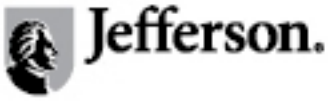

1-1-2016

Determinants of Activity Levels in African Americans With Mild Cognitive Impairment.

Barry W. Rovner, MD
Departments of Neurology and Psychiatry Sidney Kimmel Jefferson Medical College at Thomas Jefferson University, barry.rovner@jefferson.edu

Robin J. Casten, PhD
Department of Psychiatry and Human Behavior Sidney Kimmel Jefferson Medical College at Thomas Jefferson University, robin.casten@jefferson.edu

Benjamin E. Leiby, PhD
Division of Biostatistics Department of Pharmacology and Experimental Therapeutics Sidney Kimmel Jefferson Medical College at Thomas Jefferson University, Benjamin.Leiby@jefferson.edu

As submitted to:

Alzheimer Disease and Associated Disorders

Determinants of Activity Levels in African Americans with Mild Cognitive Impairment

And later published as:

Volume 30, Issue 1, pages: 41-46

Jan-Mar 2016

DOI: 10.1097/WAD.0000000000000096

Barry W. Rovner, MD

Departments of Neurology and Psychiatry

Sidney Kimmel Jefferson Medical College at Thomas Jefferson University

Philadelphia, Pa 19107

Robin J. Casten, PhD

Department of Psychiatry and Human Behavior

Sidney Kimmel Jefferson Medical College at Thomas Jefferson University

Philadelphia, Pa 19107

Benjamin E. Leiby, PhD

Division of Biostatistics

Department of Pharmacology and Experimental Therapeutics

Sidney Kimmel Jefferson Medical College at Thomas Jefferson University

Philadelphia, PA 19107

Address for correspondence:

Barry W. Rovner, MD

900 Walnut Street, 2nd Floor

Philadelphia, PA 19107

barry.rovner@jefferson.edu

TP: 215-503-1254; FAX: 215-503-1992

Conflicts of Interest and Source of Funding: No disclosures to report. This research is supported by grant 1R01AG035025-01A1 from the National Institute on Aging. ClinicalTrials.gov Identifier: NCT01299766

Key Words: Mild Cognitive Impairment; African Americans; Depression

Abstract

Engaging in cognitive, social, and physical activities may prevent cognitive decline. In a sample of older African Americans with Mild Cognitive Impairment (N=221), we investigated the cross-sectional relationships between activity levels and participants' demographic, clinical, and neuropsychological characteristics. The average age of participants was 75.4 years (standard deviation [SD] 7.0); 177 (80.1 %) were women. Participation in cognitive/social activities was positively associated with education, depression, literacy, mobility, instrumental activities of daily living (IADL), verbal learning, and subcomponents of executive function. A linear regression identified IADLs, education, depression, and verbal learning as independent predictors. Participation in physical activities was positively associated with gender, depression, IADLs, and subcomponents of executive function. An ordinal regression identified executive function and depression as independent correlates. These data suggest that unique characteristics are associated with cognitive/social and physical activities in older African Americans with MCI. These characteristics, coupled with low activity

levels, may increase the risk of progression from Mild Cognitive Impairment to dementia. Culturally relevant behavioral interventions to reduce cognitive decline in this high risk population are needed.

Introduction:

Mild Cognitive Impairment (MCI) is a transition state between normal cognitive aging and dementia that affects 10% to 20% of older persons and predicts progression to dementia, particularly Alzheimer's disease (AD).[1-3] Older African Americans are more likely to meet criteria for MCI than whites, possibly because comorbid medical problems (e.g., diabetes, hypertension), obstacles to health care, low health literacy, fewer years of education of uncertain quality, and limited economic resources increase their risk.[4-7] These factors also explain why African Americans are diagnosed with AD at more advanced stages than whites, when care is costlier and outcomes are less promising.[4,7] Culturally relevant preventive interventions are therefore needed to preserve cognition in older African Americans.

