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Disparities Among Older Adults in Measures of Cognitive Function by Race or Ethnicity

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This study examined racial or ethnic differences in cognitive function, cross-sectionally and longitudinally, using survey data from the Asset and Health Dynamics Among the Oldest Old. A version of the Telephone Interview for Cognitive Status (TICS), proxy assessments of cognition, and difficulties in performing daily tasks were assessed. Blacks performed below Whites on the TICS at baseline and on proxy assessments of cognition. TICS score declined with age for Whites and Blacks, with some relative gains for Blacks. At baseline, Blacks more often had difficulties in performing daily tasks, with some increase in difficulties relative to Whites with age. Differences between other groups and Whites were smaller than those between Blacks and Whites.

DECLINING cognitive function is a determinant of several unfavorable outcomes among elderly individuals, including increases in limitations in activities of daily living (ADLs; Fillenbaum, Peterson, Welsh-Bohmer, Kukull, & Heyman, 1988; Freedman, Martin, & Schoeni, 2002; Zsembik, Peek, & Peek, 2002). It often leads to placement in a nursing home (Branch & Jette, 1982; Kelman & Thomas, 1990), hospitalization, and death (Sloan & Taylor 2002). In spite of its importance to health, functioning, and for maintaining independence, few studies have examined differences in cognitive function among the elderly population by race or ethnicity (see, e.g., Bohnstedt, Fox, & Kohatsu, 1994; Whitfield et al., 2000; also see Bohannon, Fillenbaum, Pieper, Hanlon, & Blazer, 2002; Cagney & Lauderdale, 2002). Until recently, data have been lacking to assess longitudinal trajectories in cognitive function by race or ethnicity. Research on differences in cognitive performance among older adults has been impeded by lack of information on antecedents of observed differences among elderly individuals and a lack of measures on cognitive function that are valid for various racial and ethnic groups.

Starting in early life, cumulative disadvantage, which is associated with race or ethnicity, may affect functioning in late life (Kelley-Moore & Ferraro, 2004). A person's cognitive performance after the age of 70 years plausibly reflects the person's endowments at birth as well as the history of events and experiences occurring during childhood and early adulthood, middle age, and late life. Cognition in young adulthood reflects a combination of genetic endowment and health at birth (Gottfredson, 2004; Hack et al., 2002), amount and quality of schooling received (Hanushek, 2002; Margo, 1994), parental inputs (Repetti, Taylor, & Seeman, 2002; Shaw, Krause, Chatters, Connell, & Ingersoll-Dayton, 2004), and peer effects (Brody, Kim, Murry, & Brown, 2003). From early to late adulthood, people differ in the cognitive demands of work (Amick et al., 2002; Schooler & Mulatu, 2001) and stress (House, 2002; Mendoza-Denton, Downey, Purdie, Davis, & Pietrzak, 2002), both at home and at work. Material deprivation, caused by low income and wealth, may negatively affect cognitive performance of elderly individuals (Cagney & Lauderdale, 2002; Hack et al.). Particularly in late middle age and thereafter, adverse health events, such as various neurological and psychiatric diseases and diseases of other organ systems (Mehta, Yaffe, & Covinsky, 2002; Rosenblatt, Mehta, Romanoski, Eaton, & Lyketsos, 2003), cause impaired cognition. Among socioeconomic variables, the best documented association is between educational attainment and performance on cognitive tests. Health and wealth are at least weakly linked over the life course (Adams, Hurd, McFadden, Meskill, & Ribeiro, 2003). A person who is poor at age 20 and at age 40 is much more likely to be poor at age 70. By measuring cross-sectional and longitudinal differences in cognitive performance in late life, with and without such covariates as income, one can at least narrow alternative explanations for observed differences. With panel data methods, effects of time-invariant determinants of cognitive status may be eliminated as confounding factors.

We addressed four issues in this study. First, what are cross-sectional differences in cognitive performance of persons over the age of 70 years by race or ethnicity? Second, to what extent do the differences depend on how cognitive performance is defined? Third, what are longitudinal differences by race or ethnicity in patterns of cognitive decline by age? Fourth, how does controlling for other factors affect observed differences in late life by race or ethnicity at a point in time and over time? Are differences reduced after one controls for contemporaneous health and wealth?

In this study we used data from four waves of the Study of Asset and Health Dynamics Among the Oldest Old (AHEAD), a national panel survey of U.S. households headed by individuals over the age of 70 in 1993. Although many antecedents of health and function in late life are not documented, the data are unique in containing consistent measures of cognition, health, and income and wealth on a large, nationally representative sample of elderly persons over several years. We examined effects of race or ethnicity on cognitive performance by using three alternative measures. Each measure has positive attributes, but each is subject to potential bias, albeit for different reasons.

The study's contribution is that it measures cognitive performance by using alternative approaches, which allows an

assessment of robustness of findings, in a longitudinal panel spanning 7 years. To mitigate confounding from other influences including socioeconomic characteristics and health status, and to permit comparisons with unadjusted differences by race or ethnicity, we also included such explanatory variables as self-reported physical and mental health, marital status, vision and hearing limitations, and income and wealth.

