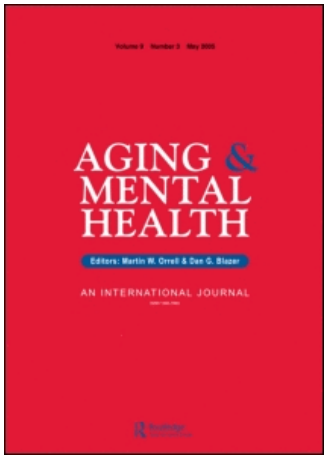

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Symptoms of depression and cognitive functioning in older American Indians

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Abstract
Depression and lower cognitive functioning are common conditions in older populations. While links between psychopathology and neuropsychological performance have been studied in the white majority population, little is known about such links in the American Indian population. American Indians aged 60 and older ($n = 140$) completed structured interviews that included a depression screener and two cognitive screening measures, the Mini-Mental State Examination (MMSE) and the Mattis Dementia Rating Scale (MDRS). Participants had mean values of 26.7/30 on the MMSE and 125.8/144 on the MDRS. The depression screen was not associated with the MMSE or MDRS total scores. However, older American Indians who screened positive for depression scored lower than did those American Indians who screened negatively for depression (27.7 versus 29.8 respectively) on the MDRS conceptualization subscale after adjusting for sociodemographic and health variables. The combined effects of psychopathology and cognitive impairment are likely to adversely impact the health and welfare of American Indians and their families. More research is needed to provide a better understanding of the relationship between psychopathology and cognition that will help inform clinical treatment for psychopathology in older ethnic minorities.

Introduction

The normal aging process brings about changes in cognitive functioning. The prominent feature of age-related cognitive decline is a decrease in processing speed, which also decreases the efficiency of functioning in several cognitive domains (Smith & Rush, 2006). In contrast, pathology-related cognitive decline progresses more rapidly and severely over time. Major depression is associated with impaired cognition in non-demented older individuals (Zakzanis, Leach & Kaplan, 1998), although the magnitude of impairment varies from little or no impairment to clinically significant deficits (Butters et al., 2004; Lockwood, Alexopoulos, Kakuma & Van Gorp, 2000). Several studies show various cognitive deficits in older depressed individuals and consistently report deficiencies in attention, memory and learning, visuospatial skills, executive functioning, and psychomotor speed (Boone et al., 1994; Lesser et al., 1996; Palmer, Boone, Lesser & Wohl, 1996; Steffens et al., 2006).

The prevalence of major depressive disorders is about 2% in adults aged 65 and older (Cole & Yaffe, 1996; Myers et al., 1984). However, the proportion increases to about 20% if clinically significant depressive symptoms alone are used to define depression instead of the formal DSM-IV diagnosis (Blazer, 1989; Blazer, Hughes & George, 1987). The pattern of cognitive deficits exhibited by those with depressive symptoms is described as occurring mainly with a deficiency in effortful processing. That is, cognitive impairments are more easily detected in a subject's performance on tasks requiring greater cognitive effort than on tasks of automatic processing (Hasher & Zacks, 1979; Weingartner, 1986; Zakzanis et al., 1998). Recovery of cognitive functioning following recovery from depression is not well understood, including the fact that cognitive impairments may persist (Nebes et al., 2003).

While some studies have examined cognitive impairment among American Indians

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(Hendrie et al., 1993; Jervis & Manson, 2002; Jervis, Beals, Fickenscher & Arciniegas, 2007; Rosenberg et al., 1996; Whyte et al., 2005), there is a paucity of research on the association between psychopathology and cognitive impairment in this population. The literature examining the relationship between psychopathology and cognitive functioning in other ethnic minorities is also limited, providing little guidance for generalizations to American Indian populations. Cognitive functioning is important for the health and welfare of older individuals; thus, it is important to understand how psychiatric status, such as depression symptoms, may be related to cognitive assessment and functioning. It is also important to investigate this association in different ethnic populations to better understand how cultural factors (i.e. attitudes, values, beliefs and behaviors of a people) may affect depression symptoms and cognitive functioning.

We investigated the relationship between symptoms of depressive and cognitive functioning in older American Indians. We hypothesized that older American Indians with such symptoms would exhibit lower cognitive performance than those American Indians who were not depressed.

Methods

Sample and setting

The sample for this study was recruited from ten senior nutrition programme sites of a Northern Plains tribe funded by the Administration on Aging. These sites serve both the reservation and several off-reservation trust areas; services include both congregate dining and home-delivered meals. The nutrition programme requires that clients be aged 60 and older, American Indian and living within a five-mile-radius of a senior nutrition center. American Indians who used the nutrition programme, either at meal sites or receiving meals at home, were recruited into the study by trained field staff who were themselves tribal members. In total, 140 older American Indians aged 60 and older completed an in-person interview and assessment of approximately 80 minutes that included questions on physical and mental health status as well as screening for cognitive functioning. The tribe's government, the Indian Health Service and the Colorado Multiple Institutional Review Board approved the study.

