CHARACTERIZING AND EXPLAINING DIFFERENCES IN COGNITIVE TEST PERFORMANCE BETWEEN AFRICAN AMERICAN AND EUROPEAN AMERICAN OLDER ADULTS

By

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This thesis is dedicated to my grandparents and great-grandparents, all of whom have inspired me to pursue a career in aging research.

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It is a consistent finding that African American adults tend to perform more poorly on cognitive tests than their European American counterparts; however, many tests have not been normed for use in ethnic minorities. Moreover, test users often have failed to take into consideration certain sociocultural (e.g., education, literacy) and health factors (e.g., cardiovascular comorbidities) that may influence test performance and be associated with ethnic status. Thus, utilizing data from the pilot study of the NIA and NINR-funded ACTIVE clinical trial, this study compared cognitive test performance between two ethnic groups and found that African American elders (N= 95) performed more poorly than European American elders (N= 67) in seven of nine cognitive dimensions assessed. A consequence of their lower performance was that African American participants were, proportionally, twice as likely to be considered "cognitively at risk" than European American participants. However, after controlling for selected sociocultural and health covariates, differences in test performance were attenuated and

became non-significant, in all but three cognitive domains, suggesting that our covariates represented important mediators of the apparent ethnic differences in cognition. These findings elucidate the challenge in using test scores and norms when making decisions regarding non-European American elders; discussion considers how neuropsychological practice might better deal with issues of cultural bias and health disparities might be remediated.

CHAPTER 1
OVERVIEW OF THE LITERATURE REVIEW

The present investigation seeks to examine differences in test performance between African American and European American older adults on various cognitive measures and to characterize some of the factors that are responsible for these differences. Questions about ethnic group differences in intellectual and cognitive functioning have a much larger historical context, and these inquiries have been the source of some of the most ardent and bitter debates in psychology. Before considering the present state of knowledge regarding group differences in cognitive functioning in later life, it is important to first briefly review this larger context of discussion.

The review of the literature will first consider the evidence for ethnic group differences in cognitive test performance across the lifespan, with a particular focus on potential sources of those differences that have been studied. Review suggests that there is a growing understanding, across the life span, that environmental and health issues may be the most important sources of cognitive disparities that are observed between ethnic groups. There is a growing body of evidence that suggests that measures of socioeconomic advantage and health may be particularly useful in explaining the observed differences in later life. Second, this literature review considers the current methodological challenges when trying to compare members of different ethnic groups with the goal of making functional impairment decisions. These challenges include the inadequate validation and standardization of most current cognitive tests, which have not considered the importance of cultural diversity. Across the life span, much of the

normative data regarding cognitive functioning has been largely based on European American samples, with the under-representation of ethnic minority individuals. Furthermore, appropriately accounting for the validity and sources of ethnic group differences in cognitive functioning is particularly critical in later life. Cognitive test performance is widely used with older clients to make statements about level of functioning, rates of cognitive decline, and cognitive impairment status. Some efforts have been made to develop cross-cultural norms, and these will be briefly considered. Third, this review focuses on particular kinds of cognitive impairment that show increased prevalence in later life (normal aging, mild cognitive impairment, dementia), and the importance of cognitive and neuropsychological test performance in identifying levels of impairment. Lastly, this review discusses the small amount of evidence that life-span differences in cognitive performance between groups persist into very late life. This sets the stage for the current study, which describes differences that exist in an ethnically diverse sample of older adults and then accounts for such differences with a variety of cultural and biomedical predictors. This study also empirically examines the potential consequences for making tentative cognitive impairment classifications, across ethnic groups, on the basis of unadjusted cognitive test scores.

CHAPTER 2
REVIEW OF THE LITERATURE

Ethnic Disparities in Cognitive Performance

Life-Span Differences and History of Investigations

Historically, scholarship in the area of intelligence and general cognitive functioning has focused on how cultural groups differ, particularly how Black or African Americans differ from the dominant, European American majority group. This history of race and intelligence is shrouded with much controversy and debate and has been a source of division in the United States for the better part of its history (Lind, 1995). The work of race theorists and eugenicists has always strived to scientifically prove the genetic inferiority of individuals of African descent relative to European Americans in intellectual ability (Rosen & Lane, 1995; Jones, 1995). Such racialist theoretical opinion has its roots in the tenets of Social Darwinism, a class stratification theory, which refers to the idea of an enduringly poor underclass of people genetically inferior to European American or Anglo groups. Arthur Jensen's (1969) work claimed that intelligence is generally an inherited trait, and the higher performance of European Americans relative to African Americans on IQ measures across social classes must be due to immutable intellectual differences between the two groups (Plucker, 2003). He further asserted that the effects of poverty, discrimination, and related factors had no bearing on this differential performance (Plucker, 2003). Additionally, Herrnstein and Murray (1994) supported Jensen's and many others' views regarding race and intelligence. They concluded that the IQ score differential between African Americans and European

Americans of about a standard deviation, remains at all levels of socioeconomic status (SES) and increases at higher levels of SES. They further stated that the recent narrowing of the average IQ gap between African Americans and European Americans (by 1 standard deviation) is attributed to a lessening of low African American scores instead of an overall increase in average scores (Herrnstein and Murray, 1994).

There are various problems with such theory concerning race and intelligence. One problem is the rationale used to explain average differences between groups in IQ heritability relies on the considerable heritability of within-group IQ (Gould, 1995). It is well known that it is inaccurate to assume that the origin of individual differences in a given trait is the same source of group differences in that trait (Gould, 1995). The observed group differences have numerous other potential sources (i.e., environmental conditions) beyond genetic heritability. Even further, research has demonstrated that individuals of differing racial groups are genetically more alike than different (Bamshad & Olson, 2003).

Next, Herrnstein and Murray (1994) fail to provide sufficient support for the concept of general intelligence, or “g” in their work (Gould, 1995). They frequently confuse correlation with causation when examining the relationship between IQ and socioeconomic status (SES) in speculating that low IQ causes low SES and not the opposite (Plucker, 2003). In using logistic regression to determine the relative importance of IQ and SES in the probability of expression of various desirable or undesirable behaviors, Herrnstein and Murray (1994) fail to consider the multi-collinearity of these variables (Plucker, 2003). That is, the substantial overlap in variability associated with these constructs, making it difficult to determine which one

predicts the other. The faulty nature of Herrnstein and Murray's arguments is elucidated in highlighting the fact that SES cannot directly cause a person to have a high or low IQ (Gould, 1995). Instead, income and other factors related to SES serve as markers of the environment in which a person is reared as a child (Plucker, 2003). Thus, it is more reasonable to consider that there exists an association between the environmental factors related to SES and one's IQ score, and this assertion is often referred to as the "Flynn Effect" (Holloway, 1999). There is a growing body of empirical data that suggests environmental factors have an enormous impact on IQ, and gains in IQ have been generated by the environment (Dickens & Flynn, 2001).

So why do differences in cognitive test performance persist? There is growing recognition that, across the lifespan, cultural and health factors have great importance in explaining performance gaps that remain. It is with the history of race and intelligence in mind that the subsequent literature review and investigation addresses issues related to cultural bias in cognitive testing of African Americans, while focusing on a population of older adults, which previously has been given very little attention by the scientific community (Whitfield, 2002).

Methodological Challenges in Group Comparisons: Norming

Prior to the past few decades, most intelligence tests were standardized using middle-class European Americans, such that earlier versions of intelligence tests were invalid measures of intelligence for African Americans (Buffkins, 2003). In fact, a great majority of cognitive and neuropsychological measures have not been developed for use with African American populations, and thus, do not have the appropriate normative data for making statements about these individuals' cognitive status (Manly & Jacobs, 2002). This is significant because norms are established as "average" or "expected" levels of

performance, and this information is used to compare an individual to a sample representative of the population and make statements about a person's relative impairment or exceptionality.

In response to the need for more culturally fair testing batteries, the Cross-Cultural Neuropsychological Test Battery (CCNB) was developed in a sample of older adults (Dick, Teng, Kempler, Davis, & Taussig, 2002). The test battery was normed on 336 healthy older adults and 90 demented patients from five ethnic groups: African American, Caucasian, Chinese, Hispanic, and Vietnamese. The battery includes tests measuring cognitive domains, including mental status, recent memory, language, visuospatial, attention, reasoning, and psychomotor speed (Dick et al., 2002). The researchers made special efforts to modify test administration to reduce the effects of illiteracy or low education on performance and to use language translators for tests in only English. While the CCNB accurately discriminated healthy from cognitively impaired older adults, both ethnicity and education had a significant effect on performance (Dick et al.). Education accounted for 15% of the variance in scores, while ethnicity accounted for 10%, and African Americans scored more poorly than the other four ethnic groups on visuospatial measures (Dick et al.). One of the challenges with the CCNB is that the sample is from the Los Angeles, CA area, which lessens its generalizability to individuals from other regions of the US. Additionally, many of the measures used may not be widely utilized clinically (e.g., Cognitive Abilities Screening Instrument, and Common Objects Memory Test).

Another study examined neuropsychological test performance of African American and European American elders and developed cross-cultural norms on the Consortium to

Establish a Registry for Alzheimer's Disease (CERAD) battery, also in response to the need for more cross-cultural norms (Fillenbaum et al., 2001). This study developed normative data for adults 71 years and older from North Carolina, the Monongahela Valley, Pennsylvania, and Indianapolis, Indiana. They compared the performance of African American and European American elders from North Carolina, European American elders from the Monongahela Valley, PA, and African American elders from Indianapolis, IN. The results indicate that when age, sex, and education were controlled, there were no significant performance differences for race on any of the test measures (Fillenbaum, Heyman, Huber, Ganguli, & Unverzagt, 2001). Nevertheless, African American elders consistently had poorer scores than their European American counterparts. The authors attributed this finding to possible differences in acculturation and education quality (Manly et al., 1998). Finally, the study results showed that both African American and European American elders from North Carolina obtained poorer scores than participants of corresponding race from Indianapolis and Monongahela Valley, which the authors explained could be the result of poorer education for both races in the South compared to that of Indianapolis and Monongahela Valley (Fillenbaum et al., 2001). These findings further stress the importance of considering sociocultural factors when making statements about cognitive or neuropsychological functional status.