An extensive epidemiologic literature suggests that cognitive, social, and physical activities may prevent cognitive decline in cognitively normal persons.[8-13] Whether engaging in these activities reduces cognitive decline in persons with MCI is uncertain.

Some studies suggest that cognitive rehabilitative interventions for persons with MCI improve targeted cognitive functions but few other cognitive domains or activities.[14-16] Physical and psychosocial interventions also have modest cognitive benefits.[17-19] Possible mechanisms for these effects may include reduced amyloid deposition, improved cardiovascular and cerebrovascular integrity, better glycemic control, lower blood pressure, and better general physical and mental health. [20-22]

We are currently conducting a randomized controlled trial to test the efficacy of a behavioral intervention to reduce cognitive decline by increasing activity participation in older African Americans with MCI.[23] As part of that research, we are interested in identifying the baseline characteristics of participants who respond best, or less well, to the intervention. One predictor of response may be their baseline level of activity. As the clinical trial is ongoing, no outcome results are yet available. In this cross-sectional study, we investigated the relationship between participation in cognitive, social, and physical activities and participants' demographic, clinical, and neuropsychological characteristics. We tested the hypothesis that participation in these activities would be associated with education, depression, mobility, various aspects of cognition, and everyday functioning. The results may identify important treatment moderators, and thereby increase the theoretical and translational impact of the clinical trial.

Methods

The methods of this clinical trial have previously been reported.[23] Briefly, 221 African Americans were enrolled in a clinical trial testing the efficacy of a behavioral intervention to reduce cognitive decline over 2 years. The inclusion criteria are: 1) self-identified African American race; 2) age over 65 years; and 3) amnestic MCI (single or multiple domain). To meet the latter criterion, participants had self-reported memory decline; preserved general cognition (i.e., Mini Mental Status Examination [MMSE] score over 22); self-reported independence in basic activities of daily living; and scores more than 1.5 standard deviations (SD) below age-, education-, and race-adjusted norms in delayed recall on the Hopkins Verbal Learning Test-Revised (HVLT-R).[24-26] The exclusion criteria were: 1) Axis I Diagnostic and Statistical Manual-IV psychiatric diagnosis; 2) sensory deficits that precluded neuropsychological testing; 3) reduced life expectancy (given the 2 year follow-up period); and 4) institutional residence. Race-concordant Community Health Workers (CHWs) recruited participants from senior

centers, senior high rise apartment buildings, churches, and primary care clinics. To screen for cognitive impairment, the CHWs administered Trial 1 of the HVLT-R (immediate recall) to potentially eligible participants. Recalling fewer than 5 of 12 words was considered screen positive. A previous study reported that the average Trial 1 HVLT-R score for African Americans aged 60-71 years is 4.4 (SD 1.3).[26] A total of 1,034 persons were screened and 524 (50.7%) screened positive. For the latter, the CHWs scheduled an in-home visit to obtain informed consent and complete the baseline assessment. Jefferson's Institutional Review Board approved this approach to contacting, consenting, and evaluating persons for possible research participation. The CHWs obtained the following data at baseline:

Demographic characteristics: These included age, sex, education, marital status, and literacy as measured on the Reading Recognition Subtest of the Wide Range Achievement Test-Version 3 [WRAT-3]).[27]

Physical health status: Participants reported the presence of chronic medical conditions, mobility (i.e., ability to walk two blocks without help), and medication use. The latter was used to obtain the Chronic Disease Score, which is a weighted score based on current medication use that predicts healthcare utilization and costs.[28] Higher scores (transformed into z scores) reflect greater severity of medical comorbidity.

Instrumental activities of daily living (IADL): This was assessed with the Alzheimer's Disease Cooperative Study Activities of Daily Living–Prevention Instrument (ADL-PI),

which self-rates level of difficulty performing instrumental activities over the past 3 months (e.g., managing medications, handling money, shopping, preparing food).[29] Scores range from 0 to 45 with higher scores representing better function.