Measures

Demographics. Self-reported demographic variables included age, sex and years of education. English fluency was measured by a binary variable of either speaking English 'moderately or very well' or not.

Physical health and chronic conditions. Participants reported whether they had ever experienced arthritis, diabetes, high blood pressure, heart disease, cancer, HIV or AIDS, stroke, high cholesterol, liver problems, multiple sclerosis or seizures and epilepsy. If participants answered in the affirmative, they were asked whether they had had this problem in the last 12 months and whether a doctor, medicine man or other healthcare professional had ever provided a diagnosis. For each individual we computed a count of the number of the endorsed health problems listed above as a summary index of physical health problems. We also obtained a lifetime history of alcoholism and of head injury or concussion.

Participants reported what medications they were taking and the reason each was prescribed. We assessed each individual medication for potential adverse affects on cognition. Medications we considered to have a possible negative effect on cognition included antacid (e.g. zantac), antianxiety (e.g. clonazepam, lorazapam), antidepressants (e.g. peroxitine, fluoxetine, sertraline), antihistamine (e.g. diphenydramine, chlorpheniramine), cholesterol medications (e.g. zocor), hallucinogens (e.g. peyote), heart medications (e.g. digoxin), immunosuppressant (e.g. prednisone) and muscle relaxants and pain relievers (e.g. oxycodone, propoxyphene, fentanyl). The presence of any of the above medications was used as an indicator of adverse medications (0 versus 1 or more).

Participants reported whether they needed assistance in activities of daily living (Ebrahim, Nouri & Barer, 1985) such as using the telephone, shopping, preparing food, housekeeping, doing laundry, finding transportation, taking medications, handling money, getting out of bed, eating meals, bathing, using the toilet, dressing from the waist down and grooming. We grouped the total number of limitations in activities of daily living for each individual into three categories for analysis: no limitations, one limitation and more than one limitation.

Depressive symptoms. We administered a set of depression screening questions derived from the Composite International Diagnostic Instrument (Robins, Wing, Wittchen & Helzer, 1988) to all participants. The first depression question asked whether respondents had ever experienced a two-week period when nearly every day they had felt sad, blue or depressed. We then asked those who had experienced such a period how long it had been since they last experienced a two-week period of depressed mood. We refer to a depressed individual as a person who screened positive for a two-week period of depressed mood within the past year. The Composite International Diagnostic Instrument depression screeners have acceptable reliability and validity (Andrews, Peters, Guzman & Bird, 1995; Janca, Robins, Bucholz & Early, 1992; Peters & Andrews, 1995).

These depression-screening questions were used previously in both clinical and epidemiological studies of American Indians (Beals, Manson, Mitchell & Spicer, 2003, 2005).

Cognitive screening measures. The Mini Mental State Examination (MMSE) (Folstein, Folstein & McHugh, 1975) is a widely used measure to screen for cognitive impairment and to document cognitive functioning changes over time (Spreen & Strauss, 1998). It is brief and easily administered and scored. Eleven items assess orientation to time and place, attention and concentration, language, constructional ability and immediate and delayed recall memory. Scoring consists of a sum of correct responses resulting in a continuous scale from 0–30 points, with higher scores indicating better cognitive functioning. Prior to testing, focus groups comprised of tribal members were conducted to identify potential problems with the comprehensibility and cultural relevance of the cognitive screens. Subsequently, terms in the MMSE orientation section were modified and are described elsewhere (Jervis et al., in press). For example, the term 'room' was substituted for floor because few buildings on this reservation have more than one story.

The Mattis Dementia Rating Scale (MDRS) (Mattis, 1976) is a widely used measure of cognitive functioning and dementia screening. The MDRS is based on a hierarchical structure of administration with the most difficult item given first. Items include repeating a sequence of numbers forwards and backwards, naming items in a supermarket in one minute, copying shapes, comparing and discriminating between objects and remembering previously tested items. Full credit is given for a correct initial response without further probing in subsequent items. The total score is calculated by a sum of multiple cognitive domains and ranges from 0–144 points. Similar to the MMSE, focus groups identified potential problems with the comprehensibility and cultural relevance of some MDRS items and minor modifications were made (Jervis et al., in press). For example, the phrase 'tribal chairman' was used instead of the term 'mayor' during the MDRS memory and attention subtests.