Similar to educational level and quality, health status plays an important role in observed cognitive performance. Considering the ethnic group differences in disease prevalence, it is understandable that differential cognitive performance could in part be attributed to varying disease rates.

The Larger Context of Group Differences: Health Disparities

Evidence has shown that across the lifespan, there are vast disparities in the health status of African Americans compared to European Americans. Explanations for such disparities are varied, ranging from genetic or environmental factors (e.g., socioeconomic status, education) to differences in medical care access (Berkman & Mullen, 1997). Studies have indicated that African American adults, on average, are likely to have attained less formal education than European American adults (e.g., Harper & Alexander, 1990), and these differences are over and above cohort differences in education attainment (Adams-Price, 1993). Zsembik and Peek (2001) found that race had an indirect effect on late-life cognitive functioning through social correlates, in particular education and insurance coverage. In addition, African Americans are at greater risk for developing conditions such as hypertension, diabetes, heart disease and stroke (National Center for Health Statistics (NCHS), 1990). Lower performance on cognitive and neuropsychological measures has been observed to be related to the presence of cardiovascular disease, hypertension, and other related chronic health conditions (Waldstein, 1995; Breteler, van Swieten, Bots, Grobbee, 1994). These persistent health differentials put African Americans at greater risk for poor health outcomes for most sources of disease, disability and even death (Berkman & Mullen). Additionally, these chronic conditions have important implications for neuropsychological impairment (Miles, 2002). While overall health status of Americans has improved, these improvements have been greater for European Americans and the gap in health has increased between the two groups (Berkman & Mullen). One revealing example is the differential increase in life expectancy at age 65. While European American men and women in the United States experienced an increase in life expectancy of 2.4 and 3.1

years, respectively, in contrast, African American men had an increase of 1.5 years and African American women had an increase of 2.5 years (U.S. Department of Health and Human Services, 1993). While many public health initiatives, such as “Healthy People 2000” and “Healthy People 2010” have been implemented to reduce or eliminate such disparities, they have fallen short of their goals (Whitman, 2001).

Furthermore, there are existing differences in health status between African Americans and European Americans in rates of cognitive decline and dementing illness. Research has demonstrated age-specific prevalence rates of dementia to be higher in Latinos and African Americans than non-Latino whites residing in Manhattan in New York City (Gurland et al., 1999). However, when age and educational level were controlled, these differences in rates were inconsistently observed (Gurland et al.). Similarly, a study seeking to determine whether cognitive performance differentials in African American and European American older adults were due to differential item functioning on a modified telephone interview for cognitive status measure, found that most of the group difference (89%) could be attributed to measurement or structural differences (Jones, 2003). This suggests that the test items functioned differently in assessing cognitive status in the two groups. The remaining difference between groups attributable to heterogeneity in background variables (e.g., education, income level) was non-significant (Jones, 2003).

Whitfield and his colleagues (2000) studied the effect of race and health-related factors on naming and memory in 1,175 healthy African American and European American older adults (aged between 70 and 79 years) from the MacArthur Successful Aging Study. Their results indicated that demographic characteristics (except age), better

health status, and increased speed of performance were significant predictors of scores on the Boston Naming Test (Whitfield et al.).

The effects of higher incidence and prevalence of many chronic health conditions in African Americans extend to later life and greatly influence normal and pathological aging.

Focus on Cognitive Disparities in Later Life

Major Findings

Many research studies have suggested that African Americans show lower performance on a variety of standardized cognitive and neuropsychological test measures (e.g., Lichtenberg, Ross, & Christensen, 1994; Boekamp, Straus, & Adams, 1995; Adams et al., 1982). It is has been now established that numerous mediating factors (e.g., education, health conditions, and socioeconomic status) are influential with regards to African Americans' performance on tests of cognitive ability and functioning, and these factors often are not taken into consideration in many existing norms (Whitfield et al., 2000; Izquierdo-Rorrera & Waldstein, 2002; Zsembik & Peek, 2001). Furthermore, there is the potential for cultural bias in neuropsychological assessment of ethnic minority older adults, particularly when there are extant differences in education and language (Loewenstein, Arguelles, Arguelles, & Linn – Fuentes, 1994). Scholars now agree on the importance of ensuring that measures of intellectual or cognitive function are appropriate for use with cross-cultural populations due to the implications for misclassification and misdiagnosis of ethnic minority individuals (Manly & Jacobs, 2002; Friedman, Schinka, Mortimer, & Graves, 2002; Froehlich, Bogardus, & Inouye, 2001; Loewenstein et al., 1994).

The Special Challenge of Late Life Cognitive Assessment: Cognitive Status

Normal cognitive aging has been characterized as a multidimensional and multidirectional process (Baltes, Staudinger, & Lindenberger, 1999). There is evidence for age-related decline in what are known as fluid cognitive abilities (e.g., abstract reasoning, perceptual speed), which are thought to be innate abilities less influenced by culture or education (Horn & Catell, 1966). Nevertheless, there is evidence to suggest that there is a relative stability in crystallized cognitive abilities, which are thought to be highly dependent on cultural and environmental factors (e.g., language) (Horn & Catell, 1966). These age-related declines in cognitive abilities are observed in both cross-sectional and longitudinal comparisons with younger adults (Schiae, 1994) and are not indicative of pathology or impairment. Normal cognitive aging ends and impairment begins when cognitive performance is lower than to be expected based on age and education-corrected norms. There are many impairments that can result, including dementia and mild cognitive impairment (MCI).

Dementia is a common disorder among the elderly population in the United States. Estimates suggest that Alzheimer's disease (AD) in particular, is the fourth or fifth leading cause of death in the US, while it is estimated that people with milder forms of impairment number around 2.7 million. Recently, research has been focused on what is thought to be the precursor to AD: MCI (Smith et al., 1996). Broadly defined, MCI is the impairment for only one domain of cognitive function. However, most research has been focused specifically on the most common form of MCI, amnestic MCI, which is characterized by impairment in only the cognitive domain of memory. This type of MCI is thought to be the transitional state between normal aging and AD.

Clinically, MCI is used to describe those patients whose memory loss is to a greater extent than what is expected for their age, yet their condition does not meet the criteria for clinically probable AD (Petersen et al., 2001). Much of the current MCI literature conceptualizes the disorder within the larger framework of a cognitive continuum. This continuum consists of the idea that MCI falls in between normal aging and AD. Longitudinally, these patients progress at an accelerated rate to AD as compared to healthy, aged-matched individuals (Smith et al., 1996; Petersen et al.). A cross-sectional and longitudinal study that endeavored to clinically characterize participants with MCI compared normal elderly adults with those that had MCI, and mild AD (Smith et al.). The study's results showed that the normal and MCI groups differed only in their memory functioning (Smith et al.). The MCI and AD groups were similar in memory function; however, the AD patients demonstrated impairments in other cognitive domains as well. In addition, the MCI group declined at a faster rate than the normal group, but at a slower rate than did the group with mild AD. This suggests that MCI can be differentiated from normal aging and AD and should in fact be considered as a separate clinical entity (Grundman, Corey – Bloom, Jernigan, & Archibald, 1996; Petersen et al., 1999).

Most of the current research regarding MCI has been focused on distinguishing those who will progress to AD versus those who will not. Epidemiological studies have shown that 10 to 15% of those with MCI progress to AD per year. In a longitudinal study, researchers took Clinical Dementia Rating (CDR) scores of participants to compare those with ratings of "0" to those with ratings of "0.5". Participants with ratings of "0" were put in a normal group, while those with ratings of "0.5" were separated into

three groups. These groups included MCI that represented AD, incipient AD, and uncertain dementia. The study's results showed that after five years, the group that represented AD progressed to greater dementia. Of this group, 60.5% progressed to a CDR rating of "1" or greater. For the incipient AD group, 35.7% of the participants progressed to a rating of "1" or greater, while 19.9% of the uncertain dementia group progressed. However, only 6.8% of the normal controls progressed to greater dementia after five years (Morris et al., 2001).

Another longitudinal study focused on patients who were at high risk of developing AD at the Mayo Clinic (Petersen et al., 1997). All patients (n =75) met the criteria for MCI. This study showed that the strongest predictor of the progression of MCI to AD was the patients' Apolipoprotein E status. Those patients with the E4 allele were more likely to convert to AD at a faster rated than non-carriers did (Petersen et al.).

Methodological Challenge: Differential Diagnosis of Levels of Impairment

Given the overlap in some symptoms of normal aging, MCI, AD, and other dementias, differential diagnosis between various cognitive disorders and diseases is paramount. In a report by the Neuropsychological Assessment Panel of the American Academy of Neurology's (AAN) Therapeutics and Technology Assessment Subcommittee in 1996, the utility of neuropsychological tests as consistent diagnostic measures was questioned. Numerous studies have shown neuropsychological measures to be good in distinguishing between cognitively normal and cognitively impaired groups; however, there is a relative dearth of research to examine how well neuropsychological assessment accurately diagnoses individuals with a particular impairment or disease (Ivnik et al., 2000). Nevertheless, there are very few psychological conditions for which a diagnosis can be made solely on the basis of a

single test score. Nevertheless, when the data are considered in the proper context, cognitively normal and impaired older adults can be accurately diagnosed close to 80% of the time based on an individual score obtained when eventually demented people were first evaluated (Ivnik et al.). Ivnik et al. addressed these issues by investigating four different approaches to interpreting cognitive test data. These approaches included the use of absolute scores, difference scores, profile variability, and change scores. Their findings showed that absolute scores and difference scores were useful in data interpretation, while profile variability and change score measures were not (Ivnik et al.).