Methods

Data

AHEAD is a national panel survey of U.S. households. When the first wave was conducted in 1993, the survey sampled noninstitutionalized persons aged 70+ years and their spouses or partners, who could be any age. Follow-up interviews of the same sampled persons were conducted in 1995, 1998, and 2000, irrespective of their living arrangements. In 1998 and 2000, AHEAD was merged with the Health and Retirement Study (HRS), a panel survey of persons who were primarily aged 51 to 61 when initially interviewed in 1992.

Sample Construction

We excluded respondents who were younger than 70 at baseline from our analysis, yielding a sample of 7,443 at Wave 1. In follow-up interviews, observations were lost because of death or other reasons for sample attrition. Over 10% of respondents typically died between two consecutive waves, and attrition for reasons other than death was between 6% and 7%. Combining observations from waves yielded a sample of 23,120 observations. Some analyses excluded cases in which proxy respondents were used, which reduced the number of observations to 19,964.

Cognition Measures

Cognitive performance reflects a variety of abilities, including memory, conceptual and spatial skills, and use of language (Suthers, Kim, & Crimmins, 2003). Measures available in AHEAD permitted us to assess cognition in three ways, using (a) a cognition test administered to persons who could respond to cognition questions; (b) assessments by proxy respondents of the respondent's cognitive performance for persons who could not respond to the cognition questions for reasons of poor physical health, low cognition, or other factors; and (c) daily activities that rely on cognition and other skills, based on answers by sample persons who responded to the survey questions or answers provided by proxies.

Cognition test.—AHEAD included a battery of identical questions in each wave to elicit the cognitive performance of respondents. This summary measure was based on a modified version of the Telephone Interview for Cognitive Status (TICS) and tests of immediate and delayed verbal recall (Brandt, Spencer, & Folstein, 1988; Herzog & Wallace, 1997). These questions included a memory test based on word recall, a working memory measure based on a serial 7s subtraction test, and a test of knowledge, language, and orientation, which involved naming objects, answering vocabulary questions, and answering such questions as responding to today's date. In our basic specification, we assigned missing values a value of 0.

The word recall test required respondents to remember as many words as possible from a list of 10 words provided by the interviewer. Respondents were then asked to recall the list of words twice: immediately after and 5 min after the list of words was administered (maximum, 20 points). The serial subtraction test required the respondent to subtract 7 from 100 five times (maximum, 5 points). Respondents were also asked to count backward starting from 20 to 10. If the respondent did not perform this task correctly the first time, the person was asked to repeat the exercise. We assigned values of 2, 1, or 0, depending on whether the respondent counted backward correctly, either the first time, the second time, or not at all.

The knowledge, language, and orientation test asked respondents the month, day, year, and day of week of the interview (maximum, 4 points). The naming of objects exercise required the respondent to name the following: the thing used to cut paper; the prickly plant that grows in the desert; the current U.S. President; and the current U.S. Vice President (maximum, 4 points). The maximum score was 35 points, with the word recall, subtraction test, and knowledge, language, and orientation components having maximum scores of 20, 5, and 10, respectively.

The cognitive tasks represented a range of difficulty levels, with naming tasks being the easiest and the recall and the serial 7s tasks being the most difficult. The survey used a combination of in-person and telephone interviews. Herzog and Rodgers (1999) found no difference in measured performance depending on whether the cognitive test was conducted over the telephone or in person.

Proxy assessments of sample persons' cognitive performance.—Proxy respondents were used when the sample person was unable to respond because of illness, refusal to cooperate, or inability to understand the interviewer's language (14% of cases). Proxy respondents were asked to respond to questions about a sample person's cognitive status on a 5-point scale ranging from *excellent* to *poor*. We specified binary variables, classifying responses from excellent through fair as *good* (= 1) and poor as *bad* (= 0). The dependent variables were (a) exercised good judgment; (b) had good memory; (c) had good organizational ability; and (d) did not wander off.

Herzog and Rodgers (1999), using AHEAD Wave 2 respondents, compared cognitive performance on the aforementioned test among persons they could interview who required a proxy with those who could respond on their own. Not surprisingly, there were large differences in performance. Respondents represented by a proxy but who took the test anyway had a mean score of 9.5 on the cognitive test just described, compared with 20.1 for persons without a proxy.

Ability to perform personal tasks.—The third set of dependent variables was based on measures of personal activities requiring some, but not exclusively, cognitive skill (Foley, Heimovitz, Guralnik, & Brock, 2002; Stutts, Stewart, & Martell, 1998). The binary variables for self- or proxy-reported ability to perform personal tasks, several of which were limitations in instrumental activities of daily living (IADLs), were 1 if the person had difficulty in (a) preparing hot meals, (b) shopping for groceries, (c) making telephone calls, (d) taking medication, (e) driving, (f) managing money, and (g) using

a map (to figure out how to get around in a strange place). We coded persons unable to do the task at all as having difficulty and assigned them a value of 1.

