e., memory impairment). Second, Yaari et al. (6) noted that delayed recall accounted for most of the predictive accuracy of the mTICS, and this is consistent with both our results and those of Lines et al. (8). Finally, there were significant differences in the recruitment and samples of these studies that might have affected results. For example, Yaari et al. (6) were recruiting for a large scale clinical trial, where the current study was for a local observational trial. Additionally, the current study enrolled 80% females, whereas the previous study had more males.

Results of the current study might extend the applicability of the mTICS for research and clinical settings by using this telephone-based screening measure to predict performances on a more comprehensive, in-person neuropsychological battery of memory measures. For example, the mTICS baseline total score predicted 38% of the baseline memory composite variance on three widely used verbal and visual memory measures. Predictions of participants' baseline memory composites could also be obtained using factor scores or individual items of the mTICS. These predictions of baseline memory composites could be significantly improved if participants' ages were included in the model. Education and gender, however, did not improve memory composite predictions. Since the mTICS and age (and education and gender) accounted for only half of the memory composite variance, future studies might investigate other variables that could improve these predictions. Nonetheless, to our knowledge, this is the first study to predict performances on a comprehensive, in-person baseline memory composite using this brief, telephone screening instrument.

Similar to the baseline memory composite predictions, the current study demonstrated the mTICS could predict performances on a memory composite after one year. The total score, the memory and language/attention factor scores, and two of the individual items of the mTICS were also able to predict 21 – 28% of the memory composite scores after one year. Similar to the baseline memory composite score predictions, the predictions of one-year memory composites improved with age, but not education or gender. Future studies should also search for variables that could improve these prediction models, as well as further validate these findings with larger and more diverse samples.

Since the current results have research implications, a brief case example using the prediction models might be beneficial. An 81 year old potential research participant receives a total score on the mTICS of 25. Using the values in Table 3, it is predicted that this individual's performance on a baseline memory composite would be z = −1.67 (i.e., constant + [unstandardized beta weight for mTICS total score * 25] - [unstandardized beta weight for age * 81] = −2.24 + [0.12*25] – [0.03*81] =−1.67). Since this predicted baseline memory composite is a z-score (i.e., M=0.0, SD=1.0), it falls nearly two standard deviations below the mean. If an investigator were recruiting individuals with aMCI, then he/she might identify this individual as likely meeting objective criteria for this condition if the researcher brought him/her into the laboratory. Alternatively, if only cognitively healthy individuals were being recruited, then the researcher might exclude this individual because his/her memory functioning is likely to be too abnormal for the study. In this way, these regression models can be used to more accurately select potential research participants for studies of cognition. An Excel spreadsheet that will calculate these memory composites from mTICS scores can be obtained from the first author.

The prediction models could also be used to screen cognitive functioning in older patients who have difficulty coming into the clinic, such as those in rural areas or with limited financial resources. For example, a 76 year old patient could be screened over the telephone with the mTICS, and his/her scores on delayed recall of the 10 words might be 4. Again, using the values in Table 3, this patient's predicted memory composite if tested would be z = 0.25 (i.e., constant + [unstandardized beta weight for delayed recall score * 4] - [unstandardized beta weight for age * 76] = 0.25), which falls very close to the mean. If there were no other indicators of cognitive dysfunction, then the clinician might decide to forgo formal neuropsychological testing at this point due to the relatively "average" mTICS performance. In this particular case, the mTICS, which can be administered by trained staff either in-person or over the telephone, might have saved limited resources.