Sensitive neuropsychological measures can be helpful in identifying MCI in its early stages; however, neither AD nor MCI can be diagnosed by neuropsychological assessment alone (Heyman et al., 1998; Petersen, 2001). Many use a cutoff of 1.5 standard deviations below average performance in individuals with similar age and education (Petersen, 2000). This cutoff point is problematic because if its reliance on available normative data, which do not consider sociocultural factors. Memory tasks, such as the Hopkins Verbal Learning Test – Revised (HVLT-R) or Rey Auditory Verbal Learning Test (AVLT), that emphasize information acquisition and recall are the most sensitive in detecting early disease. Particularly, the memory measures of delayed recall and learning are indicative of early cognitive decline. These memory tasks tax the sites that are involved in the earliest pathological lesions of AD, which are the entorhinal cortex, perforant pathway, and the hippocampal formation of the medial temporal lobe. In addition, volumetric measurements of the hippocampus are useful in distinguishing normal aging from mild AD. In normal elderly adults, there is a decreased capacity to acquire new information and a delayed recall of previously learned information. Instead,

in MCI and early AD, the capacity to acquire new information is defective, while there is a significant impairment in the ability to recall learned information after a delay (Petersen, Smith, Ivnik, Kokmen, & Tangalos, 1994; Welsh, Butters, Hughes, Mohs, & Heyman, 1991).

Another approach in differential diagnoses of individuals is the use of standardized equivalent scores (ES) (Capitani et al., 1997). This approach offers a solution to the problem of standardizing neuropsychological test scores after age and education corrections have been made. Once the data have been converted to ES, it is possible to compare results from various tests to one another. This study's findings suggest that ES approach is a flexible approach to comparing various scores on tests in neuropsychological test batteries.

Finally, one study examined the predictive ability of sixteen cognitive tests in distinguishing persons with and without pre-symptomatic Alzheimer's disease (pre-AD) (Chen et al., 2000). Traditionally, the Mini-Mental State Examination (MMSE) has been used to screen for dementia as an overall measure of cognitive functioning. However, the MMSE has been criticized as being too easy, thereby making it subject to ceiling effects and a less accurate screening measure for cognitive impairment. The value of the MMSE's predictive ability has not been compared to that of other cognitive measures. Thus, Chen and colleagues compared 120 pre-symptomatic non-demented older adults to 483 non-demented controls on the MMSE and 15 other cognitive tests. Overall, they found memory measures to be the most accurate at discriminating between those with and without pre-AD. Specifically, they found the Word List Delayed Recall task to discriminate best between groups. Word List 3rd Learning Trial was the next best

predictor, followed by Word List 1st Learning Trial, Trail Making Test B, and the MMSE. In addition, the results indicated that together, the Word List Delayed Recall task and the Word List 3rd Learning Trial were significantly more accurate than the MMSE. Furthermore, they found the optimal set of measures to be the Word List Delayed Recall task and Trail Making Test B. These measures together were best at discriminating between those who would develop AD 1.5 years later and those remaining non-demented.

With the importance of properly making differential diagnoses in the majority populations, it is equally important that this is done in ethnic minority groups through appropriate cross-cultural norming of test measures (Dick et al., 2002). Challenges arise when cross-cultural norms that have been developed are not generalizable to various cultural subgroups. One example is how norms developed for African American individuals in the southern US, may not be relevant for African Americans living in the Midwest region of the country (Fillenbaum et al., 2001). This within group variance in culture may be likely attributed to differences in acculturation (Manly et al., 1998). There are varying degrees of acculturation present in all ethnic minority groups, such that highly accultured African Americans, or Hispanic Americans, comprise very different groups from recent immigrants from Africa or Latin America and Spain (Fortuny, Heaton, & Hermosillo, 1998). While the task of sub-group norming is a difficult one, it is agreed by many that it must be completed.

Although there is the critical need to continue develop appropriate cross-cultural norms for existing cognitive measures, it is also useful to consider the utility of alternate measures of cognitive functioning when assessing African American older adults. Mast,

Fitzgerald, Steinberg, MacNeill, & Lichtenberg (2001) studied the utility of the MMSE and the Fuld Object Memory Evaluation (FOME). The MMSE has been more frequently studied and is used often in identifying dementia patients, while the FOME has been less frequently studied or used in screening for AD (Mast et al., 2001). A few studies have shown that the FOME may have a potential utility in clinical diagnosis, specifically in African American older adults, because performance on the measure is not significantly correlated with years of formal education (LaRue, 1989; Summers, Lichtenberg, & Vagel, 1998). The FOME focuses solely on memory functioning, which is the cognitive domain that is usually first compromised in Alzheimer's and other dementing illness. Mast et al. found the FOME to have an overall correct classification rate for African American elders of 86.5% versus 74.2% for the MMSE. Furthermore, it had a sensitivity of 98.3% and specificity of 64.5%, while the MMSE had a sensitivity of 79.3% and specificity of 64.5% for the African American group (Mast et al.). Most notable was the FOME's positive and negative predictive power, which was 83.8% and 95.2% respectively (Mast et al.). However, the MMSE had a positive predictive power of 80.7% and a negative predictive power of 62.5% (Mast et al.). These results show the critical need for less frequently employed screening measures to be further studied and used in diagnosis of dementia, especially amongst African American older adults.

Evidence of Late Life Cognitive Impairment Disparities Across Ethnic Groups

Despite the vast knowledge of progression from normal aging to MCI and AD, relatively little is known regarding cognitive functioning in aging African Americans, and few research studies have focused on those impaired with dementia (Whitfield, 2002). Understanding and expanding the current state of knowledge in this area has been limited by cultural socioeconomic barriers that lead to minorities to be more likely un or

underinsured (Kenton, 1991; Whitfield, 2002). Additionally, it has been suggested by numerous research studies that the instruments used to identify cognitive impairments have not been validated for use in ethnic minorities and lead to over-diagnosis of dementia (Manly & Jacobs, 2002; Whitfield, 2002). Many cognitive measures have normative data based on European American populations, with little or no normative data based on African American groups, which fail to account for the unique sociocultural experiences of non-European American groups.

As a result, older African Americans are judged to be more cognitively impaired more frequently than European Americans. Fillenbaum et al. (1990) showed that African American elders had higher rates of false-positives for dementia classification than Caucasians, when their cognitive scores were compared to the neurological gold standard of Diagnostic and Statistical Manual (DSM) III criteria and the guidelines of the National Institute of Neurological and Communicative Disorders and Stroke-Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA). Similarly, Gurland, Wilder, & Groxx (1992) demonstrated a higher false-positive rate for African American versus Caucasian older adults when comparisons between mental status screenings and a clinician's gold standard of clinical criteria. One specific problem in making comparisons in cognitive test performance between African American and European American samples is that, when African Americans perform more poorly, this may be more reflective of education and cultural bias in neuropsychological measures (Manly & Jacobs, 2002). Thus, there is a growing need for alternate ways for the assessment and diagnosis of cognitive impairment in African American older adults.

Similarly, it has been proposed that more research is needed to understand how AD differs by race and culture, for the effects of diversity on the disease's prevalence, phenomena, and progression are poorly understood (Powell, 2002). Powell (2002) highlights the need for more evidence that the clinical variation in symptom presentation seen in European Americans is the same in ethnic and other minority groups in the US. There remains the need to investigate how race affects age of onset, symptoms, treatment, prognosis, and social response, as well as, the effects of cultural psychology in the willingness to utilize health care resources and enrollment in clinical studies (Powell, 2002). Finally, while the effects of education on measures of clinical health have been considered, there is still the need to investigate the importance of race effects on cognitive measures and to assess the validity of commonly used clinical measures and their impact on ethnic minority populations (Powell, 2002).

Nevertheless, there are concerns that must be addressed with regard to all patients with AD. These include the need for simpler and shorter clinical measures of AD and the need for national or international neuropsychological standards in this regard (Powell, 2002). Presently, there is a wide variation in the use and interpretation of neuropsychological measures, and despite widespread use, neuropsychological testing continues to be poorly defined (Powell, 2002). Powell (2002) cites the need for systematic study of neuropsychological testing as it is applied to AD, and dementia in general.

Explaining Elders' Group Differences in Cognitive Performance

One of the most common general findings in gerontological research on cognitive aging has been the major role of education in individual variability in intellectual abilities among older adults. A problem that has been noted with dementia and AD assessment is

the paucity of measures that consider education and race (Fillenbaum et al., 1988). Studies suggest that future research explores the role of education, both quantitatively and qualitatively in the epidemiology of cognitive impairment associated with AD (Folstein, Anthony, & Parhad, 1985; Whitfield, 2002; Whitfield & Wiggins, 2003). Furthermore, Whitfield (2002) suggests that studies examine the practical aspects of cognitive functioning and include performance on measures of everyday problem solving in the assessment of cognitive status.