Except for ability to drive and manage money, questions about specific tasks followed affirmative responses to this screening question: "Because of a health or memory problem, do you have any difficulty in . . . (list of tasks)?" In Wave 1, the question specified whether help was needed rather than whether the respondent had difficulty in performing the task. Thus, the responses were not exactly comparable over time. For this reason, and to account for secular trends not otherwise accounted for by the explanatory variables, in the longitudinal analysis, we included binary variables for individual waves with Wave 1, the omitted reference group.

For driving, the survey did not specify whether driving or not driving was due to a health or memory problem in any wave. In Wave 1, the question about managing money was worded as difficulty in general. Beginning with Wave 2, the survey asked specifically whether the difficulty was attributable to a health or memory problem. This change in the way the question was posed accounts for a decrease between Waves 1 and 2 in the fraction of sample persons who had difficulty in managing money.

The tasks with the highest proportions of persons having difficulty were using a map and driving. As with the proxy assessments, we excluded observations with missing values for the particular activity.

Explanatory Variables

Explanatory variables for race and ethnicity were White (omitted reference group), Black, Hispanic, and other race. Because Hispanics could be of any race, we assigned all persons who self-reported as being Hispanic to the Hispanic category; others were classified as either White, Black, or other race. Although other race is likely to have been predominately Asian, AHEAD did not release any data on national origin in its public use file. Other demographic variables were age, gender (male = 1), marital status (currently married = 1), and educational attainment (in years), and self-reported measures of an emotional, nervous, or psychiatric problem, depressive symptoms, vision and hearing impairments, and overall health.

The variable for depressive symptoms was based on an abridged (8-item) version of the 20-item Center for Epidemiological Studies–Depression (CES-D) scale to measure depression level (Radloff, 1977). The survey asked the respondent to rate his or her vision and hearing on a 5-point scale ranging from *excellent* to *poor* and, for vision, allowed for a sixth type of response that the person was legally blind. We defined a variable for "visually impaired" if the person responded that his or her vision was poor or if he or she was legally blind. For hearing, we defined the person as "hearing impaired" if he or she reported poor ability to hear. We included measures of household income, wealth, and a binary variable for negative net worth, set to 1 if the household's liabilities exceeded its assets. When net worth was negative, we set the continuous variable for wealth to 0.

In the analysis of personal tasks, we included a binary variable indicating whether the information on difficulty with performing the task was provided by a proxy or the respondent. The cognitive test was only administered to sample persons who did not use a proxy. Proxy assessments of cognition were only asked when a proxy respondent was used.

Estimation

We performed both a cross-sectional analysis, based on Wave 1 data, and a longitudinal analysis based on data from all four waves. In the longitudinal analysis, we used person-specific (individual) fixed effects and a time trend to measure the effects of aging. By accounting for omitted heterogeneity, individual fixed effects accounted for unobserved factors related to attrition and other time-invariant factors. Parameter estimates on the time trend variables in the longitudinal analysis show the relationship between age and the dependent variables for the omitted reference group, Whites. By interacting the time trend (minimum, 0; maximum, 7) with binary variables for Black, Hispanic, and other races, we could assess differences in the age trajectories between Whites and the other race or ethnicity groups. AHEAD's Wave 1 did not obtain information about ability to use a map; our cross-sectional analysis of using maps was based on Wave 2 and our longitudinal analysis was based on Waves 2–4.

Our main purpose in the longitudinal analysis was to assess trajectories in indicators of cognitive performance as persons grew older. The individual fixed effects controlled for age at entry to the sample. In the longitudinal analysis, we only included covariates that were time varying. We excluded race or ethnicity (not interacted with the wave binary variables), gender, and educational attainment from this analysis.

When the dependent variable was the TICS score or one of its components, we used ordinary least squares. When the dependent variable was a binary in cross-sectional analysis—proxy versus self-report, cognitive assessments by respondents requiring a proxy, and ability to perform personal tasks at Wave 1—we used logit regression (STATA, version 7.0). When the dependent variable was a binary variable in the longitudinal analysis, we used a linear probability model. Although STATA contained software for logit analysis with fixed effects, this program was impractical for our study, given the large number of individual fixed effects in our analysis. We also used a linear probability model in the cross-sectional analysis to permit a comparison of the findings with results from the logit analysis.

Results

Trends in Cognitive Test Scores and in Limitations in IADLs

Median and mean total cognitive test scores for Whites at Wave 1 were 21 and 20.1, respectively, out of a maximum total score of 35. Mean scores for Blacks, Hispanics, and other race were significantly lower than for Whites (all $p < .001$), with 14.3 for Blacks, 15.4 for Hispanics, and 15.8 for other race. In addition, Whites were much less likely than the other groups to have scored 10 or less.

Mean scores on the TICS for Whites and Blacks declined from 1 to 2 points from Wave 1 through Wave 4, a 7-year period. Scores for Hispanics decreased less than this, whereas scores for persons in the other-race category increased.