In addition to a total score indexing overall cognitive functioning, the MDRS provides subscale scores for five different cognitive domains. The cognitive domains include attention, initiation/perseverance, construction, conceptualization and memory. Attention, as measured on the MDRS, refers to the ability to process the important stimuli or ideas at hand while suppressing other distracting stimuli or ideas and to sustain this focused activity over a period of time. Attention subtest examples include a digit span test of repeating a string of numbers forwards and backwards. Scores from this subtest range from 0–37. Mattis Dementia Rating Scale initiation/perseverance refers to the capacity to begin an intentioned process in working towards a goal (initiation) and to disengage in the task or response when it is no longer appropriate (perseverance). Initiation/perseverance tasks include creating lists of items and alternating movements, with scores ranging from 0–37. Mattis Dementia Rating Scale construction refers to the ability to accurately perceive and create visuospatial designs. Construction tasks include copying geometric designs, with scores ranging from 0–6. Mattis Dementia Rating Scale conceptualization refers to the ability to organize, reason and think abstractly about different stimuli. Conceptualization tasks include recognizing similarities and differences among objects, with scores ranging from 0–39. Mattis Dementia Rating Scale memory refers to the ability to store information for later use and to retrieve information previously learned. Memory tasks include sentence recall and design recognition, with scores ranging from 0–25.

Analytic strategy

The goal of our analytic strategy was to estimate the association between symptoms of depression and measures of cognitive functioning. Of the participants recruited into the study, 137 completed the MMSE and 129 completed the MDRS. In our initial descriptive analysis we examined means and frequency distributions for sociodemographic and health factors among individuals with and without a recent history of depression symptoms. We assessed statistical differences in demographic and health factors according to depression symptom status with *t*-tests and chi-squared tests.

We examined the mean values of the MMSE and MDRS scores according to a history of depression symptoms. These mean values, along with their 95% confidence intervals (CI), were plotted to illustrate the magnitude of differences associated with depression symptoms; *t*-tests assessed the statistical significance of the mean differences. Following these unadjusted comparisons we used regression methods to re-examine the association between depression symptoms and each of our cognitive functioning measures after adjusting for sociodemographic and health factors. In our multivariate analysis, we selected factors for adjustment based both on prior research and observed associations within our data. Variables we decided *a priori* on scientific grounds to include in our regression modeling were demographic factors including age, sex and education. Based on our modelling we constructed adjusted least-square estimates of the mean values of each cognitive functioning measure and compared the values across groups defined by recent history of depression symptoms. Hypothesis testing is based on Student T tests of the adjusted parameter estimates for symptoms of depression using STATA release 9 software (StataCorp, 2005).

Results

Table I presents the means and frequency distributions for sociodemographic and health factors for those participants with and without a recent history of depression symptoms status. The sample had 42 individuals who screened positive for a recent history of depression symptoms. Compared to non-depressed participants, the participants with symptoms of depression had a significantly higher percent of females ($\chi^2 = 4.17$; $p = 0.04$), fluent English speakers ($\chi^2 = 7.49$; $p = 0.01$) and participants with head injuries or concussions ($\chi^2 = 6.94$; $p = 0.01$). We detected no significant differences in those with and without a history of depression symptoms for age, years of education, alcoholism, number of chronic health problems or number of medications with an adverse cognitive effect. Participants with symptoms of depression exhibited fewer limitations in Activities of Daily Living than non-depressed participants, though this association was not significant ($\chi^2 = 4.89$; $p = 0.09$).

Figure 1 presents the unadjusted cognitive performance for the participants with and without symptoms of depression based on the MMSE and MDRS total scores. The MMSE mean total scores were similar for the depressed symptoms ($\overline{X} = 26.8$; 95%CI: 26.0, 27.7) and non-depressed ($\overline{X} = 26.7$; 95%CI: 26.1, 27.3) participants ($t(135) = 0.17$; $p = 0.86$); similarly the differences were not significant between the depressed symptoms ($\overline{X} = 126.5$; 95%CI: 123.5, 129.5) and non-depressed ($\overline{X} = 125.5$; 95%CI: 123.3, 127.8) participants on the MDRS total scores ($t(127) = 0.50$; $p = 0.62$). Table II presents the MDRS subscale performance for those who screened with and without a recent history of depression symptoms. Participants with symptoms of depression performed higher than the non-depressed participants on the MDRS attention subscale ($\overline{X} = 36.0$; 95%CI: 35.5, 36.5) compared to ($\overline{X} = 35.4$; 95%CI: 35.1, 35.7), respectively, ($t(127) = 1.98$; $p = 0.05$) but lower on the MDRS construction subscale ($\overline{X} = 5.7$; 95%CI: 5.6, 5.9) compared to ($\overline{X} = 5.9$; 95%CI: 5.8, 6.0), respectively, ($t(127) = 2.10$; $p = 0.04$). The two groups were similar in performance on all other MDRS subscales.