There have been a few studies that have examined the role of education quality in accounting for group differences in cognitive test performance. First, Manly et al. (1999) compared neuropsychological test performance in non-demented literate and illiterate elderly adults. The results found an overall effect for literacy status on neuropsychological test performance when groups were match on years of education (Manly et al., 1999). However, certain measures were unaffected by literacy status, suggesting that these measures can be used to accurately detect cognitive decline among illiterate elders in the sample (Manly et al., 1999). Next, Manly, Jacobs, Touradji, Small, & Stern (2002) sought to determine whether differences in quality of education could explain differences in neuropsychological test performance between African Americans and European Americans, matched on education. The study's results showed that African Americans scored significantly lower on measures, even when matched on education (Manly et al., 2002). However, when scores where adjusted for reading performance on the Wide Range Achievement Test – 3rd Edition (WRAT-3), the overall race effect was greatly reduced and racial differences on all tests, except category fluency and a drawing measure, became non-significant (Manly et al.).

As the aforementioned studies suggest, years of education alone is an inadequate explanation for differences in cognitive performance, for this variable systematically differs between racial groups and its relationship to cognitive test performance given the historical effects of school segregation in the US prior to 1954 (Loewenstein et al., 1994; Whitfield & Baker-Thomas, 1999; Manly et al., 2002). It was noted that adjusting certain neuropsychological measures for quality of education might be valuable in improving their specificity (Manly et al.). Additionally, Whitfield and Wiggins (2003) examined the effect of educational racial desegregation in the US in 1954 on cognitive performance, specifically fluid and crystallized abilities, among 197 older African Americans in Baltimore. The study compared groups of different age cohorts that had either received desegregated or segregated education, and the results showed that for those receiving a desegregated education, their mean cognitive performance was significantly higher than that of the individuals receiving segregated education (Whitfield & Wiggins, 2003). Nevertheless, when controlling for age, gender, years of education, and years in desegregated schools, differences in cognitive scores became non-significant, except for measures of vocabulary and spatial ability (Whitfield & Wiggins, 2003). This study further provides evidence for the importance of considering the quality of past education when considering cognitive functioning and test performance in later life.

Manly et al. (1998) studied cognitive test performance in African American and European American non-demented older adults, and they found that non-demented African American participants scored significantly lower on measures of verbal and nonverbal learning and memory, abstract reasoning, language and visuospatial skills than did non-demented European American participants. After the groups were matched for

educational level, many differences became non-significant (Manly et al.). However, significant differences in test performance persisted for figure memory, verbal abstraction, category fluency, and visuospatial skill measures (Manly et al.). Furthermore, these persistent significant differences could not be accounted for by occupational attainment, or medical conditions, such as hypertension and diabetes. Manly and her colleagues stressed that these findings underline the importance of using culturally appropriate norms when evaluating ethnically diverse older adults for dementia.

CHAPTER 3
THE PRESENT STUDY

Many research studies have investigated group differences in neuropsychological test performance and made group comparisons based on that performance (Carlson, Brandt, Carson, & Kawas, 1998; Inouye, Albert, Mohs, Sun, & Berkman, 1993; Manly et al., 1998). However, it has been suggested that future studies of cognitive assessment of African Americans must also account for sociocultural factors that influence cognitive test performance (Manly & Jacobs, 2002). Whitfield (2000) has further suggested that health factors (especially hypertension, diabetes) are other important covariates. The present study seeks to further extend Manly and Whitfield's work in examining differences in neuropsychological test performance, while accounting for mediating factors such as education and health quality. The present study offers the following aims:

1. To investigate whether there are significant mean differences in cognitive test performance between African American and European American older adults.

Hypothesis 1. There will be differences in performance on cognitive measures between African American and European American older adults, with European Americans expected to perform better. Analysis: Multivariate analysis of variance (MANOVA) will be utilized in order to investigate differences in cognitive test performance between the two groups.

2. To investigate whether a consequence of the expected lower performance of African Americans could lead proportionately more of them to be classified as showing “low memory” performance, suggestive of possible amnestic MCI status.

Hypothesis 2. It is expected that there will be an association between ethnic group membership and cognitive status grouping, such that there will be proportionately more African Americans will be classified as having low memory scores. Analysis: A Chi-Square cross-tabulation will be conducted to consider the association between group membership and cognitive status.

3. To investigate whether these persistent group differences are attenuated when controlling for education and selected ethnicity-associated health conditions (e.g., hypertension, diabetes).

Hypothesis 3. It is expected that differences in cognitive test performance in African American and European American elders will be attenuated when controlling for education and health variables. *Analysis*: Multivariate analysis of covariance will be used where education, literacy, and health variables are used to explain ethnicity-related variation in cognitive measures.

CHAPTER 4
METHOD

Participants and Recruitment

Participants were recruited as a pilot sample for the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) clinical trial. This research is sponsored by the National Institute on Aging and the National Institute for Nursing Research in the US, and it is a randomized, controlled, single-masked clinical trial that studies whether cognitive training protocols can affect cognitively-based measures of daily functioning. The 162 participants in the present analyses were selected from the larger pool of potential participants identified by each of six field sites (Birmingham, AL; Boston, MA; Indianapolis, IN; Baltimore, MD; Detroit, MI; and north central Pennsylvania). The goal of recruitment was to obtain a sample with 50% African American participants to determine whether cognitive measures were valid for use with ethnic minority elders. There were a number of measurement approaches used to collect the data, including the use of standardized paper-and-pencil tests, computer-administered tests, observational measurement of activity performance, measurement of physical functioning, self-administered questionnaires, transcription of medications taken, collection of archival data from Medicare/Medicaid health-service utilization records, and collection of driving records from state departments of motor vehicles. Four kinds of measurements were obtained: demographic information, medical and functional information, cognitive performance, and everyday performance.

Inclusion Characteristics

Participants were selected from the population of adults 65 years of age or older, who were not in need of formal care; though they were at risk for loss of functional independence due to advanced age, lower educational attainment, lower socioeconomic status, or declining health. The sample was obtained from the six field sites and consisted of 170 older adults, with eight excluded from the present analyses if they identified themselves as non-African American or non-European American. Recruitment of cognitively impaired individuals stressed subjective memory complaints, which was confirmed by the cognitive assessment for qualification into the study.

Exclusion Characteristics

Potential participants in the ACTIVE pilot study were screened to exclude individuals based on the following criteria: age < 65 years at initial screening; a score of 22 or lower on the MMSE or self-reported diagnosis of Alzheimer's disease; substantial functional decline, as determined by self-report of need for assistance in performing activities of daily living (ADL); medical conditions, such as stroke, certain cancers, or ongoing chemotherapy and or radiation treatment; severe sensory loss; communication difficulties; recent or current participation in cognitive training studies; or unavailability during any phase of the study.

Sample Characteristics

Table 4-1 describes the participant characteristics. The sample was "young-old", with an overall average age of 73.68 years. Eighty-three percent of the sample was female, and the larger population was relatively represented with regards to years of education. Nevertheless, the sample was not the average college-educated sample represented in most cognitive aging research. Given the goals of the pilot study to over-

sample African American elders, it is notable that 58.6% of the sample was African American. There was an under-representation of very old and male participants, especially in the African American sample, as is customary in cognitive aging research. As a result, the African American sample was significantly younger and had more females than the European American sample.

Table 4-1. Participants' Characteristics

	Overall	African American Group	European American Group
Sample size	n = 162	n = 95	n = 67
Age*	m = 73.68 (6.08)	m = 72.24 (5.92)	m = 75.71 (5.75)
Gender*	83.3% F	90% F	75% F
	16.7% M	10% M	25% M
Years of Education	m = 12.07 (2.97)	m = 11.93 (3.39)	m = 12.27 (2.25)

Procedure

The procedure of the pilot study is outlined in Figure 4-1. First, participants were recruited from the population of older adults in each of the field site areas. Potential participants were screened via telephone to determine their eligibility and willingness to participate. During this screening, information about participants' sociodemographic and health status, ADL, mood, and study availability was obtained. Next, eligible and willing individuals were invited to an in-person screening. In this screening, physical measurements (e.g. blood pressure, pulse, grip strength, height, weight, etc.) and information regarding instrumental activities of daily living (IADL) were gathered. Following this session, those that met eligibility requirements and that were still interested in the study had an individual baseline cognitive assessment. This assessment was followed by a group cognitive assessment.

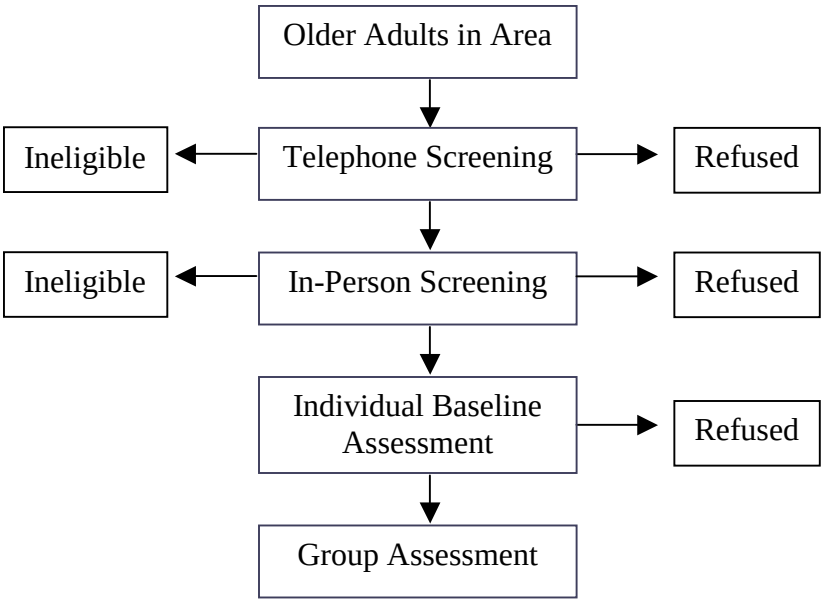

Figure 4-1. Procedure of ACTIVE Pilot Clinical Trial

Cognitive Measures

The cognitive battery consisted of commonly used cognitive measures of global cognitive status, language, memory, inductive reasoning, processing speed/attention, visual/divided attention, and everyday cognition. Table 4-2 lists the cognitive domains of interest, as well as the corresponding available cognitive measures. Most measures were administered in one-on-one sessions, with a tester, although several were given in group testing situations. In addition, memory tests differed from standard administration in that participants had to write and not verbalize their recall lists. The chosen measures represent commonly used cognitive instruments to test function of cognitive domains in aging populations. In addition, the measures were selected to meet the endpoints of the larger clinical trial.