Despite the potential value of the mTICS, some limitations of the current study should be acknowledged. First, the current results should be used with caution when applying them to individuals who are not comparable to the study sample. For example, individuals with severe cognitive impairments (i.e., baseline mTICS scores <19) were excluded from the study. Accordingly, the applicability of the prediction model to those individuals is unknown. The sample was 65 years and older and exclusively Caucasian; a younger (and/or more ethnically diverse sample) might lead to different results. Second, the classification of participants as aMCI or NC was based on a clinical interview and psychometric data. Neuroimaging and other laboratory work were not collected to rule out specific conditions that may cause cognitive difficulties, and future studies might incorporate these procedures to strengthen the validity of the classification groups. Third, due to the extensive testing to determine cognitive status independent of the mTICS, our sample was considerably smaller than used in other studies. Fourth, the mTICS predicted between 21 – 43% of the baseline and one year memory composite Validation of mTICS scores. Accounting for additional variance would make the mTICS an even more valuable research and clinical tool. Finally, the current study examined the three mTICS factors identified by Lines et al. (8), but the results could have been different if the four factors identified by Brandt et al. (18) were used. We chose the three factors model of the mTICS because that project specifically studied patients with MCI, whereas the four factor model was developed on largely "normal" elders.

Despite these limitations, the current findings validate the utility of the mTICS when screening for cognitive functioning in mildly impaired elderly samples. However, two additional cautionary notes should be mentioned. First, the mTICS is a screening measure, and is not a substitute for an in-person evaluation. Over the telephone, it is difficult to know if sensory limitations (e.g., decreased hearing) are interfering with performance. Similarly, it is difficult to know participants are using ancillary aids (e.g., writing down the "memory" items) to improve their performance. Second, although the mTICS is strongly correlated with other screening measures (e.g., r = 0.82 – 0.96 with Mini Mental Status Examination) (10–12, 19), it may have some advantages with amnestic conditions due to it's expanded immediate and delayed recall items. For example, no participants in the current study achieved maximum scores on either the immediate or delayed recall items. Future studies might directly assess the sensitivity of the mTICS in a wider range of memory disorders.

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Table 1

Demographic information and testing scores for the groups

	aMCI (N=61)	NC (N=62)	Total (N=123)
Sex (% females)	78.6%	80.6%	79.6%
Age (years)	82.43 (6.43)	77.18 (7.80)	79.78 (7.59)
Education (years)	15.34 (2.82)	15.45 (2.57)	15.40 (2.69)
WRAT-3 Reading	0.62 (0.34)	0.51(0.40)	0.56 (0.38)
BVMT-R Delayed Recall	−2.05 (1.05)	−0.15 (0.99)	−1.09 (1.39)
HVLT-R Delayed Recall	−1.46 (1.08)	0.15 (0.84)	−0.64 (1.25)
RBANS Delayed Memory Index	−0.60 (0.99)	0.41 (0.63)	−0.09 (0.97)
Baseline Memory Composite	−1.36 (0.70)	0.14 (0.56)	−0.60 (0.98)
One-Year Memory Composite	−1.05 (0.92)	0.17 (0.93)	−0.46 (1.11)

Note. With the exception of Sex, all values are means and standard deviations. All cognitive scores are expressed as z-scores (M=0.0, SD=1.0). aMCI = amnestic Mild Cognitive Impairment. NC = normal comparison subjects. Total = both groups combined. WRAT-3 = Wide Range Achievement Test – Third Edition. BVMT-R = Brief Visuospatial Memory Test – Revised. HVLT-R = Hopkins Verbal Learning Test – Revised. RBANS = Repeatable Battery for the Assessment of Neuropsychological Status. The Memory Composite scores are the average of the age-corrected z-scores for RBANS Delayed Memory Index, BVMT-R Delayed Recall, and HVLT-R Delayed Recall.