Depressive symptoms: This was assessed with Geriatric Depression Scale (GDS-15 items), which self-rates depressive symptoms (e.g., depressed mood, loss of interests, hopelessness) as "present' or "absent" over the past week.[30] Scores range from 0 to 15 with higher scores indicating worse depression.

Participation in activities: This was assessed with the Florida Cognitive Activities Scale (FCAS) and the U.S. Health Interview Survey (US-HIS).[31-33] The FCAS is a 25-item measure of predominantly cognitive and social activities ("cognitive/social") with known reliability and validity in older African Americans. It rates the frequency of activity participation on a 5 point scale as: "used to do activity but not in past year" (0); "a few times a year" (1); "every couple of months" (2); "a couple times a month" (3); "a few times a week" (4); and "every day" (5). Items include board games, crossword puzzles, reading the newspaper, craft work, home repairs, cooking, and going to church or social clubs. Scores range from 0 to 125, with higher scores indicating more frequent activity participation. The 9-item US-HIS characterizes participation in physical activities (e.g., walking for exercise, dancing, swimming, and biking) as the number of times, and amount of time in minutes, that a person engages in each activity in the previous 2 weeks. Each item is scored as the product of the number of times a person engages in an activity by the number of minutes spent in that activity.

Cognition: This was assessed with the Hopkins Verbal Learning Test-Revised (HVLT-R) and the National Alzheimer's Coordinating Center's (NACC) Uniform Data Set (UDS) Neuropsychological Battery.[25, 34] The HVLT-R is a word-list learning and memory test that consists of a 12 item-word list presented in 3 consecutive learning trials. The Total Recall score is the sum of the 3 learning trials; scores range from 0 – 36. The Delayed Recall score is the number of correctly recalled words 20 minutes later; scores range from 0 – 12. The UDS Neuropsychological Battery includes the MMSE and tests of immediate and delayed verbal episodic memory (Logical Memory of the Wechsler Memory Scale [WMS-R] – Revised) IA and IIA, respectively); attention (Digit Span, Forwards and Reverse); semantic memory/language (Boston Naming and Category Fluency Test); processing speed/ visuospatial ability (WAIS-R Digit Symbol and Trailmaking Test Part A); and various subcomponents of executive function (Trailmaking Test Part B, Digit Span, and Digit Symbol). Participants who met criteria for amnestic MCI and scored below the 7th percentile in a second cognitive domain met criteria for amnestic MCI-Multiple Domain.

Statistical methods:

Bivariate comparisons across FCAS-defined activity groups were made using ANOVA for continuous variables and chi square or Fisher's Exact Test (for expected values less than 5) for categorical variables. A multivariable regression with FCAS score as the dependent variable was conducted, with all baseline variables considered as covariates.

For the US-HIS, proportional odds logistic regression was used to estimate bivariate associations between the ordinal dependent variable of US-HIS score grouping and all baseline variables. A multivariable proportional odds model was fit with US-HIS score grouping as the dependent variable and all baseline variables considered as covariates. Both unadjusted and adjusted odds ratios for having higher activity were calculated.

Results

The average age of participants was 75.4 years (standard deviation [SD] 7.0); 177 participants (80.1%) were women; and mean years of education was 12.5 (SD 2.6). One hundred seventy six participants (79.6 %) met criteria for amnestic MCI-Multiple Domain and 45 participants (20.4 %) met criteria for amnestic MCI-single domain. Table 1 shows the total sample mean scores and percentile ranks on the various neuropsychological tests. Percentile scores were based on normative scores from the appropriate test manuals, adjusted for age, race, and education.[35-37] As expected, the lowest scores and percentile ranks were on tests of memory. The higher scores and ranks on tests of semantic memory, language, and executive function suggest that the overall sample was not globally cognitive impaired.