Table 1. Cognition Test Results at Wave 1

	Total Test Score		Word Recall		Subtraction Test		Knowledge, Language, and Orientation	
Variable	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Black	−3.46	0.19***	−1.30	0.13***	−1.11	0.06***	−1.06	0.07***
Hispanic	−0.91	0.30**	−0.13	0.19	−0.30	0.10**	−0.48	0.10***
Other race	−3.10	0.58***	−1.30	0.40***	−0.86	0.18***	−0.90	0.20***
Age	−0.30	0.01***	−0.20	0.01***	−0.04	0.00***	−0.06	0.00***
Male	−0.47	0.13***	−0.88	0.09***	0.45	0.04***	−0.04	0.04
Married	0.20	0.14	0.13	0.10	−0.04	0.04	0.09	0.04*
Years of education	0.60	0.02***	0.28	0.01***	0.18	0.01***	0.14	0.01***
Had psychological problem	−0.40	0.22	−0.13	0.15	−0.06	0.07	−0.23	0.07***
Visually impaired	−0.65	0.24**	−0.30	0.16	−0.12	0.08	−0.24	0.08**
Hearing impaired	−1.06	0.31***	−0.66	0.19***	−0.16	0.10	−0.21	0.11*
CES-D score	−0.31	0.04***	−0.19	0.03***	−0.06	0.01***	−0.06	0.01***
Very good health	0.22	0.22	0.04	0.17	0.12	0.07	0.06	0.06
Good health	−0.26	0.22	−0.34	0.16*	0.08	0.07	0.01	0.06
Fair health	−0.38	0.24	−0.44	0.17**	−0.01	0.08	0.08	0.06
Poor health	−0.80	0.30**	−0.49	0.21*	−0.21	0.09*	−0.10	0.09
Net worth (in 10,000)	0.0011	0.0023	0.0010	0.0017	0.0012	0.0007	−0.0006	0.0005
Household income (in 10,000)	0.0104	0.0231	0.0073	0.0168	0.0017	0.0059	−0.0018	0.0029
Negative net worth	0.14	0.42	0.27	0.28	−0.28	0.14*	0.20	0.15
Constant	36.85	0.99***	20.72	0.68	3.94	0.31***	12.26	0.32***
N	6,643		6,643		6,643		6,643	
Adjusted R^2	0.38		0.25		0.30		0.29	

Notes: SE = standard error. CES-D = Center for Epidemiological Studies–Depression. Table data used ordinary least squares.
*$p < .05$; **$p < .01$; ***$p < .001$.

The mean number of difficulties in performing personal tasks increased between Waves 1 and 4 for persons in all race or ethnicity groups. Except for Hispanics, the increase was monotonic. At baseline, Whites had fewer difficulties on average than did persons in the other race or ethnicity groups; by Wave 4, the mean number of difficulties had increased by about 0.45 (out of seven tasks). Differences in the mean number of difficulties between Whites and Blacks increased between Waves 1 and 4.

Differences in Mean Values of Explanatory Variables by Race or Ethnicity

Mean age did not differ among the four race or ethnicity subsamples. However, there were particularly large differences in mean years of schooling, household income, and wealth. Whites, on average, had 11.5 years of schooling; this was in contrast to 8.4 for Blacks, 5.9 for Hispanics, and 9.9 years for other race. Mean income ranged from $27,700 for Whites to $13,600 for Blacks and $12,500 for Hispanics. Only about 1% of Whites had negative net worth. Percentages for the other groups were considerably higher; up to 6% of Hispanics had a negative net worth.

Cognitive Tests Scores: Cross-Sectional Regression Analysis

Holding other factors constant, we found that, compared with Whites, at baseline (Wave 1), Blacks' total scores on the TICS were 3.5 points lower ($p < .001$) on average (Table 1). The 3.5-point difference was considerably lower than the unadjusted White–Black difference of 5.8 points. The adjusted differences at Wave 1 between Whites and other race were nearly as large as were the adjusted differences between Whites and Blacks, at 3.1 points ($p < .001$); the adjusted differences between Whites and Hispanics were smaller, 0.9 ($p = .003$), than those between Whites and the two other groups and much smaller than the unadjusted difference of 4.7. Controlling for the other factors had a much larger effect on the difference between the scores for Whites and Hispanics than between Whites and the other two groups.

Having a higher age ($p < .001$), being of the male gender ($p < .001$), attaining lower educational levels ($p < .001$), having a sensory problem, both for vision ($p = .007$) and hearing ($p < .001$), having a higher number of depressive symptoms ($p < .001$), and being in poor health ($p = .007$) were associated with a lower total score. There were no statistically significant relationships between the total score and marital status, having ever had a psychological problem, and wealth or income. Only one coefficient on wealth or income was statistically significant at conventional levels—for negative net worth in the analysis of the subtraction test.

Almost half of the difference in total scores between Whites and Blacks and between Whites and other race reflected differences in word recall, for which there was a 1.3 difference ($p < .001$), adjusted for effects of other covariates, out of a maximum score of 20. There was no statistically significant difference between Whites and Hispanics in word recall. About half of the difference in the total scores between Hispanics and whites reflected lower scores for Hispanics on knowledge, language, and orientation. Spanish speakers could take the Spanish-language version of AHEAD, but this does not exclude the possibility of cultural biases in the test, especially on the knowledge, language, and orientation component.