Table 4-2. Cognitive Test Battery Measures.

Cognitive Domain	**Measure**	**Source**
Global Cognitive Status	Mini Mental State Examination	Folstein, Folstein, & McHugh, 1975
Language	Wide Range Achievement Test – 3rd Edition	Wilkinson, 1993
	Vocabulary Tests from the Kit of Cognitive Reference Tests	Ekstrom et al., 1976
Memory: Episodic, Learning, and Percent Retention (Forgetting)	Rey Auditory Verbal Learning Test	Rey, 1964
	Hopkins Verbal Learning Test – Revised	Benedict et al., 1998
	Rivermead Behavioural Memory Test	Wilson et al., 1985
Inductive Reasoning	Letter Series from the Schaie – Thurstone Adult Mental Abilities Test	Schaie, 1985
	Word Series Test from the Schaie – Thurstone Adult Mental Abilities Test	Schaie, 1985
	Number Series Test, Form B (Adapted)	Ekstrom et al., 1976
	Letter Sets from the Kit of Cognitive Reference Tests	Ekstrom et al., 1976
Processing Speed and Attention	Digit Symbol Substitution Test	Wechsler, 1981
	Finding A's from the Kit of Cognitive Reference Tests	Ekstrom et al., 1976
	Identical Pictures from the Kit of Cognitive Reference Tests	Ekstrom et al., 1976
Visual and Divided Attention	Useful Field of View	Ball & Roenker, 1993
	Complex Reaction Time Computer-Administered Tests	Ball & Owsley, 2000
Everyday cognition	Everyday Problems Test	Willis & Marsiske, 1994

Global Cognitive Status

Mini-Mental State Exam. To measure overall cognitive status, the Mini-Mental State Exam (MMSE) (Folstein, Folstein, & McHugh 1975) was used. The MMSE measures orientation to time and place, attention/concentration, language, constructional ability, and immediate and delayed recall. The MMSE was designed as a briefer version of a mental status examination to examine global cognitive functioning in individuals,

and the MMSE has attained widespread clinical use as a screening tool. There are 30 items, and scores range from 0 to 30. The MMSE's internal consistency ranges from .31 for community-based samples to .96 for groups including medical patients (Spreen & Strauss, 1998). It is estimated that its test-retest reliability is between .80 and .95 for test intervals of less than two months (Spreen & Strauss, 1998).

Language

Wide Range Achievement Test – Third Edition. For assessment of language, the Wide Range Achievement Test – 3rd Edition (WRAT – III) Reading subtest was utilized (Wilkinson, 1993). The WRAT – III assesses literacy or reading level attainment in older adults. In this task, participants were presented with a series of 42 words to read and pronounce, with a total possible score ranging from 0 to 57. Coefficient alphas for the WRAT – III range from .85 to .95 over the nine subtests (Spreen & Strauss, 1998). Over a one-month period, test retest reliability is estimated between .91 and .98 (Spreen & Strauss, 1998).

Vocabulary Test. Language was also measured using the Vocabulary Test from the Kit of Cognitive Reference Tests (KCRT) (Ekstrom, French, Harman, & Derman, 1976). In this test, participants were asked to indicate the appropriate synonym of each word presented in 15 test items. Odd-even split-half reliability for this test is .76.

Memory: Episodic, Learning, and Percent Retention

Rey Auditory Verbal Learning Test. To evaluate the cognitive domain of memory, the Rey Auditory Verbal Learning Test (AVLT) (Rey, 1964) was used. The measure assesses the ability to form and retain new verbal memories for a list of words. Individuals heard a 15-item word list that was read aloud by the examiner with an 8-second pause between each word. Next, they were asked to record all of the words they

could remember in any order. This was repeated for five trials of learning and recall. The AVLT has short-term (6 – 14 days) test- retest reliability for total number of words learned over five trials of r = .77 (Spreen & Strauss, 1998). The test has moderate test-retest reliability over a one-year interval (Spreen & Strauss, 1998).

Hopkins Verbal Learning Test – Revised. The Hopkins Verbal Learning Test – Revised (HVLT – R) (Benedict Schretlen, Groninger, & Brandt, 1998) provides a similar index of verbal memory as the AVLT. For this measure, a list comprised of 12 words from three semantic categories was read to participants for 3 trials. After each time the list was read, individuals were asked to recall as many words as possible, in any order. A delayed recall trial was completed following a 20-25 minute delay interval. Finally, a longer list of 24 words, including 12 target words and 12 non-target words, was read, and individuals responded either "yes" or "no" to indicate whether or not each word was from the original 12-word list. Test-retest reliability for total number of words learned over three trials is r = .74 (Benedict et al., 1998).

Rivermead Behavioural Memory Test. The Rivermead Behavioural Memory Test Paragraph Recall task measures the ability to learn and retain verbal memories for brief stories (Wilson, Cockburn, & Baddeley, 1985). Individuals heard a brief story and were given 3 minutes to record as many of the 21 story propositions as they could recall. Parallel forms of the Rivermead have a moderate to high reliability (> .80) (Spreen & Strauss, 1998).

Inductive Reasoning

Word Series Test. Inductive reasoning ability was measured using the Word Series Test from the Schaie – Thurstone Adult Mental Abilities Test (STAMAT) (Schiae, 1985). The Word Series Test is a 30-item test designed to measure individuals' ability to

correctly determine how a series of words (e.g., days of the week, months of the year) progress. Individuals chose from five choices the word that best completed each series. Test-retest correlation coefficients for the STAMAT form for older adults (Form OA) range from .80 to .86 over a three-year period.

Letter Series Test. The Letter Series Test, also from the STAMAT (Schaie, 1985), is designed to determine an individual's ability to correctly identify the letter that appropriately completes a series of letters for each of the test items. Test-retest correlation coefficients for the STAMAT Form OA range from .80 to .86 over a three-year period.

Number Series Test. The Number Series Test (Adapted from the Number Series Test, Ekstrom et al., 1976) is similar to the Letter Series task. Participants had to correctly determine from five numbers the one that accurately completed the series of numbers presented for each of the 20 test items. Odd-even split-half reliability for the Number Series Test, Form B is .75.

Letter Sets Test. Inductive reasoning was also measured using the Letter Sets test from the KCRT (Ekstrom et al., 1976). In this test, individuals were asked to decipher the rule which related four groups of letters to each other and then identify a fifth group of letters to which the rule did not apply. Test-retest reliability for the test is .69.

Processing Speed and Attention

Digit symbol substitution test. To assess processing speed and attention, the Digit Symbol Substitution Test (Adapted from the WAIS – R, Wechsler, 1981) was used. In the Digit Symbol task, there are 8 symbols in the top portions of 8 boxes, with corresponding numbers in the bottom portions of the boxes. These symbols and numbers are located in a key at the top of each page. Test items have boxes with numbers in the

top portions with no symbols in the bottom parts. Individuals were asked to copy as many of the symbols to each of the empty boxes as they could in two minutes. The WAIS – R examiner's manual does not include reliability information for adults aged 55 – 74 on the Digit Symbol task, because these individuals were not retested. The average estimated correlation coefficient based on the nearest age group retested is .82.

Finding A's Test. The Finding A's Test from the KCRT (Ekstrom et al., 1976) measured individuals' speed in finding the letter "a" in words. Individuals were presented with 25 columns of 41 words and given two minutes to mark the words with "a's" in them. Odd-even split-half reliability for this measure is .94.

Identical Pictures Test. The Identical Pictures Test, from the KCRT (Ekstrom et al., 1976), asks individuals to indicate the figure from a group of five figures that correctly matched the test item. Participants were given one and-a-half minutes to complete as many of the 48 items as they could. Odd-even split-half reliability for the measure is .98.

Visual and Divided Attention

Useful Field of View Test. To assess visual and divided attention, the Useful Field of View Test (UFOV) (Ball & Roenker, 1993) was used. The UFOV consists of three segments that each measures an element of an individual's useful field of view. First, a target object was presented in the center of the computer screen, to which the participant had to attend. Next, the target object was presented again; however, this time a second stimulus object was presented in the periphery of the screen to which the participant also had to attend. Last, the two objects were presented again, this time with distracters embedded in the periphery, making it more difficult to attend to the objects. The UFOV

has a test-retest reliability over a two-week period of r = .72 for segment one, r = .81 for segment two, and r = .80 for segment three of the test.

Complex Reaction Time Computer-Administered Tests. The Complex Reaction Time (CRT) computer-administered task (Ball & Owsley, 2000) measures the time it takes for individuals to successfully perform certain motor behaviors, such as using a computer mouse, after viewing a screen presentation of an instructional road sign. Both time and accuracy of responses are recorded. Psychometric data for this measure are not yet available.

Everyday Cognition

Everyday Problems Test. For everyday cognitive functioning, the Everyday Problems Test (EPT) (Willis & Marsiske, 1993) was utilized to assess problem solving and reasoning in practical situations in older adults. Participants were presented with 14 enlarged printed materials of everyday stimuli (e.g., tax forms, medicine labels) and asked to record answers to two questions about each stimulus. The participants were instructed to not spend too much time on any one question; however, they given as much time as needed to complete the test. Cronbach's alpha for the EPT is .94 (Willis & Marsiske, 1994). Test-retest (one-year period) reliability for the measure is .91 (Willis & Marsiske, 1994).