FCAS scores were normally distributed (range 0 to125; median 53; and mean [SD] 54.0 [14.2]. Participants were categorized as having *low* (i.e., one standard deviation [SD]

below the mean), *intermediate* (i.e., within one SD below or above the mean), or *high* (i.e., one SD above the mean) levels of activity. Thirty seven participants (16.7%) had *low* activity levels; 147 (66.5%) had *intermediate* activity levels; and 37 (16.7%) had *high* activity levels. Table 2 compares the demographic, clinical, and neuropsychological characteristics of participants by FCAS activity level. The latter was positively associated (i.e., $p \leq 0.05$) with education, literacy (WRAT-3 score), mobility, IADL function, GDS score, and HVLT Total Recall, WMS-R Logical Memory IA, Digit Symbol Substitution, and Trailmaking Test Part A and B scores. All variables in Table 2 were included in a linear regression analysis with FCAS scores as the dependent variable. Table 3 shows the regression results, and indicates that IADL function, education, GDS score, and HVLT Total Recall score each contributed independently to cognitive/social activity participation. The model accounted for 25% of the variance.

The distribution of US-HIS scores was positively skewed [skewness = 4.7 (.16); kurtosis = 32.3 (.33)], with nearly 20% of the sample (n = 45) reporting no physical activity. The most common activities in which participants engaged were walking for exercise (68.2%), calisthenics or general exercise (44.7%), dancing (18.5%), and gardening or yard work (14.6%). Participants engaged in an average of 5.4 hours (SD 8.4) of physical activity/2 weeks. We divided the sample into three groups: participants who engaged in fewer than 60 minutes of exercise/2 weeks; 61 - 149 minutes/2 weeks; or 150 minutes or more/2 weeks.

Table 4 shows the unadjusted and adjusted odds ratios and confidence intervals for the relationship of participants' demographic, clinical, and neuropsychological characteristics and US-HIS physical activity. The odds ratios indicate the likelihood of being in a higher physical activity group. The unadjusted analyses show that physical activity was positively associated (i.e., $p \leq 0.05$) with male gender, scores on the WRAT, GDS, and chronic disease (CDS), ability to walk two blocks, and IADL performance. Notably, none of the neuropsychological test scores were related to physical activity in the unadjusted analysis. The adjusted analyses, however, indicate that scores on the GDS, Digit Span Backwards, and Trailmaking Test Part B contributed independently to physical activity participation. The 0.90 odds ratio for GDS indicates that every one point increase in GDS score (i.e., worse depression) reduces the odds of being in the higher physical activity group by 10%. The adjusted odds ratios for Trailmaking Test Part B [i.e., 1.05; (95% CI 1.00, 1.09)] and Digit Span Backwards [i.e., 0.80; (95% CI 0.66, 0.99)] suggest that better performance on these tests was associated with lower physical activity, although these relationships may represent a statistical artifact given the absence of significant relationships in the unadjusted analysis.

Discussion

We found that unique demographic, clinical, and neuropsychological characteristics were associated with participation in cognitive/social and physical activities in older African Americans with MCI. All participants had clinically meaningful deficits in memory and most had deficits in other cognitive domains. The participants were not, however, globally cognitively impaired or dependent in basic activities of daily living, and therefore did not meet criteria for dementia.[42] Cognitive/social activities were independently associated with instrumental activities of daily living, education, depression, and verbal learning. Physical activities were independently associated with depression. All of these factors are known to contribute to the risk of progression from MCI to dementia, and their association with low activity levels may magnify that risk. In fact, low activity levels may represent an early sign of progression in this sample.[38-41]