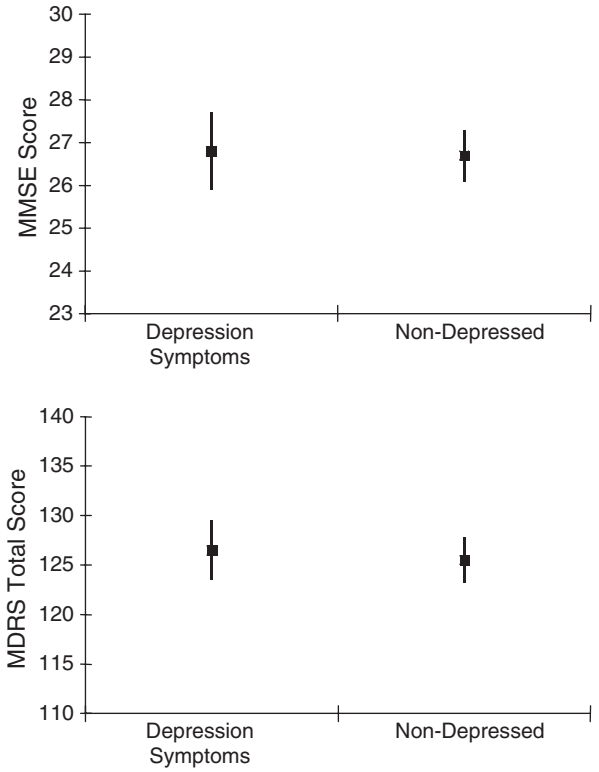

Figure 1. Mini-Mental State Examination and Mattis Dementia Rating Scale performance mean scores for the depressed symptoms and non-depressed groups. The vertical line represents the 95%CI of the distribution of scores, with the mean score shown as a marker through that region.

Table I. Sociodemographic and health characteristics by depression symptoms status in older American Indians.

Characteristic	Depression symptoms			
	Yes $n = 42$		No $n = 98$	
Sociodemographic				
Age in years, mean (95%CI)	69	(67, 71)	70	(69, 72)
Female, *n* (%)	35	(83)	65	(66)
Education, mean (95%CI)	10.7	(10.0, 11.4)	10.5	(9.9, 11.0)
Speaks English 'well', *n* (%)	41	(98)	78	(80)
Health status				
Alcoholism diagnosis, *n* (%)	5	(12)	9	(9)
Head injury or concussion, *n* (%)	11	(26)	9	(9)
Number of limitations on activities of daily living, *n* (%)				
0	31	(74)	74	(76)
1	8	(19)	8	(8)
Greater than 1	3	(7)	16	(16)
Median number of chronic health problems, median (range)	3	(1, 8)	3	(0, 6)
Medications with negative cognitive effect, *n* (%)				
0	36	(86)	79	(81)
1 or more	6	(14)	19	(19)

Table III presents adjusted mean cognitive performance measures derived from the multivariate regression models in those who screened with and without a history of depression symptoms. Each mean is adjusted for age, sex, education, English fluency, alcoholism, head injury or concussion, limitations of activities of daily living, number of chronic health problems and number of medications with negative effect on cognition. For the MMSE and MDRS total scores, there were no significant differences in the mean values according to a recent history of depression symptoms (MMSE: $t(120) = 0.31$; $p = 0.76$; MDRS: $t(112) = 0.97$; $p = 0.33$). Participants with symptoms of depression performed lower on the MDRS conceptualization task ($\overline{X} = 27.6$; 95%CI: 26.1, 29.3) than did the non-depressed participants ($\overline{X} = 29.8$; 95%CI: 28.8, 30.8) after adjusting for sociodemographic and health factors ($t(112) = 2.11$; $p = 0.04$). There were no significant differences in the mean values of the other MDRS subscales between the two groups.

Discussion

We examined symptoms of depression and cognitive functioning in older American Indians. Older American Indians with and without depressive symptoms scored similarly on the MMSE and the MDRS. However, older American Indians with depressive symptoms performed worse on the MDRS conceptualization subscale than non-depressed older American Indians after accounting for sociodemographic and heath indicators. Experiencing symptoms of depression within the last year appeared to impact the older individuals' ability to conceptualize how objects were similar and different during testing.

Recent studies of neuropsychological performance in older depressed individuals have investigated executive dysfunction such as planning, problem solving and abstraction in depression (Auriacombe et al., 2001; Butters et al., 2004; Lockwood et al., 2000). One of these studies (Auriacombe et al., 2001) reported a significantly lower score for depressed individuals in a similarities test, from which the MDRS conceptualization subtest was developed. If more effortful processing is required during the MDRS conceptualization subscale for this sample of older American Indians relative to the other subscales, then the differential performance results found would support the theory of a deficiency of effortful processing in depression (Hasher & Zacks, 1979; Weingartner, 1986; Zakzanis et al., 1998). In contrast to our findings, prior studies have not shown an association between depression and this conceptualization subscale (Zakzanis et al., 1998).

Cultural factors may play a role on MDRS conceptualization performance in this study. Overall performance on this subtest was notably low compared to normative studies of similar age groups (Montgomery, 1982; Vangel & Lichtenberg, 1995). Less than half the participants scored greater than 75% correct on the MDRS conceptualization

Table II. Unadjusted mean cognitive functioning scores for MDRS subscales according to depression symptom status.