Table 2

Total scores, factor scores, and individual items for the mTICS for the groups

	aMCI (N=61)	NC (N=62)	Total (N=123)
Item 1: Name (2 points)	2.00 (0.00)	2.00 (0.00)	2.00 (0.00)
Item 2: Telephone number (2 points)	1.93 (0.35)	2.00 (0.00)	1.97 (0.25)
Item 3: Month, date, year, season, and day of week (5 points)	4.85 (0.40)	4.89 (0.31)	4.87 (0.36)
Item 4: Immediate list recall (10 points)	3.15 (1.47)	4.53 (1.93)	3.85 (1.84)
Item 5: Counting backwards 20-1 (2 points)	1.95 (0.21)	2.00 (0.00)	1.98 (0.15)
Item 6: Serial sevens (5 points)	3.64 (1.41)	4.60 (0.61)	4.12 (1.18)
Item 7: Naming “scissors” (2 points)	1.97 (0.25)	2.00 (0.00)	1.98 (0.18)
Item 8: Naming “cactus” (2 points)	1.82 (0.56)	1.97 (0.25)	1.89 (0.44)
Item 9: U.S. President (2 points)	2.00 (0.00)	1.90 (0.43)	1.95 (0.31)
Item 10: U.S. Vice President (2 points)	1.54 (0.84)	1.55 (0.84)	1.54 (0.84)
Item 11: Word opposite (2 points)	2.00 (0.00)	1.94 (0.35)	1.97 (0.25)
Item 12: Naming repetition (2 points)	1.93 (0.35)	2.00 (0.00)	1.97 (0.25)
Item 13: Finger tapping (2 points)	1.89 (0.32)	1.95 (0.21)	1.92 (0.27)
Item 14: Delayed list recall (10 points)	1.52 (1.29)	3.08 (1.62)	2.31 (1.66)
Memory factor (items 4 and 14)	4.67 (2.39)	7.61 (3.27)	6.15 (3.22)
Orientation factor (items 1, 2, 3, 9, and 10)	12.32 (1.12)	12.33 (1.08)	12.33 (1.09)
Language-attention factor (items 5, 6, 7, 8,11, 12, and 13)	15.19 (1.64)	16.45 (0.84)	15.82 (1.44)
Total (items 1–14)	32.28 (3.75)	36.24 (3.91)	34.28 (4.30)

Note. All values are means and standard deviations. aMCI = amnestic Mild Cognitive Impairment. NC = normal comparison subjects. Total = both groups combined.

Table 3

Constants and unstandardized beta weights for baseline and one-year prediction models

Index	F(df)	R^2	SE_{est}	Constant	Other variables in equation
Baseline memory composite based on mTICS total score	44.6 (2,119)	0.43	0.75	−2.24	(total * 0.12) – (age * 0.03)
Baseline memory composite based on language/ attention factor	33.4 (2,119)	0.36	0.79	−1.46	language/attention * 0.29) – (age * 0.05)
Baseline memory composite based on memory factor	34.9 (2,119)	0.37	0.79	1.41	(memory * 0.28) – (age * 0.03)
Baseline memory composite based on immediate recall item	25.7 (2,119)	0.30	0.88	1.86	immediate recall * 0.19) – (age* 0.04)
Baseline memory composite based on serial 7's item	30.3 (2,119)	0.34	0.81	1.89	(serial 7's * 0.32) – (age* 0.05)
Baseline memory composite based on delayed recall item	37.2 (2,119)	0.38	0.78	1.41	delayed recall * 0.28) – (age* 0.03)
One-year memory composite based on mTICS total score	14.5 (2,86)	0.25	0.97	−0.47	(total * 0.09) – (age * 0.04)
One-year memory composite based on language/ attention factor	17.1 (2,86)	0.28	0.95	−1.62	(language/attention * 0.29) – (age * 0.04)
One-year memory composite based on memory factor	11.6 (2,86)	0.21	0.99	2.40	(memory * 0.09) – (age * 0.04)
One-year memory composite based on serial 7's item	15.4 (2,86)	0.26	0.96	1.85	(serial 7's * 0.31) – (age* 0.05)
One-year memory composite based on delayed recall item	13.2 (2,86)	0.24	0.98	2.26	(delayed recall * 0.20) – (age* 0.04)

Note. SE_{est} = standard error of estimate. Age is in years. mTICS scores are raw scores. These formulas will generate baseline and one-year composite z-scores (M=0.0, SD=1.0).