The results of this study must be understood in the context of the study's limitations. The participants were recruited from the community and primary care clinics and enrolled in a randomized controlled trial. These characteristics limit generalizability. We conducted many statistical comparisons and thus there is a risk of finding statistically significant relationships by chance that are not clinically meaningful. Our use of the HVLT to identify potential participants constrained test scores, but HVLT Total Recall scores had substantial variability and range. By contrast, Delayed Recall scores were uniformly low as expected, given the study eligibility criteria. We relied on self-reports of functional abilities and activity levels, which may be biased by faulty recall. Some studies suggest, however, that individuals with MCI can provide accurate appraisals of their functional abilities.[43] We did not assess some variables which likely relate to activity participation, such as pain, personality traits (e.g., extroversion), access to transportation, and social support, and we used different metrics to rate participation in cognitive/social and physical activities (i.e., number of occasions and number of minutes, respectively). The FCAS and the US-HIS target different activity domains, however. Most FCAS activities are cognitive and social in nature although some FCAS activities (e.g., walking with a friend) require physical activity. The US-HIS more clearly assesses physical activity. Previous studies have noted the difficulty of deriving pure activity classifications; Schinka et al (2005) discuss this issue extensively.[44,45] Despite these limitations, our results provide new insights into the determinants of activity participation in this unique sample of older African Americans.

Depressive symptoms were common to low participation in cognitive/social as well as physical activities. Loss of interest, anhedonia, and anergia diminish motivation to pursue many different types of activities and, in persons with MCI, amplify the effects of apathy, which is the most frequently occurring behavioral symptom of MCI.[46] Whether depression is a risk factor for or prodromal sign of dementia is uncertain but depression adds to apathy to impede activity engagement, and may accelerate progression to dementia.

The bivariate analyses for cognitive/social activities revealed positive associations with various aspects of executive function, including attention, cognitive flexibility, perceptual-scanning skills, and processing speed. These subcomponents of executive function were not independent predictors of cognitive/social activity, however, after controlling for HVLT Total Recall. The latter involves both learning, an indicator of hippocampal function, and working memory, a prefrontal executive function. To the extent that Total Recall recruits the latter, and to the extent that cognitive/social activities depend on planning, initiating, and sustaining activity, then worse performance on Total Recall may understandably be linked to lower levels of participation in these types of activities. Moreover, as a sensitive indicator of Alzheimer's disease pathology, worse Total Recall may be a proxy for more pervasive underlying disease.[24, 47]

Education was also associated with cognitive/social activity levels. Persons with less education and low literacy have less opportunity to pursue cognitive and leisure activities due to financial and intellectual limitations and, on that basis, may be at higher

risk for dementia.[10, 48] Literacy, as an indicator of quality of education, may provide a more precise indicator of cognitive reserve than years of education, and determine whether someone with underlying brain pathology expresses symptoms of dementia.[49]

We also found that performance of instrumental activities of daily living was independently associated with cognitive/social activity levels. Persons with MCI often have difficulty with or take longer completing such higher order activities (e.g., traveling, managing finances, and taking medications) and these difficulties increase the risk of dementia.[41, 50]

Regarding physical activity participation, the unadjusted analyses revealed positive associations with depression, gender, literacy, physical functioning, and IADLs but no association with neuropsychological test performance. The latter finding suggests that cognitive function per se in this sample of older African Americans with MCI is unrelated to physical activities. Sturman et al (2005), using the same instrument we used to assess physical activity participation, and some of the same neuropsychological tests, in a sample of older persons (61.1% African American), similarly found no association between physical activity participation and neuropsychological test performance.[33] They hypothesized that the absence of an independent relationship may reflect the moderately low levels of physical activity in older urban populations.

To our knowledge, no studies similar to ours have examined relationships between activity levels and demographic, personal, and cognitive characteristics of older persons

with MCI. Our results are consistent with studies that have examined these relationships in representative populations of older persons. Dotson et al (2008), studying activity participation using the FCAS in a large community sample of older African Americans, found small negative correlations between higher activity levels and age and depressive symptoms, and moderate positive correlations with years of education and overall cognition, memory, and executive function.[31] Gow et al (2012) and Wilson et al (2003) found participation in cognitive, leisure, or physical activity was associated with higher levels of cognitive ability, which reflected prior ability and more years of education.[8, 48] Together these results suggest both a protective effect of activity on cognition and a facilitative effect of pre-existing cognitive strengths on later activity levels. The converse, as we found, is that low activity participation reflects deficits in mood, memory, executive function, education, and everyday functioning, which represent five unique domains of mental and physical life. These characteristics may moderate treatment outcomes in the clinical trial we are now conducting, and identify participants who respond best, because the intervention reverses activity loss in participants at greatest risk, or who respond less well because they have more advanced disease.