	Depression symptoms		
Mattis Dementia Rating Subscale	Yes $n = 39$ (95%CI)	No $n = 90$ (95%CI)	*P*-value
Attention	36.0 (35.5, 36.5)	35.4 (35.1, 35.7)	0.05
Initiation/perseverance	34.2 (32.6, 35.7)	32.9 (31.9, 33.9)	0.17
Construction	5.7 (5.6, 5.9)	5.9 (5.8, 6.0)	0.04
Conceptualization	28.6 (27.0, 30.2)	29.5 (28.4, 30.6)	0.38
Memory	22.0 (21.0, 23.0)	21.8 (21.1, 22.5)	0.73

Table III. Adjusted mean cognitive functioning scores for MMSE and MDRS measures according to depression symptoms status.

	Depression symptoms		
Cognitive functioning	Yes $\bar{X}$ (95%CI)	No $\bar{X}$ (95%CI)	*P*-value
Mini-Mental State Examination	26.6 (25.7, 27.4)	26.7 (26.2, 27.3)	0.76
Mattis Dementia Rating Scale–Total score	124.5 (121.3, 127.7)	126.2 (124.1, 128.2)	0.41
Mattis Dementia Rating Subscale			
Attention	36.0 (35.5, 36.4)	35.4 (35.1, 35.7)	0.08
Initiation/perseveration	33.5 (31.9, 35.0)	33.3 (32.3, 34.3)	0.88
Construction	5.7 (5.6, 5.9)	5.9 (5.8, 6.0)	0.10
Conceptualization	27.7 (26.1, 29.3)	29.8 (28.8, 30.8)	0.04
Memory	21.7 (20.6, 22.7)	21.8 (21.1, 22.4)	0.88

Note: Adjusted for age (years), sex, education (years), speaks English 'moderately or very' (binary), alcoholism, head injury or concussion, Limitations of Activities of Daily Living (coded 0, 1, or greater than 1), number of chronic health problems, dichotomized number of medications with adverse effects on cognition.

subtest compared to the other subtests in which more than 85% of the participants performed to the same criterion level. The conceptualization task proved especially challenging to older individuals in this cultural setting. Acculturation affects cognitive performance (Manly, 2006; Manly et al., 1998b) and may impact higher-order cognitive functions, such as abstract reasoning than on other cognitive domains.

Education likely played a role in cognitive performance among this sample. Studies of cross-cultural cognitive development find that people with little or no formal westernized high school or college education perform worse on tests of formal operations which include abstract reasoning (Laurendeau-Bendavid, 1977; Shea, 1985). This sample of older American Indians averaged slightly above a tenth grade education level. In addition, the quality of education that American Indians received in the middle of the twentieth century is questionable (Pickering, 2000, 2004). More research is needed to understand the cultural and educational influences of differential test performance among cognitive domains in American Indians. Cultural relevance and performance on cognitive screens in older American Indians is the focus of another report (Jervis et al., in press) in which complex relationships were found among gender, health and cognitive screen performance.

Attention is another cognitive domain associated with depression. In a recent meta-analysis of neurocognitive functioning in major depressive disorder (Zakzanis et al., 1998), tests sensitive to attention provided some of the greatest effect sizes. Zakzanis et al. (1998) listed the MDRS initiation/perseveration and memory subscales as having some of the largest effect sizes for major depressive disorder but these findings were not replicated in our study.

We found no significant differences in overall performance between individuals who screened for recent symptoms of depression and non-depressed older American Indians on two widely used cognitive screening measures, the MMSE and the MDRS. Lowered cognitive screen scores have been reported with depressed individuals (Gallassi, Di Sarro, Morreale & Amore, 2006; Steingart & Herrmann, 1991; van Ojen, Hooijer, Bezemer & Jonker, 1995; van Reekum, Simard, Clarke, Binns & Conn, 1999; van Reekum et al., 2000); however, not all depressed individuals exhibit cognitive impairments (Houston & Bondi, 2006). Participants reported their own depression symptoms in this study and brief interview questions assessed the experience of feeling depressed along with follow-up questions regarding recency of symptoms. This limited assessment of depression may have affected our ability to find an association between depression and cognitive screen total scores. Structured clinical interviews or medical record review would have provided a more rigorous method of measuring depression.

Depression in later life is associated with many cognitive dysfunctions that may vary in etiology (Austin, Mitchell & Goodwin, 2001; Butters et al., 2004; Lockwood et al., 2000; Smith & Rush, 2006). Recent research suggests that mild cognitive impairment may be a prodrome of dementia. Indeed, mild cognitive impairment is associated with biomarkers of Alzheimer's disease and individuals with this impairment are at an increased risk for developing dementia (Smith & Rush, 2006). Dementias are marked by memory impairment as well as difficulties in other cognitive domains. Valid neuropsychological assessment is crucial in identifying pathological cognitive impairment in excess of that accompanying normal aging in all populations. This study used MMSE and MDRS cognitive screening scores in the analysis. We did not base our analysis on thresholds or normalizations since it is not clear that thresholds and normalizations derived from the majority population are appropriate for American Indians (Jervis et al., in press).