For other race, the largest difference with Whites was in word recall ($p < .001$). The White–other race differential in word recall was the same as that between Whites and Blacks. Persons of other race performed slightly better than Blacks on the subtraction and the knowledge, language, and orientation tests. Persons who self-reported as being of other race were administered the English version of AHEAD.

Table 2. Age Trajectory for Cognition Test Scores, Waves 1–4

	Total Test Score		Word Recall		Subtraction Test		Knowledge, Language, and Orientation	
Variable	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Black × Years	0.06	0.03*	0.08	0.02***	−0.01	0.01	−0.003	0.01
Hispanic × Years	0.10	0.05*	0.07	0.04	0.001	0.01	0.03	0.01*
Other race × Years	0.38	0.10***	0.23	0.08**	0.07	0.03*	0.06	0.03*
Years	−0.26	0.01***	−0.18	0.01***	−0.05	0.00***	−0.04	0.00***
N	19,919		19,919		19,919		19,919	

Notes: The regressions included all of the other time-varying covariates listed in Table 1: married, psychiatric problem, vision, hearing, CES-D, self-reported health, income, and wealth. Table data used ordinary least squares with individual fixed effects.

*$p < .05$; **$p < .01$; ***$p < .001$.

Cognitive Test Scores: Longitudinal Regression Analysis

Total cognitive test scores declined over time for Whites, the omitted reference group ($p < .001$; see Table 2). With time-varying covariates included, the decline in total scores between Waves 1 and 4 for Whites was 0.26 per year ($p < .001$), about the same as the unadjusted rate of decline. Total scores declined for Blacks, but at an annual rate of 0.06 less than that for Whites ($p = .041$). This lower rate of decline reflected a lower rate of decline in word recall ($p < .001$), although scores declined for both groups. For Hispanics, total scores improved relative to Whites at a rate of 0.10 per year ($p = .028$). For other race, not only did scores improve relative to Whites ($p < .001$), but there was an improvement in total score with age, and in each of the three components of the total score.

Proxy Assessments: Probability That a Proxy was Used

Blacks, Hispanics, and persons of other race were all more likely than Whites to have had a proxy respondent (all $p < .01$ or better; see Table 3). Black ($p = .003$) and Hispanic ($p = .006$) respondents both had a 0.02 higher probability of using a proxy. Persons of other race were more likely to have used a proxy than were Blacks and Hispanics, at 0.11 higher than Whites ($p < .001$). Older persons, men, married individuals, and persons with fewer years of schooling were more likely to have required a proxy respondent (all ps $< .001$). Persons who reported that they had ever had a nervous, emotional, or psychological condition, those with vision and hearing impairments, and those in fair or poor health were more likely to have relied on proxies ($p < .001$), as were persons within low-income households ($p = .002$) or with negative worth ($p = .003$).

Proxy Assessments of Sample Persons' Cognitive Performance: Cross-Sectional Regression Analysis

Our next set of measures of cognitive functioning was based on assessments by proxy respondents—either informal caregivers (relatives, friends) or paid caregivers of the sample person (Table 4). The largest difference between Blacks and Whites was in organizational ability. Blacks were 0.19 less likely than Whites to have had good organizational ability ($p < .001$). The next largest difference was for good judgment. According to the proxy reports, Blacks were 0.11 less likely to have had good judgment ($p = .02$). There were no statistically significant differences between Blacks and Whites in the probability of having good memory or for having never wandered off. For Hispanics and other race, there were no statistically significant differences between these groups and Whites on any of the four measures.

Difficulty in Performing Daily Tasks: Cross-Sectional Regression Analysis

At baseline, Blacks were less likely than Whites to be able to perform five of seven tasks: preparing hot meals, 0.02 less likely ($p = .02$); making telephone calls, 0.02 less likely ($p < .001$); taking medication, 0.01 less likely ($p < .001$); driving, 0.16 less likely ($p < .001$); and using a map, 0.12 less likely ($p < .001$; see Table 5, marginal effects from the logit analysis). Hispanics were less able to perform five of these tasks than were Whites: preparing hot meals, 0.02 less likely ($p = .03$); shopping for groceries, 0.04 less likely ($p = .01$); making telephone calls, 0.02 less likely ($p = .004$); driving, 0.23 less likely ($p < .001$); and using a map, 0.11 less likely ($p = .006$). For other race, the only statistically significant differences compared with Whites were in preparing hot meals, 0.05