The mechanism by which activity participation may be neuroprotective and reduce cognitive decline, if it does, in persons with MCI, is unknown. Older African Americans, however, comprise one of the fastest growing minority groups in the United States and nearly 25% have MCI.[4, 51] These demographic and clinical realities, coupled with the uncertain efficacy and safety of current investigational medications for Alzheimer's

disease and their limited accessibility to older African Americans, necessitate culturally relevant behavioral interventions to prevent cognitive decline in this high risk population.[52]

References:

1. Petersen RC, Roberts RO, Knopman DS, et al. Mild cognitive impairment: ten years later. Arch Neurol 2009; 66:1447-1455.

2. Plassman, BL, Langa, KM, Fisher, GG, et al. Prevalence of cognitive impairment without dementia in the United States. Ann Intern Med 2008; 148: 427-434.

3. Farias ST, Mungas D, Reed B, Harvey D, DeCarli C. Progression of mild cognitive impairment to dementia in clinic-vs community-based cohorts. Arch Neurol 2009; 66:1151-1157.

4. Alzheimer's Association. 2010 Alzheimer's disease facts and figures. Alzheimers Dement. 2010; 6(2):158-194.

5. Unverzagt FW, Gao S, Lane KA, et al. Mild cognitive dysfunction: An epidemiological perspective with an emphasis on African Americans. J Geriatr Psychiatry Neurol 2007; 20: 215-226.

6. Lilienfeld DE, Perl DP. Projected neurodegenerative disease mortality among minorities in the United States, 1990-2040. Neuroepidemiology 1994;13:179-186.

7. Cooper C, Tandy AR, Balamurali TBS, et al. A systematic review and meta-analysis of ethnic differences in use of dementia treatment, care, and research. Am J Geriatr Psychiatry 2010; 18:193–203.

8. Gow AJ, Mortensen EL, Avlund K. Activity participation and cognitive aging from age 50 to 80 in the Glostrup 1914 cohort. J Am Geriatr Soc 2012; 60:1831–1838.

9. Hamer M, Chida Y. Physical activity and risk of neurodegenerative disease: a systematic review of prospective evidence. Psychological Medicine 2009; 39: 3–11.

10. Verghese J, LeValley A, Derby C, Kuslansky G, Katz M, Hall C, et al. Leisure activities and the risk of amnestic mild cognitive impairment in the elderly. Neurology 2006; 66: 821-827.

11. Larson EB. Prospects for delaying the rising tide of worldwide, late-life dementias. International Psychogeriatrics 2010; 22:8, 1196–1202.

12. Middleton LE, Yaffe K. Promising strategies for the prevention of dementia. Arch Neurol. 2009; 66(10):1210-1215.

13. Fratiglioni L, Paillard-Borg S, and Winblad B. An active and socially integrated lifestyle in late life might protect against dementia. Lancet Neurol 2004; 3: 343–353.

14. Greenaway MC, Duncan NL, Smith GE. The memory support system for mild cognitive impairment: Randomized trial of a cognitive rehabilitation intervention. Int J Geriatr Psychiatry 2013; 15 28(4):402-409.

15. Stott J, Spector A. Review of the effectiveness of memory interventions in mild cognitive impairment (MCI). International Psychogeriatrics 2011; 23: 526–538.