CHAPTER 5
RESULTS

This study explored ethnic group differences in cognitive test performance while considering the influence of sociocultural and health factors. The results are presented with respect to the three main research questions:

1. Will the persistent finding that there are mean differences in cognitive test performance between African American and European American older adults be replicated?

2. Could these expected differences in performance lead to African American elders being classified as being at greater risk for low memory performance than European American elders?

3. Might expected differences in performance be attenuated when controlling for the effects of education and health, thereby suggesting their potential mediating role in obtained differences?

Aim 1: Mean Differences in Cognitive Test Performance

The first major question for this study was to understand whether previous findings that African American elders perform more poorly on cognitive measures than their European American counterparts would be replicated in this pilot sample. Analysis of variance was used, with univariate and multivariate approaches utilized depending on the number of available test measures for each cognitive domain. The analyses showed that there were significant mean differences in performance, favoring the European American elders. Nevertheless, for the cognitive domains of learning and percent retention, there were no such differences. This finding will be considered further in the Discussion section of this paper. Table 5-1 shows *F* – statistics, degrees of freedom, and significance values for each analysis of variance. Even with Bonferonni correction, essentially all of

these differences would remain significant. The graph in Figure 5-1 shows composite scores, rescaled to a common T-score metric, for each of the cognitive dimensions. Except for the learning and percent retention dimensions, where significant differences exist, they are approximately .5 standard deviation in magnitude. This difference, while sizable, demonstrates the substantial overlap in the performance distributions of the two groups.

Table 5-1. *F*-statistics, Degrees of Freedom, and Significance Values for Univariate and Multivariate Analyses of Variance on Raw Cognitive Test Scores

	F-statistic	Df	*p* – value
Episodic Memory	7.944	(3, 155)	<.000
Learning	.149	(2, 154)	.861
Percent Retention (Forgetting)	.357	(3, 143)	.784
Global Cognitive Status	11.903	(1, 161)	.001
Language	9.705	(2, 158)	<.000
Reasoning	5.927	(4, 153)	<.000
Perceptual Speed/Attention	6.979	(3, 157)	<.000
Visual/Divided Attention	4.873	(2, 141)	.009
Everyday Cognition	10.092	(1, 155)	.002

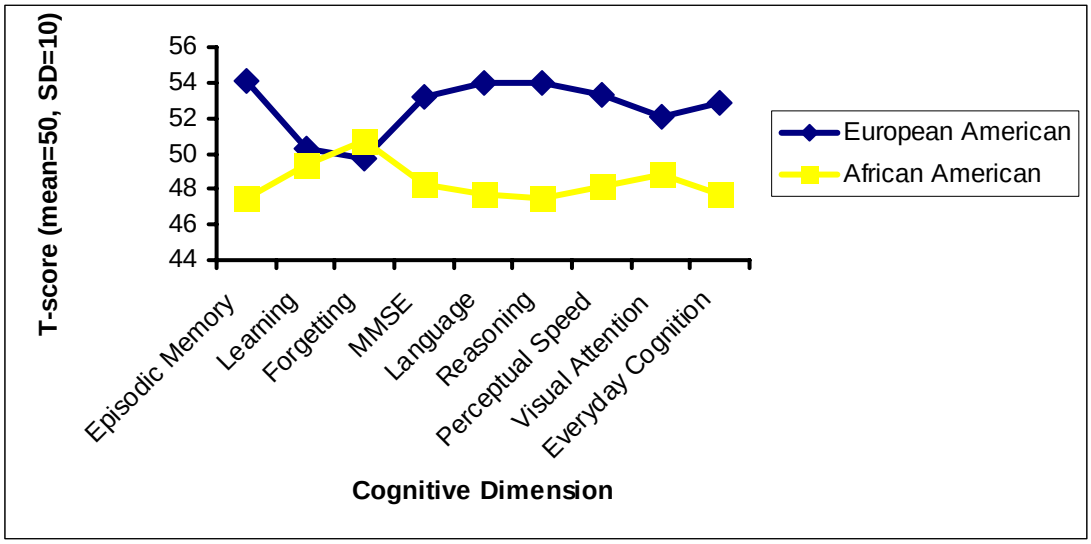

Figure 5-1. Ethnic Group Comparisons on Major Cognitive Dimensions

Aim 2: Ethnic Group Differences in Risk for Low Memory Performance

The second major study question concerned whether the risk for low memory status grouping was greater for African American elders than for European American elders. Since the ACTIVE pilot data collection was not intended for making cognitive status groupings, we were unable to classify individuals as having amnestic MCI or not. Instead, "low memory" performance was defined with regard to the study's sample. Participants were classified as falling 1.5 standard deviations below the sample mean or not. This criterion followed one of Peterson's (1999) criteria for amnestic MCI, which is impairment for one domain of cognitive functioning (characterized as 1.5 standard deviations below age and education-adjusted published norms for that individual). The problem with using Peterson's (1999) criterion was that not all available cognitive measures had appropriate published norms. In addition, the non-standard test administration (e.g., group testing, written answers) meant that there were questions about the applicability of published norms.

"Low memory" performance was determined based on eight memory measure scores: AVLT total recall (recall over trial 1 through trial 5), AVLT learning (trial 5 recall minus trial 1 recall), AVLT percent retention (delayed recall trial divided by trial 5 recall), HVLT total recall (recall over trial 1 through trial 3), HVLT – R learning (trial 3 recall minus trial 1 recall), HVLT – R percent retention (delayed trial recall divided by trial 3 recall), and Rivermead story propositions immediate recall and delayed recall.

A Chi-Square analysis showed that African American elders were at greater risk than European American elders for "low memory" performance categorization, $X^2 = 8.423$, $df = 2$, $p = .015$. As the bar graph in Figure 5-2 illustrates, the modal group for

European American elders was for no low memory performance. In contrast, African Americans were more evenly distributed across the memory performance levels. In the "two or more low memory category", proportionately twice as many African Americans were classified as showing very low memory.

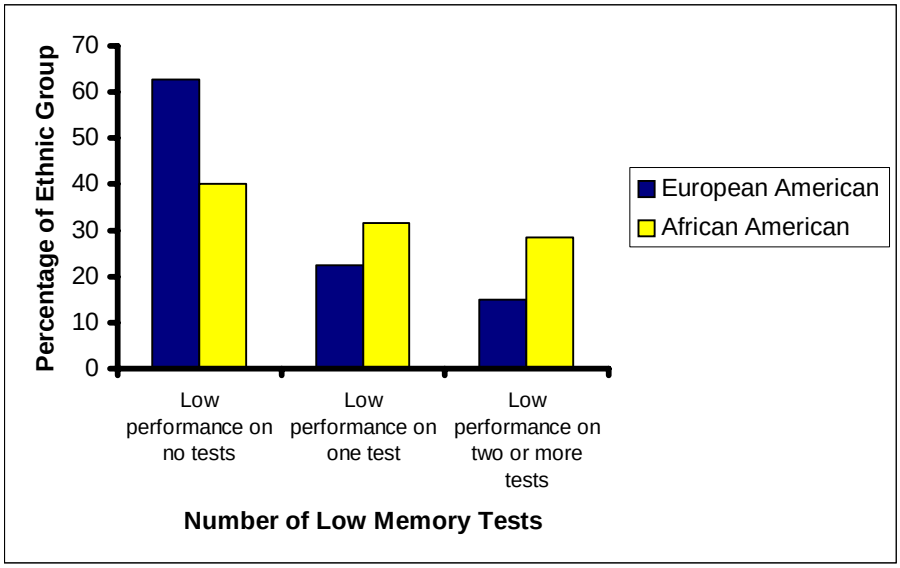

Figure 5-2. Ethnic Group Comparison in Low Memory Test Performance

Aim 3: Effect of Sociocultural and Health Factors on Cognitive Test Performance

The third major study question concerned the extent to which ethnic group differences in performance could be attenuated when controlling for the effects of education and selected ethnicity – associated health conditions. Table 5-2 displays the list of covariates that were included in the analyses. Where possible, composite variables (as for disease co-morbidity and language) were introduced, both to expand the range of variability and to reduce the number of covariates in this regression analysis on only 162 participants. The variables for depression and physical functioning (CES-D and SF-36) had missing data, so missing values were replaced with the appropriate age and education-group's mean for each participant.

In addition, included in the group of covariates are dummy variables, which code from which of the six field sites participants were recruited. These dummy variables were included due to the wide variation in the characteristics of participants from the various field sites. In two sites where participants recruited were predominantly African American, there were substantial differences in educational attainment: at Wayne State University, participants were the highest educated, while at Indiana University, the participants had the least amount of education. Thus, controlling for site membership was important to better tease out the effects uniquely associated with ethnicity.

Table 5-2. Covariates included in Analyses of Covariance

Health/demographic	Education and Achievement	Site
Age	Years of education	Dummy codes[c]
Physical Functioning (SF-36)	Language[b]	
Depression (CES-D)		
Body Mass Index		
Co-morbidity Health Composite of Diabetes, Arthritis, and Heart Disease[a]		

a: sum of three yes-no indicators for each condition
b: composite of WRAT-III Total Reading score and the score from Vocabulary
c: codes represent five of the six participating sites

Analysis of covariance, both univariate and multivariate, was used to determine whether ethnic group differences in test performance could be attenuated. The analyses showed that after introducing the covariates into the model, previously significant differences for the domains of episodic memory (p = .078), visual/divided attention (p = .074), and everyday cognition (p = .322) became non-significant. Table 5-3 shows F – statistics, degrees of freedom, and significance values for the analyses that correspond with each cognitive dimension. The line graph in Figure 5-3 illustrates the ethnic group

differences on the residual cognitive test distributions after controlling for the covariates, again rescaled to T-score metric. Performance in only the domains of global cognitive status, reasoning, and processing speed/attention significantly differs between groups.