Table 3. Proxy versus Self-Report, Waves 1–4

Variable	Coefficient	SE	Marginal Effect
Black	0.18	0.06	0.02***
Hispanic	0.23	0.08	0.02**
Other race	0.86	0.15	0.11***
Age	0.08	0.00	0.01***
Male	0.21	0.05	0.02***
Married	0.31	0.05	0.03***
Years of education	−0.08	0.01	−0.01***
Had psychological problem	0.55	0.06	0.06***
Visually impaired	0.20	0.06	0.02***
Hearing impaired	0.83	0.06	0.10***
Very good health	−0.09	0.11	−0.01
Good health	0.20	0.10	0.02*
Fair health	0.58	0.10	0.06***
Poor health	1.18	0.10	0.15***
Net worth (in 10,000)	−0.0004	0.0005	−0.00003
Household income (in 10,000)	−0.03	0.01	0.00**
Negative net worth	0.38	0.13	0.04**
Wave 2	0.15	0.06	0.01**
Wave 3	0.09	0.06	0.01
Wave 4	0.17	0.06	0.02**
Constant	−8.73	0.33	***
N	23,043		
Pseudo R^2	0.15		

Notes: SE = standard error. Marginal effect is the change in the probability of using a proxy for a one-unit change in the explanatory variable.

*$p < .05$; **$p < .01$; ***p .001.

Table 4. Cognitive Performance of Persons Requiring a Proxy Respondent, at Wave 1

	Good Judgment		Good Memory		Good Organizational Ability		Has Never Wandered Off	
Explanatory Variables	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Black	−0.53	0.23*	−0.21	0.23	−0.90	0.24***	−0.67	0.45
Hispanic	0.46	0.37	0.18	0.35	0.46	0.38	−0.32	0.63
Other race	0.02	0.52	−0.41	0.47	−0.30	0.52	−0.26	1.10
Age	−0.06	0.01***	−0.04	0.01**	−0.04	0.01**	−0.03	0.03
Male	0.13	0.21	0.21	0.21	0.27	0.21	0.51	0.43
Married	0.27	0.22	−0.03	0.22	0.33	0.23	−0.61	0.48
Years of education	−0.01	0.02	−0.04	0.03	−0.02	0.03	0.01	0.05
Had psychological problem	−0.42	0.25	−0.55	0.25*	−0.41	0.26	−0.45	0.47
Visually impaired	−0.65	0.21**	−0.44	0.22*	−0.55	0.22*	−0.22	0.45
Hearing impaired	−0.10	0.22	−0.54	0.22*	0.20	0.23	0.19	0.49
Very good health	−0.08	0.44	−0.01	0.47	0.16	0.48	0.07	0.92
Good health	0.23	0.41	−0.09	0.43	0.26	0.43	0.27	0.87
Fair health	−0.21	0.39	−0.09	0.42	−0.32	0.41	0.76	0.89
Poor health	−0.83	0.39*	−1.12	0.41**	−1.41	0.40***	−0.38	0.84
Net worth (in 10,000)	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.02
Household income (in 10,000)	−0.04	0.06	−0.11	0.06	0.01	0.06	−0.03	0.09
Negative net worth	−0.69	0.44	−0.67	0.42	−0.64	0.50	−0.84	0.73
Constant	5.97	1.35***	5.15	1.29***	5.31	1.35***	5.39	2.40
N	776		783		779		779	
Pseudo R^2	0.103		0.093		0.149		0.058	
Marginal effect								
Black	−0.11		−0.04		−0.19		−0.03	
Hispanic	0.08		0.03		0.08		−0.01	
Other race	0.004		−0.08		−0.06		−0.01	

Notes: SE = standard error. Marginal effect is the change in the probability of using a proxy for a one-unit change in the explanatory variable (e.g., Black vs White). Table data used logit analyses.

*$p < .05$; **$p < .01$; ***$p < .001$.

less likely ($p = .02$) and in ability to drive, 0.26 less likely ($p < .001$).

As an alternative to logit analysis, we also estimated linear probability models (not shown). In one instance, we found a statistically significant difference at conventional levels for a race–ethnicity variable with logit but not with linear probability. In the latter analysis, the p value for preparing hot meals for Hispanics fell from .03 with logit to .08 with linear probability. The parameter estimates from the linear probability analysis imply marginal effects that are only slightly different from their logit counterparts.

Many other factors were associated with ability to perform the tasks. For example, higher wealth was associated with a higher probability of being able to drive ($p < .001$). Those with negative net worth were less likely to be able to prepare hot meals, shop for groceries, drive, or manage money. More educated persons were more likely to be able to make a telephone call ($p < .001$); drive ($p < .001$); manage money ($p < .001$); and use a map ($p < .001$).

Difficulty in Performing Daily Tasks: Longitudinal Regression Analysis

Judging from the coefficients on the trend variables, we found that ability to perform each of the seven daily tasks declined with age for Whites (Table 6); the decreases in the probability of having difficulty in performing tasks ranged from .003 per year for managing money to .021 for driving. For Blacks, ability to prepare hot meals ($p < .001$), shop for groceries ($p = .03$), and manage money ($p < .001$) declined with age relative to Whites. Relative declines were greatest for preparing hot meals and managing money. Blacks' ability to drive improved relative to Whites ($p < .001$) but declined in absolute terms. By contrast, for Hispanics, the ability to shop for groceries ($p = .02$) improved relative to Whites with age. Driving improved relative to Whites ($p = .049$), but, as for Blacks, declined in absolute terms. For other race, differences in rates of decline were statistically significant from Whites at conventional levels. This analysis controlled for time-varying covariates, marital status, health, income, wealth, and use of a proxy respondent. Coefficients on the proxy variable, all statistically significant ($p < .001$), are substantial in magnitude.