This study has several limitations. The key variables of interest consist of screening measures for depression and cognitive functioning. It would be preferable to have a structured clinical interview for psychopathology and a more comprehensive neuropsychological battery. Another limitation of our study was the method of sampling from Northern Plains reservation nutrition centers. The general health status of older individuals attending these centers may be different than older American Indians not attending these centers. However, 59% of our sample received meals delivered to their homes, making it less likely that our sample was exceptionally healthy. Since one of the criteria for using the nutrition centers was residence within five miles of the center, elders living in remote areas were not recruited into the study. Because of the limitations with the sample we can only generalize our findings with caution to other American Indian populations or other ethnic minorities. Finally, given the paucity of research on depression and cognitive functioning in older American Indians, this study is observational in nature. Further studies are needed to better understand the specific mechanisms involved in depression and its impact on cognition in American Indians and in ethnic minority populations in general.

Questions remain regarding the use of standardized neuropsychological tests in racially and ethnically diverse populations. Most neuropsychological tests are normalized to white samples (Wong, 2000) and their use in ethnic minorities in the US is controversial (Manly, 2005). The lack of proper validation in minority populations may artificially lower cognitive performance measurements and lead to misdiagnosis in ethnic minorities (Manly, 2006). Cultural differences are associated with performance

on the MMSE and other cognitive screening measures before and after adjusting for education (Manly, 2006). Similarly, cultural factors have a significant effect on neuropsychological batteries (Adams et al., 1982; Overall & Levin, 1978), even after adjustment for socio-economic factors (Jacobs et al., 1997; Kaufman et al., 1988; Manly et al., 1998a; Reynolds et al., 1987). In our analysis of the MMSE and MDRS we adjusted for sociodemographic and health factors that may influence cognitive functioning. All our analyses are based on within-group comparisons and we did not attempt to compare cognitive functioning scores to non-American Indian populations.

This study provides important initial insights into the relationship between symptoms of depression and cognitive functioning in older American Indians. Clinicians rely on screening measures for psychiatric problems and to assess cognitive functioning in older individuals. More studies are needed in order to inform clinicians about the reliability and validity of psychiatric and cognitive screening measures in American Indian populations. Professionals in the aging and mental health fields will better serve the American Indian population by increasing the awareness and incorporation of cultural factors in the assessment and treatment of psychopathologies.

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References

Adams, R. L., Boake, C., & Crain, C. (1982). Bias in a neuropsychological test classification related to education, age and ethnicity. *Journal of Consulting Clinical Psychology*, *50*, 143–145.

Andrews, G., Peters, L., Guzman, A. M., & Bird, K. (1995). A comparison of two structured diagnostic interviews: CIDI and SCAN. *Australia and New Zealand Journal of Psychiatry*, *29*, 124–132.

Auriacombe, S., Fabrigoule, C., Lafont, S., Amieva, H., Jacqmin-Gadda, H., & Dartigues, J.-F. (2001). Letter and category fluency in normal elderly participants: A population-based study. *Aging, Neuropsychology, and Cognition*, *8*, 98–108.

Austin, M.-P., Mitchell, P., & Goodwin, G. M. (2001). Cognitive deficits in depression: Possible implications for functional neuropathology. *British Journal of Psychiatry*, *178*, 200–206.

Beals, J., Manson, S. M., Mitchell, C. M., & Spicer, P. (2003). Cultural specificity and comparison in psychiatric epidemiology: Walking the tightrope in American Indian research. *Culture Medicine and Psychiatry*, *27*, 259–289.

Beals, J., Manson, S. M., Whitesell, N. R., Mitchell, C. M., Novins, D. K., Simpson, S., et al. (2005). Prevalence of major depressive episode in two American Indian reservation populations: Unexpected findings with a structured interview. *Americal Journal of Psychiatry*, *162*, 1713–1722.

Blazer, D. G. (1989). Current concepts: Depression in the elderly. *New England Journal of Medicine*, *320*, 164–166.

Blazer, D. G., Hughes, D. C., & George, L. K. (1987). The epidemiology of depression in an elderly community population. *Gerontologist*, *27*, 281–287.

Boone, K. B., Lesser, I., Miller, B., Wohl, M., Berman, N., Lee, A., et al. (1994). Cognitive functioning in a mildly to moderately depressed geriatric sample: Relationship to chronological age. *Journal of Neuropsychiatry and Clinical Neuroscience*, *6*, 267–272.

Butters, M. A., Whyte, E. M., Nebes, R. D., Begley, A. E., Dew, M. A., Mulsant, B. H., et al. (2004). The nature and determinants of neuropsychological functioning in late-life depression. *Archives of General Psychiatry*, *61*, 587–595.

Cole, M. G., & Yaffe, M. J. (1996). Pathwawy to psychiatric care of the elderly with depression. *International Journal of Geriatric Psychiatry*, *11*, 157–161.

Ebrahim, S., Nouri, F., & Barer, D. (1985). Measuring disability after a stroke. *Journal of Epidemiology and Community Health*, *39*, 86–89.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). Mini-mental state: A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, *12*, 189–198.