Table 5-3. *F*-statistics, Degrees of Freedom, and Significance Values for Univariate and Multivariate Analyses of Variance on Corrected Cognitive Test Scores

	F-statistic	Degrees of Freedom	*p* – value
Episodic Memory	2.323	(3, 139)	.078
Learning	.429	(2, 138)	.652
Percent Retention (Forgetting)	.721	(3, 129)	.541
Global Cognitive Status	7.056	(1, 144)	.009
Reasoning (Inductive)	7.234	(4, 137)	<.000
Processing Speed/Attention	4.320	(3, 141)	.006
Visual/Divided Attention	2.652	(2, 125)	.074
Everyday Cognition	.986	(1, 137)	.322

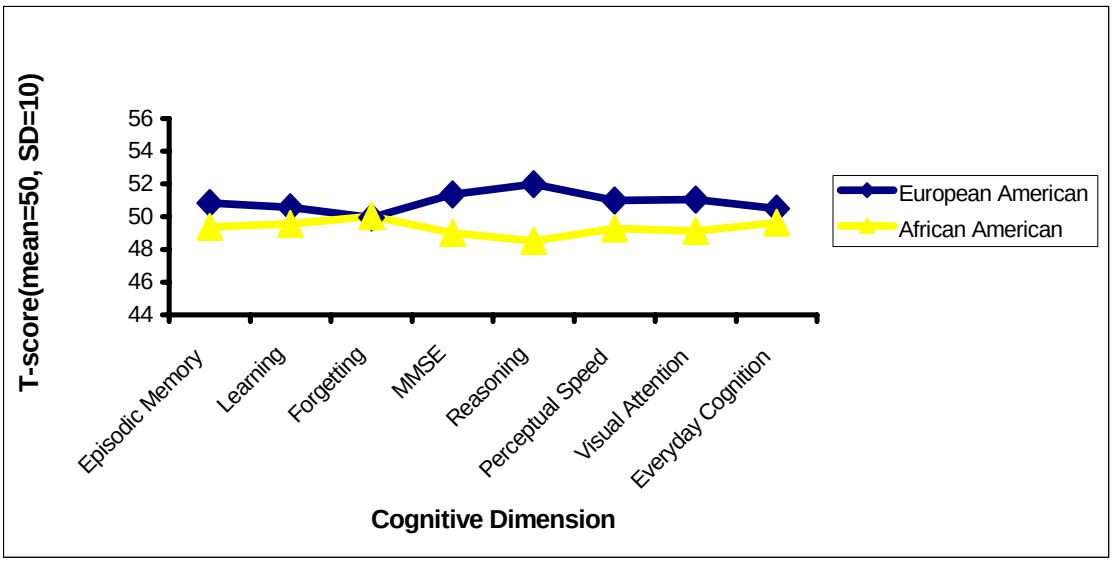

Figure 5-3. Corrected Ethnic Group Comparisons on Multiple Cognitive Dimensions

CHAPTER 6
DISCUSSION

This section has four main goals: to review the method and major findings and offer interpretation of the results; to consider the study's major limitations; to explore the broader theoretical and empirical implications for the study's findings; and to discuss the future directions for ethnic group variation in cognitive test performance.

Review of Study Findings

The aim of the current study was to characterize and explain differences in cognitive test performance between two ethnic groups of older adults. This goal was achieved through the examination of three research questions:

1. Will the persistent finding that there are mean differences in cognitive test performance between African American and European American older adults be replicated?

2. Could these expected differences in performance lead to African American elders being classified as being at greater risk for low memory performance than European American elders?

3. Might expected differences in performance be attenuated when controlling for the effects of education and health, thereby suggesting their potential mediating role in obtained differences?

The 162 participants in the present analyses were selected from a pool of participants recruited by each of six field sites (Birmingham, AL; Boston, MA; Indianapolis, IN; Baltimore, MD; Detroit, MI; and north central Pennsylvania) for a pilot study that preceded the full Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) clinical trial (Ball et al., 2001). Participants were 65 years and older, and they were mostly "young-old" (mean = 73.68; SD = 6.08), female (83.3%), and

African American (58.64%) given the ACTIVE pilot study's goal of over-representing African American older adults. The sample was initially screened by telephone to assess eligibility (persons with self-reported dementia or recent stroke, active cancers, and several visual or hearing impairments were excluded), and this was followed by in-person and group assessments. The cognitive battery was composed of commonly used cognitive measures of global cognitive status, memory, language, reasoning, processing speed/attention, visual/divided attention, and everyday cognition.

The first major study question was to determine whether African American older adults would show poorer cognitive performance than European American elders in this pilot sample. Our analyses showed that, in accordance with previous studies, there were significant mean differences in performance, with African American participants showing lower performance in seven of the nine cognitive domains, ranging from .10 to .70 standard deviations in these seven domains. This finding was expected and supported our hypothesis. Numerous studies have shown this between-group performance differential. Nevertheless, for the cognitive domains of learning and percent retention (i.e. delayed recall, or forgetting), there were no such differences.

The second major study question concerned whether the risk for low memory status grouping was greater for African American elders than for European American elders. Our analysis showed that African American elders were proportionally twice as likely as European American elders to be categorized as having "low memory" performance on the basis of their uncorrected cognitive test performance. Again, this finding was expected and supported our hypothesis. As mentioned previously, African Americans are often misclassified and misdiagnosed due to inadequate norms and cultural bias in test

measures. Though our memory classifications were atypical in making status judgments, (we based them on our sample's characteristics, rather than published norms, and - given the nature of the secondary analysis - could not consider functional data or informant corroboration) they provided a rough estimation of where individuals would fall in relation to one another.

As a side note, we did compare the number of participants classified as having low memory status using our approach (i.e., 1.5 SD below the sample mean) to the number that would have been classified as impaired using age and education-appropriate published norms on the HVLT - R. We found that our sample-based criterion was substantially more conservative than the published norms, such that our sample-based approach classified fewer individuals as having low memory scores. We therefore speculate that if indeed more of the measures had published norms, that proportionally even more of our African American participants would be classified as showing very "low memory" relative to our European American participants, and we do not believe the current results reflect inflated estimates of low memory status.

The third major study question concerned the extent to which ethnic group differences in performance could be attenuated when controlling for the effects of education and selected ethnicity – associated health conditions. The ethnic group effect disappeared for three additional cognitive domains: episodic memory, visual/divided attention, and everyday cognition. Because there have been few previous normal aging studies that have included substantial numbers of African Americans, we struggle in explaining these findings from a theoretical perspective. At the same time, our findings suggest that education, including language achievement, and certain health factors are

important mediators in the group differences observed in this and past studies. Our findings also imply that the racial/ethnic differences we see are not fully resulting from race or ethnicity per se, but rather from these associated mediating factors that are disparate or unequal between groups. Without continuing to account for these sociocultural and health factors, future research is likely to continue to underestimate the cognitive performance of African Americans relative to European Americans.

Study Limitations

This study has several limitations that are important to briefly consider here. First, we acknowledge, that while it was useful to utilize the ACTIVE clinical trial pilot data in this way, this study was a secondary data analysis. By using data already collected, we had no control over study design and method, measure-selection, or missing data. The ACTIVE pilot study was not intended as a neuropsychological comparison between African American and European American older adults. Additionally, the pilot used convenience samples and these results might be less generalizable to the population.

Second, as a consequence of utilizing the ACTIVE pilot data in this secondary analysis, our “low memory” classifications may not represent real impairment categories that clinicians would identify. What the findings do demonstrate, however, is that any diagnostic approach using a "threshold" or "cutoff score" model of impairment using unadjusted memory scores is likely to find higher levels of impairment in African American elders.

Third, the ACTIVE pilot study did not include an adequate measure of socioeconomic status. This is important in that studies have indicated that cognitive performance differentials are partly explained by the increased economic advantage that European Americans have over African Americans, which in turn leads to increased

educational and health advantage. This concern is slightly offset by the known correlation between education and income, and by the fact that we had two fairly direct measures of acculturation in the dominant culture (i.e., WRAT- III Reading and Vocabulary).

Fourth, the pilot data were collected to measure specific clinical trial endpoints (i.e., measures of reasoning, memory, and processing speed that would be intervention outcomes in the main ACTIVE cognitive training trial); hence not all measure selections were made to elucidate specific neuropsychological processes. This could be problematic when comparing this study's findings with that of other studies employing neuropsychological testing in older adults. Finally, neuropsychological testing standards were not followed in the pilot study. Group testing was partially used, and all memory tests were written. This raises the issue of data quality; however, as a clinical trial study, there were very high testing standards that help to obviate this concern.

Broader Theoretical and Empirical Implications

With these caveats in mind, we believe that the implications for this study and its findings are many. First, this study adds to the growing literature that recognizes the critical need for proper standardization of more cognitive measures and the importance of accounting for cultural and health factors that appear to have a mediating effect on cognitive test performance. Additionally, this study might be taken as supportive of the notion that African American older adults are more frequently misdiagnosed or misclassified with a cognitive impairment than their European American counterparts. We hope that our study's findings, particularly for Aim 3, might serve as a model for considering cognitive and neuropsychological test performance in African American relative to European American older adults in the future. In a larger, more representative

sample, generalized correction equations could be developed to control for some of the largest sources of consistent ethnic group differences. We wonder if the use of correction equations could have clinical utility and be implemented into the assessment behavior of practitioners who work with ethnically diverse elders. More work is needed to lessen cultural bias in test measures, or to develop new measures that are culturally fair.