Discussion

Holding other factors likely to affect cognitive functioning constant, and using three alternative types of dependent variables, each measure subject to different kinds of potential measurement error or even bias, we found appreciable cross-sectional differences at baseline in cognitive test scores on the basis of race or ethnicity, with the largest differences being between Blacks and Whites. Including covariates reduced the differentials between Blacks and Whites and Hispanics and Whites. Longitudinal analysis spanning 7 years revealed a decline in test scores for two of the three measures for Whites, the omitted reference group. Performance on the cognitive test declined with age for Blacks and Hispanics as for Whites, but at a somewhat lower rate. Scores for the other race category actually improved with age. However, for several personal tasks, performance of Blacks declined even more than that of Whites. Persons of other race had higher scores on the cognitive test in the later waves, but their ability to perform the tasks declined at about the same rate as that for Whites. Hispanics' performance on the cognitive test declined less than did that of

Table 5. Ability to Perform Personal Tasks at Wave 1 (at Wave 2 for Use Map)

	Prepare Hot Meals		Shop for Groceries		Make Telephone Calls		Take Medication		Drive		Manage Money		Use Map	
Variable	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Logit Models														
Black	−0.30	0.12*	−0.14	0.11	−0.67	0.15***	−0.61	0.16***	−0.74	0.09***	0.10	0.10	−0.50	0.10***
Hispanic	−0.40	0.18*	−0.38	0.15*	−0.61	0.21**	−0.45	0.23	−1.02	0.14***	0.12	0.15	−0.43	0.16**
Other race	−0.73	0.32*	−0.02	0.33	−0.62	0.38	−0.30	0.41	−1.13	0.31***	0.15	0.31	−0.39	0.28
Age	−0.09	0.01***	−0.10	0.01***	−0.08	0.01***	−0.09	0.01***	−0.10	0.01***	−0.07	0.01***	−0.05	0.01***
Male	0.12	0.11	0.92	0.09***	−0.31	0.14*	0.19	0.15	1.79	0.08***	0.14	0.08	1.27	0.07***
Married	0.00	0.11	0.11	0.09	−0.19	0.15	−0.25	0.15	0.14	0.08	−0.66	0.08***	0.29	0.07***
Years of education	−0.02	0.01	0.02	0.01	0.07	0.02***	0.00	0.02	0.09	0.01***	0.07	0.01***	0.14	0.01***
Used a proxy	−2.25	0.13***	−1.92	0.11***	−2.63	0.16***	−2.88	0.18***	−1.78	0.11***	−1.99	0.10***	−1.79	0.11***
Had psychological problem	−0.32	0.14*	−0.31	0.12**	−0.18	0.17	−0.40	0.18*	−0.07	0.11	−0.30	0.11**	−0.25	0.10*
Visually impaired	−0.87	0.12***	−1.19	0.11***	−0.97	0.15***	−0.60	0.16***	−1.48	0.13***	−0.86	0.11***	−0.99	0.11***
Hearing impaired	0.09	0.15	0.12	0.14	−0.51	0.18**	−0.13	0.19	0.26	0.13*	0.01	0.13	−0.30	0.13*
CES-D score	−0.16	0.03***	−0.16	0.02***	−0.15	0.04***	−0.10	0.04*	−0.08	0.02***	−0.06	0.02***	−0.09	0.02***
Very good health	−0.50	0.30	0.04	0.19	−0.28	0.36	−0.30	0.39	−0.13	0.13	−0.14	0.16	0.04	0.12
Good health	−0.99	0.28***	−0.53	0.18**	−0.83	0.33*	−0.80	0.36*	−0.44	0.12***	−0.44	0.15**	−0.20	0.12
Fair health	−1.37	0.28***	−1.07	0.18***	−0.76	0.33*	−0.88	0.36*	−0.61	0.13***	−0.77	0.15***	−0.43	0.13***
Poor health	−2.38	0.28***	−2.19	0.19***	−1.07	0.33***	−1.66	0.36***	−1.35	0.15***	−1.00	0.16***	−0.49	0.15***
Net worth (in 10,000)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00***	0.00	0.00	0.00	0.00
Household income (in 10,000)	0.01	0.02	0.02	0.03	0.00	0.04	0.03	0.04	0.05	0.03	−0.01	0.01	0.01	0.01
Negative net worth	−0.57	0.24*	−0.46	0.21*	−0.36	0.28	−0.81	0.29**	−0.78	0.21***	−0.47	0.21*	−0.31	0.23
Constant	11.91	0.74***	10.74	0.59***	10.53	0.94***	12.27	1.02***	8.14	0.50***	7.49	0.52***	3.17	0.50***
N	7,431		7,431		7,431		7,431		7,428		7,431		6,204	
Pseudo R^2	0.283		0.318		0.313		0.327		0.329		0.197		0.254	
Marginal effects														
Black	−0.02		−0.01		−0.02		−0.01		−0.16		0.01		−0.12	
Hispanic	−0.02		−0.04		−0.02		−0.01		−0.23		0.01		−0.11	
Other race	−0.05		0.002		−0.02		−0.01		−0.26		0.02		0.10	

Notes: SE = standard error; CES-D = Center for Epidemiological Studies–Depression scale. Marginal effect is the change in the probability of using a proxy for a one-unit change in the explanatory variable (e.g., Black vs White). Only results for the race and ethnicity variables are shown for the linear probability models. These regressions include all the covariates used in the logit analysis.