Gallassi, R., Di Sarro, R., Morreale, A., & Amore, M. (2006). Memory impairment in patients with late-onset major depression: The effect of antidepressant therapy. *Journal of Affective Disorders*, *91*, 243–250.

Hasher, L., & Zacks, R. T. (1979). Automatic and effortful processes in memory. *Journal of Experimental Psychology: General*, *108*, 356–388.

Hendrie, H. C., Hall, K. S., Pillay, N., Rodgers, D., Prince, C., Norton, J., et al. (1993). Alzheimer's disease is rare in Cree. *International Psychogeriatrics*, *5*, 5–14.

Houston, W. S., & Bondi, M. W. (2006). Potentially reversible cognitive symptoms in older adults. In D. K. Attix & K. A. Welsh-Bohmer (Eds.), *Geriatric neuropsychology: Assessment and intervention*. New York: The Guilford Press.

Jacobs, D. M., Sano, M., Albert, S., & Schofield, P. (1997). Cross-cultural neuropsychological assessment: A comparison of randomly selected, demographically matched cohorts of English- and Spanish-speaking older adults. *Journal of Clinical and Experimental Neuropsychology*, *19*, 331–339.

Janca, A., Robins, L. N., Bucholz, K. K., & Early, T. S. (1992). Comparison of Composite International Diagnostic Interview and clinical DSM-III-R criteria checklist diagnoses. *Acta Psychiatrica Scandinavica*, *85*, 440–443.

Jervis, L. L., Beals, J., Fickenscher, A., & Arciniegas, D. B. (2007). Performance on the Mini-Mental State Examination and Mattis Dementia Rating Scale among older American Indians. *Journal of Neuropsychiatry and Clinical Neuroscience*, *19*, 173–178.

Jervis, L. L., & Manson, S. M. (2002). American Indians/Alaska natives and dementia. *Alzheimer's Disease and Associated Disorders*, *16*(Suppl. 2), S89–S95.

Kaufman, A. S., McLean, J. E., & Reynolds, C. R. (1988). Sex, race, residence, region and education differences on the 11 WAIS-R subtests. *Journal of Clinical Psychology*, *44*, 231–248.

Laurendeau-Bendavid, M. (1977). Culture, schooling and cognitive development: A comparitive study of children in French Canada and Rwanda. In P. R. Dasen (Ed.), *Piagatian psychology: Cross-cultural contributions* (pp. 123–168). New York: Gardner/Wiley.

Lesser, I. M., Boone, K. B., Mehringer, C. M., Wohl, M. A., Miller, B. L., & Berman, N. G. (1996). Cognition and white matter hyperintensities in older depressed patients. *American Journal of Psychiatry*, *153*, 1280–1287.

Lockwood, K. A., Alexopoulos, G. S., Kakuma, T., & Van Gorp, W. G. (2000). Subtypes of cognitive impairment in depressed older adults. *American Journal of Geriatric Psychiatry*, *8*, 201–208.

Manly, J. J. (2005). Advantages and disadvantages of separate norms for African Americans. *Clinical Neuropsychologist*, *19*, 270–275.

Manly, J. J. (2006). Cultural Issues. In D. K. Attix & K. A. Welsh-Bohmer (Eds.), *Geriatric neuropsychology: Assessment and intervention* (pp. 198–222). New York: The Guilford Press.

Manly, J. J., Jacobs, D. M., Sano, M., Bell, K., Merchant, C. A., Small, S. A., et al. (1998a). Cognitive test performance among nondemented elderly African Americans and whites. *Neurology*, *50*, 1238–1245.

Manly, J. J., Miller, S. W., Heaton, R. K., Byrd, D., Reilly, J., Velasquez, R. J., et al. (1998b). The effect of African-American acculturation on neuropsychological test performance in normal and HIV-positive individuals. The HIV Neurobehavioral Research Center (HNRC) Group. *Journal of International Neuropsychological Society*, *4*, 291–302.

Mattis, S. (1976). Mental status examination for organizc mental syndrome in the elderly patient. In L. Bellak & T. B. Karasu (Eds.), *Geriatric psychiatry*. New York: Grune and Stratton.

Montgomery, K. M. (1982). *A normative study of neuropsychological performance of a normal elderly sample*. Victoria, British Columbia: University of Victoria.

Myers, J. K., Weissman, M. M., Tischler, G. L., Holzer, C. E. 3rd, Leaf, P. J., Orvaschel, H., et al. (1984). Six-month prevalence of psychiatric disorders in three communities 1980–1982. *Archives of General Psychiatry*, *41*, 959–967.

Nebes, R. D., Pollock, B. G., Houck, P. R., Butters, M. A., Mulsant, B. H., Zmuda, M. D., et al. (2003). Persistence of cognitive impairment in geriatric patients following antidepressant treatment: A randomized, double-blind clinical trial with nortriptyline and paroxetine. *Journal of Psychiatric Research*, *37*, 99–108.