Nevertheless, there is the question of whether adjusting norms or test scores of African American older adults would preclude proper diagnosis of real cognitive impairment or disease. In the real world, the idea of "adjusting the score" is not so clear-cut. On a list memory task, there is a real difference between someone who remembers three words and someone who remembers six. The current work clearly supports a growing body of research that suggests that the reason for a score difference may be related to education and acculturation and health factors. Nonetheless, the three-point difference persists. The question is whether, regardless of the source of the differences, they highlight a potential functional or practical disadvantage for those performing more poorly.

Thus, in contemplating persistent score differences between ethnic groups, it is important to attend more to the resulting functional differences, particularly the activities of daily living that might be impaired, and ways to remediate this functional impairment. It is important to note, however, that while there is the possibility that poorer cognitive performance on unadjusted measures is real, previous research suggests the opposite; when comparing assessment using cognitive or neuropsychological testing versus the gold standard of DSM and NINCDS – ADRDA criteria, far more African American older adults are falsely diagnosed with dementia using the neuropsychological assessment

method (Fillenbaum, et. al., 1990; Gurland, et. al., 1992). More work is needed not only to identify real cognitive impairment in African American older adults, but also to reduce the high rate of false positive diagnosis of dementia.

More likely, it is important to consider whether the cognitive test performance differences between African American and European American elders could be indicative of differences in cognitive reserve between the groups. Cognitive reserve refers to the ability for the brain, or mind, to experience insult (through aging or traumatic brain injury, etc.) but still operate effectively (Stern, 2002). An important aspect of cognitive reserve is higher levels of intelligence and educational and occupational attainment, which provide for less relative impairment resulting from cognitive decline (Stern, 2002). For example, Singer, Lindenberger, and Baltes (2003) using the Berlin Aging Study data, showed that there was a persistent level difference between high- versus low-educated individuals across the adult lifespan. Both education groups declined at a similar rate, but because education meant that decline was starting from a higher level, it took high-educated individuals longer, on average, to reach any "low performance" thresholds. Given the differing levels of average intelligence and educational and occupational achievement, it is possible that European American older adults showed higher cognitive test performance and less “low memory” classification due to increased cognitive reserve. If this is the case, then an important next question is investigating ways that African Americans might boost their cognitive reserve.

Indeed, we have evidence that may be directly supportive of this notion in the current study. Related to this cognitive reserve hypothesis to explain the observed group differences is our finding that learning and percent retention (forgetting) were the same

for the two groups. There are various explanations for this finding. First, it could be that since the learning and percent retention scores are based on difference scores, these dimensions are less sensitive to group differences due to lower reliability and smaller ranges. However, we used *composite* scores made of *three different* tests for the learning and percent retention indicators, which makes this psychometric issue less concerning. A second hypothesis is the idea that trial-to-trial learning and percent retention are measures of "online processing", rather than stored cognitive reserve. In the language of life-span psychology, learning and percent retention may also be conceptualized as the "mechanics" of cognition (Baltes, 1999; Horn & Catell, 1966), while the other cognitive dimensions (i.e., language, memory, reasoning) are more reflective of acquired skills from acculturation and education over the life span. Salthouse (1999) refers to these latter constructs as "products of past processing," and they can also be thought of as crystallized abilities or the "pragmatics" of cognitive ability (Baltes, 1999; Horn & Catell, 1966).

Since the pragmatics of cognition reflect acculturation and lifetime opportunity structures, it is understandable that these cognitive dimensions might be more sensitive to ethnic group differences, given the disparities in education and socioeconomic status. In the case of list memory, for example, while the number of words initially remembered may be determined by lifetime verbal knowledge, or cognitive reserve (i.e., it is harder to remember words you cannot understand or do not use), this initial recall is controlled for in the calculation of learning and percent retention because it is subtracted out. We speculate whether immediate, "online processing" tasks are less reflective of stored past processing, but rather indicate current cognitive efficiency. If this is the case, we can be

optimistic about the relative absence of *real* cognitive differences between our groups. In accordance, we note the importance of delayed recall (computed as a difference between immediate recall and later recall) as an important measure for identifying mild cognitive impairment. By placing particular emphasis on such an "online processing" task, the use of delayed recall or forgetting may not put African American elders at the same evaluative disadvantage as many other measures.

Hence, we can now move towards beginning to think about a macro-level, public health approach to boosting cognitive reserve in African Americans across the lifespan, and in this way, work to attenuate the vast health disparities between minority and majority groups in the U.S. As stated previously, African Americans are at greater risk for developing conditions such as hypertension, diabetes, heart disease and stroke, as well as vascular dementia. Though the overall health status of Americans has improved over the years, these improvements have been greater for European Americans and the gap in health has increased between the two groups (Berkman & Mullen, 1997). As the present study along with many other studies has demonstrated, these health gaps in combination with less formal educational attainment by African American adults (e.g., Harper & Alexander, 1990) have a great impact on cognitive performance and risk for impairment status in aging.

Public health initiatives, such as “Healthy People 2000” and “Healthy People 2010” have been implemented to reduce or eliminate the disparities, but they have not been fully successful (Whitman, 2001). More programs are needed to promote prevention and early detection and treatment of common chronic health conditions in the African American community. Additionally, improvement in public education is a

mechanism for reducing disparities. It is important to note how education is connected to health status, as higher educational attainment leads to more economic and social resources that make it possible to obtain more adequate health care. One example of an educational initiative is the "Head Start" program. This and other programs are desperately needed across the lifespan to prevent some of the cognitive problems common among African American elders.

Future Directions

There are various directions this line of research may take. First, and most obvious, is the continued effort to develop normative data for existing cognitive and neuropsychological tests for African American older adults. Along with the efforts to develop African American norms for the CERAD and the CCNB test batteries, another effort is to extend the Mayo Older American Norms Study to include African American norms by the Mayo Clinic in Jacksonville, FL. There is also the San Diego African American Neuropsychological Norms Project (e.g. Evans et al., 1999) and the Normative Studies Research Project Battery in Detroit, MI (Litchenberg et al., 1998). These and other norming projects will help in reducing misclassification and misdiagnosis of African American elders with regards to cognitive and neuropsychological functioning. Nevertheless, one challenge becomes disseminating these specialized norms, such that practicing clinicians, who assess minority patients, use them. Their use, for example, can clearly extend the time and effort needed to use information from a neuropsychological assessment, which is a difficulty in already time-pressed practitioners. Secondly, since most of these norms are based on regional samples of African Americans, there is concern that due to the heterogeneity of African Americans in the US, all norms may not

be generalizable to the general population of African American older adults (Fillenbaum et al., 2001).

A second direction is the development of culturally – sensitive measures that take into account the unique culture of African Americans, as well as other ethnic minority groups. One approach is to operationally define performance or competence in everyday cognition that is culturally appropriate. Measures of everyday cognition are considered more ecologically valid and could provide a less-biased measure of cognition, due to its strong relationship to fluid abilities (Schaie, 1990). In one study, the utility of the Everyday Problems Test (EPT) in African Americans was explored, and it found the EPT to have high split-half reliability and concluded that it is an appropriate measure for use with African American samples of adults (Whitfield et al., 1999). Another study used a less studied dementia screening measure (FOME) and found it have better clinical utility in African Americans than the MMSE (Mast et al., 2001).

Other approaches include the “emic” and “etic” approaches to assessment, in which “emic” methods focus on developing specific measures for use with African Americans, while “etic” methods attempt to create “cultural – free” tests (Manly & Jacobs, 2002). While these approaches can be advantageous, there are disadvantages, including the possibility for there to eventually be an overwhelming number of tests and the challenges associated with developing a truly “culture-free” measure (Manly & Jacobs, 2002).

Finally, as mentioned above, a third line of future research is the implementation of intervention programs to address disparities in education and health. One challenge in this area is determining the appropriate point across the life span to intervene, such that the effects might be felt in late life. Naturally, education intervention would work easiest

and best during childhood, allowing individuals to build up their cognitive reserve. Nonetheless, studies, particularly the ACTIVE clinical trial, have shown that older adults can achieve cognitive gains from cognitive training (Ball et al., 2001). Furthermore, health interventions and prevention programs may be implemented at any point in the lifespan, though there is the possibility that some interventions may not be as effective later in life. However, preliminary findings suggest that, in the full ACTIVE trial, there was no difference between African American and European American elders in the magnitude of training-related improvement, suggesting that late-life training may be at least as efficacious for older persons of color as it has been shown to be in European American elders (Michael Marsiske, personal communication, January 2004).

As the minority older adult population continues to grow, the challenges and issues addressed and discussed in this study become more salient. It is critical that both future research and clinical practice are informed by this and related research, so as to discover more about African American older adults and the African American community in general. This community has long been ignored in research, and it is due time to remedy this under-representation and implement ways of improving the lives of this often underserved group.

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BIOGRAPHICAL SKETCH

My academic and research interest in aging began when I was an undergraduate student at Florida A&M University. During this time, I was a Distinguished Scholar, with a full academic scholarship. After graduating summa cum laude and earning a Bachelor of Arts in psychology in three years, I was accepted to the Department of Clinical and Health Psychology doctoral program at the University of Florida. Upon acceptance, I was awarded a University of Florida Alumni Fellowship. Last summer, I was named a Minority Aging Network in Psychology (MANIP) 2003 Fellow for APA's Minority Fellowship Program. More recently, I received an outstanding poster award for this work at the seventeenth annual University of Florida College of Public Health and Health Professions Research Fair. Broadly defined, my research interests are in the cognitive and public health aspects of aging in ethnic minority older adults.