16. Vidovich MR, Lautenschlager NT, Flicker L, Clare L, McCaul K, Almeida OP. The PACE study: a randomized clinical trial of cognitive activity strategy training for older people with mild cognitive impairment. Am J Geriatr Psychiatry 2014 (in press). http://dx.doi.org/10.1016/j.jagp.2014.04.002.

17. Lautenschlager NT, Cox KL, Flicker L, Foster JK, van Bockxmeer FM, Xiao J, Greenop KR, et al. Effect of physical activity on cognitive function in older adults at risk for alzheimer disease: a randomized trial. JAMA 2008; 300(9):1027-1037.

18. Baker LD, Frank LL, Foster-Schubert K, Green PS, Wilkinson CW, McTiernan A. Effects of aerobic exercise on mild cognitive impairment: A controlled trial. Arch Neurol. 2010; 67(1):71-79.

19. Barnes DE, Santos-Modesitt W, Poelke G, et al. The Mental Activity and eXercise (MAX) trial: a randomized controlled trial to enhance cognitive function in older adults. JAMA Intern Med. 2013;173 (9):797-804.

20. Valenzuela M, Sachdev P. Brain reserve and dementia: A systematic review. Psychol Med 2006; 36: 441-454.

21. Landau SM, Marks SM, Mormino EC, et al. Association of lifetime cognitive engagement and low beta-amyloid deposition. Arch Neurol 2012;69(5):623-629.

22. Daviglus ML, Plassman BL, Pirzada A, et al. Risk factors and preventive interventions for Alzheimer disease: State of the science. Arch Neurol 2011; 68:1185-1190.

23. Rovner BW, Casten RJ, Hegel MT, et al. Preventing cognitive decline in older African Americans with mild cognitive impairment: Design and methods of a randomized clinical trial. Contemporary Clinical Trials 2012; 33: 712-720.

24. Albert MS, DeKosky ST, Dickson D, et al. The diagnosis of mild cognitive impairment due to Alzheimer's disease: recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. Alzheimers Dement 2011; 7(3):270-279.

25. Benedict, RHB, Brandt, J. Manual: Hopkins verbal learning test-revised/Brief visuospatial memory test-revised. Lutz, FL; Psychological Assessment Resources. 1998.

26. Friedman M, Schinka J, Mortimer J, et al. Hopkins verbal learning test revised: norms for elderly African-Americans. The Clinical Neuropsychologist 2002; 16: 356-372.

27. Wilkinson GS. Wide-Range Achievement Test (3rd Edition). Wilmington, DE: Wide-Range, Inc., 1993.

28. Clark DO, Von Korff M, Saunders K, et al. A chronic disease score with empirically derived weights. Medical Care 1995; 33: 783-795.

29 . Galasko G, Bennett D, Sano M, et al. ADCS prevention instrument project: assessment of instrumental activities of daily living for community-dwelling elderly

individuals in dementia prevention clinical trials. Alzheimer Dis & Assoc Disord 2006; 20: S152-S169.

30 . Yesavage JA. Geriatric Depression Scale. Psychopharmacol Bull 1988; 24:709-711.

31. Dotson VM, Schinka JA, Brown LM, et al. Characteristics of the Florida Cognitive Activities Scale in older African Americans. Assessment. 2008; 15: 72. DOI: 10.1177/1073191107307509

32. Schinka JA, McBride A, Vanderploeg RD, Tennyson K, Borenstein AR, Mortimer JA. Florida Cognitive Activities Scale: Initial development and validation. J Int Neuropsychol Soc 2005; 11: 108-116.

33 . Sturman MT, Morris MC, Mendes de Leon C, et al. Physical activity, cognitive activity, and cognitive decline in a biracial community population. Arch Neurol 2005; 62: 1750-1754.

34. Morris J, Weintraub S, Chui H, et al. The Uniform Data Set (UDS): Clinical and cognitive variables and descriptive data from Alzheimer's disease centers. Alzheimer Dis Assoc Disord 2006; 20: 210-216.