Overall, J. E., & Levin, H. S. (1978). Correcting for cultural factors in evaluating intellectual deficit on the WAIS. *Journal of Clinical Psychology*, *34*, 910–915.

Palmer, B. W., Boone, K. B., Lesser, I. M., & Wohl, M. A. (1996). Neuropsychological deficits among older depressed patients with predominantly psychological or vegetative symptoms. *Journal of Affective Disorders*, *41*, 17–24.

Peters, L., & Andrews, G. (1995). Procedural validity of the computerized version of the Composite International Diagnostic Interview (CIDI-Auto) in the anxiety disorders. *Psychological Medicine*, *25*, 1269–1280.

Pickering, K. (2000). *Lakota culture, world economy*. Lincoln: University of Nebraska.

Pickering, K. (2004). Decolonizing time regimes: Lakota conceptions of work, economy and society. *American Anthropologist*, *106*, 85–97.

Reynolds, C. R., Chastain, R. L., Kaufman, A. S., & McLean, J. E. (1987). Demographic characteristics and IQ among adults: Analysis of the WAIS-R standardization sample as a function of the stratification variables. *Journal of School Psychology*, *25*, 323–342.

Robins, L. N., Wing, J., Wittchen, H. U., & Helzer, J. E. (1988). The Composite International Diagnostic Interview: An epidemiologic instrument suitable for use in conjunction with different diagnostic systems and in different cultures. *Archives of General Psychiatry*, *45*, 1069–1077.

Rosenberg, R. N., Richter, R. W., Risser, R. C., Taubman, K., Prado-Farmer, I., Ebalo, E., et al. (1996). Genetic factors for the development of Alzheimer disease in the Cherokee Indian. *Archives of Neurology*, *53*, 997–1000.

Shea, J. D. (1985). Studies of cognitive development in Papua New Guinea. *International Journal of Psychology*, *20*, 33–61.

Smith, G., & Rush, B. K. (2006). Normal aging and mild cognitive impairment. In D. K. Attix & K. A. Welsh-Bohmer (Eds.), *Geriatric neuropsychology* (pp. 27–55). New York: The Guilford Press.

Spreen, O., & Strauss, E. (1998). *A compendium of neuropsychological tests: Administration, norms, and commentary,* (2nd ed.). New York: Oxford University Press.

StataCorp (2005). Stata Statistical Software: Release 9. College Station, TX: StatCorp LP.

Steffens, D. C., Otey, E., Alexopoulos, G. S., Butters, M. A., Cuthbert, B., Ganguli, M., et al. (2006). Perspectives on depression, mild cognitive impairment and cognitive decline. *Archives of General Psychiatry*, *63*, 130–138.

Steingart, A., & Herrmann, N. (1991). Major depressive disorder in the elderly: The relationship between age of onset and cognitive impairment. *International Journal of Geriatric Psychiatry*, *6*, 593–598.

van Ojen, R., Hooijer, C., Bezemer, D., & Jonker, C. (1995). Late-life depressive disorder in the community: The relationship between MMSE score and depression in subjects with and without psychiatric history. *British Journal of Psychiatry*, *166*, 311–315.

van Reekum, R., Simard, M., Clarke, D., Binns, M. A., & Conn, D. (1999). Late-life depression as a possible predictor of dementia: Cross-sectional and short-term follow-up results. *American Journal of Geriatric Psychiatry*, *7*, 151–159.

van Reekum, R., Simard, M., Clarke, D., Conn, D., Cohen, T., & Wong, J. (2000). The role of depression severity in the cognitive functioning of elderly subjects with central nervous system disease. *Journal of Psychiatry & Neuroscience*, *25*, 262–268.

Vangel, S. J., & Lichtenberg, P. A. (1995). Mattis Dementia Rating Scale: Clinical utility and relationship with demographic variables. *Clinical Neuropsychologist*, *9*, 209–213.

Weingartner, H. (1986). Automatic and effort-demanding cognitive processes in depression. In L. W. Poon, T. Crook, K. L. Davis, C. Eisdorfer, B. J. Gurland, et al. (Eds.), *Handbook of clinical memory assessment for older adults*. Washington, DC: American Psychological Association.

Whyte, S. R., Cullum, C. M., Hynan, L. S., Lacritz, L. H., Rosenberg, R. N., & Weiner, M. F. (2005). Performance of elderly native Americans and Caucasians on the CERAD neuropsychological battery. *Alzheimer Disease & Associated Disorders*, *19*, 74–78.

Wong, T. M. (2000). Neuropsychological assessment and intervention with Asian Americans. In E. Fletcher-Janzen, T. L. Strickland & C. R. Reynolds (Eds.), *Handbook of cross-cultural neuropsychology* (pp. 43–53). Dordrecht, Netherlands: Kluwer Publishers.

Zakzanis, K. K., Leach, L., & Kaplan, E. (1998). On the nature and pattern of neurocognitive function in major depressive disorder. *Neuropsychiatry, Neuropsychology and Behavioral Neurology*, *11*, 111–119.