35. Lucas JA, Invik RJ, Smith GE, Ferman TJ, Willis FB, et al. Mayo's older African-American's normative studies: Norms for Boston naming test, controlled oral word association, category fluency, animal naming, token test, WRAT-3 reading, trail making test, stroop test, and judgment of line orientation. The Clinical Neuropsychologist. 2005; 19: 243-269.

36. Heaton RK, Miller SW, Taylor MJ, Grant I. Revised comprehensive norms for an expanded Halstead–Reitan Battery: Demographically adjusted neuropsychological norms for African American and Caucasian adults. Psychological Assessment Resources, Inc., Lutz, FL, 2004.

37. Wechsler D. WAIS-III administration and scoring manual. San Antonio, TX: Psychological Corporation, 1997.

38. Houde M, Bergman H, Whitehead V, et al. A predictive depression pattern in mild cognitive impairment. Int J Geriatr Psychiatry 2008; 23: 1028–1033.

39. Manly JJ, Byrd D, Touradji P, et al. Literacy and cognitive change among ethnically diverse elders. Int J Psycho 2004; 39: 47-60.

40. Dickerson BC, Sperling RA, Hyman BT, et al. Clinical prediction of Alzheimer disease dementia across the spectrum of mild cognitive impairment. Arch Gen Psychiatry 2007;64:1443-1450.

41. Farias ST, Mungas D, Reed BR, et al. Progression of mild cognitive impairment to dementia in clinic- vs community-based cohorts. Arch Neurol 2009; 66:1151-1157.

42. McKhann GM, Knopman DS, Chertkow H, et al. The diagnosis of dementia due to Alzheimer's disease: recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. Alzheimers Dement. 2011;7:263-269.

43. Farias ST, Mungas D, Jagust W. Degree of discrepancy between self and other-reported everyday functioning by cognitive status: dementia, mild cognitive impairment, and healthy elders. Int J Geriatr Psychiatry 2005; 20: 827–834.

44. Akbaraly TN, Portet F, Fustinoni S, et al. Leisure activities and the risk of dementia in the elderly: Results from the Three-City Study. Neurology 2009; 73: 854–861.

45. Schinka JA, McBride A, Vanderploeg RD, Tennyson K, Borenstein AR, Mortimer JA. Florida Cognitive Activities Scale: Initial development and validation. J Int Neuropsychol Soc 2005; 11: 108-116.

46. Geda YE, Roberts RO, Knopman DS, et al. Prevalence of neuropsychiatric symptoms in mild cognitive impairment and normal cognitive aging. Arch Gen Psychiatry. 2008; 65:1193-1198.

47. De Jager CA, Hogervorst E, Combrinck M, et al. Sensitivity and specificity of neuropsychological tests for mild cognitive impairment, vascular cognitive impairment and Alzheimer's disease. Psychological Medicine 2003; 3: 1039–1050.

48. Wilson RS, Barnes LL, Bennett DA. Assessment of lifetime participation in cognitively stimulating activities. J Clin Exp Neuropsych 2003; 25: 634–642.

49. Jefferson AL, Gibbons LE, Rentz DM, et al. A life course model of cognitive activities, socioeconomic status, education, reading ability, and cognition. J Am Geriatr Soc 2011; 59:1403–1411.

50. Hughes TF, Chang CCH, Bilt JV, et al. Mild cognitive deficits and everyday functioning among older adults in the community: The Monongahela-Youghiogheny Healthy Aging Team Study. Am J Geriatr Psychiatry 2012; 20:836–844.

51. Unverzagt FW, Gao S, Baiyewu O, et al. Prevalence of cognitive impairment: Data from the Indianapolis study of health and aging. Neurology 2001; 57: 1655-1662.

52. Chin AL, Negashm S, Hamilton R. Diversity and disparity in dementia: the impact of ethnoracial differences in Alzheimer disease. Alzheimer Dis Assoc Disord 2011; 25: 187–195.