*$p < .05$; **$p < .01$; ***$p < .001$.

Whites, but, with one exception, Hispanics did not improve relative to Whites in performing personal tasks.

The compression in performance between Whites and other race and Whites and Hispanics plausibly reflected some recent immigrants' increased familiarity with life in the United States. Another possibility is that they had less familiarity with responding to household surveys initially, and they learned how to respond to cognition questions over time. Such learning is evident in a temporary improvement in scores at Wave 2, which eventually was offset by the effects of aging on test performance.

Both the baseline differences in all three measures and the lack of convergence between elderly Blacks and Whites are troublesome. For one, they may reflect a continuing legacy of segregation and discrimination. For another, they many reflect a differential need for support (such as for formal care) that is not being currently met by the public sector. Differences persisted in our analysis even after we accounted for variation in educational attainment, marital status, health, income, and wealth, and, for the personal tasks, a binary variable for proxy status, all of which differed systematically between Blacks and Whites.

In the longitudinal analysis, we accounted for time-varying changes in health and wealth and income and in marital status. Trajectories of these variables by race or ethnicity differ over the life course. By including measures of levels in late life, we

Table 6. Age Trajectory for Ability to Perform Personal Tasks

	Prepare Hot Meals		Shop for Groceries		Make Telephone Calls		Take Medication		Drive		Manage Money		Use Map	
Variable	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Black × Years	−0.010	0.002***	−0.005	0.002*	−0.001	0.002	0.001	0.002	0.007	0.002***	−0.007	0.002***	0.006	0.004
Hispanic × Years	−0.002	0.003	0.007	0.003*	0.003	0.003	0.003	0.002	0.005	0.003	0.003	0.003	0.006	0.006
Other race × Years	0.003	0.006	−0.002	0.006	0.001	0.005	−0.007	0.005	0.006	0.005	0.002	0.006	0.002	0.012
Years	−0.013	0.001***	−0.011	0.001***	−0.011	0.001***	−0.007	0.001***	−0.021	0.001***	−0.003	0.001***	−0.008	0.002***
Proxy	−0.330	0.009***	−0.271	0.011***	−0.312	0.009***	−0.258	0.008***	−0.206	0.009***	−0.319	0.010***	−0.241	0.018***
N	23,023		23,023		23,025		22,939		23,026		23,026		15,582	

Notes: SE = standard error. The regressions also include the other covariates listed in Table 5 and used ordinary least squares with individual fixed effects.

*$p < .05$; **$p < .01$; ***$p < .001$.

accounted for this. Low earnings in early and midlife are likely to be reflected in low wealth in late life, as are differences by race or ethnicity in lifelong attachment to the labor force (Antecol & Bedard, 2004). Although a person's health is likely to fluctuate over time, on average, poor health earlier in the life course is likely to be associated with poorer health in late life.

The longitudinal analysis with fixed effects eliminated influences of time-invariant factors, both those measured, such as educational attainment and gender, and those not measured by AHEAD, such as genetic endowment, cumulative effects of stress, and relative lack of intellectual or stimulating job opportunities, with one important caveat. If there are interactions between race or ethnicity and these omitted factors, then a panel data analysis with fixed effects does not eliminate the influence of these factors.

We assumed that respondents who did not answer a particular question on the cognition test did not really know the answer. Making the opposite assumption, that the person knew the answer, produced few differences in findings.

Any one measure of cognition may be subject to specific biases. In our study, we allowed for differences in measurement tools and in evaluators of the sample persons' cognitive status. With one of the three measures, the evaluators were often relatives or friends of the sample person. Another measure relied completely on self-responses, but there may be differences in test validity related to race or ethnicity. The third mainly relied on self-responses, with a minority of responses coming from proxies (14%); this measure related to specific activities in which persons of all races and ethnicities commonly engage, rather than on responses to a test. Relative to the other two measures, measures of difficulty in performing daily activities are less direct measures of cognitive performance. To account for other influences on the dependent variables, we included covariates, such as for physical health, education, and, in specifications not shown, family income. If there are biases, it seems very unlikely that the biases are all in the same direction.

Even though our analysis was more comprehensive in using a panel and in the range of dependent variables included, our findings are consistent with previous research showing differences by race or ethnicity in cognitive performance, even with controls for such variables as educational attainment (Branch & Jette, 1982; Shapiro & Tate, 1991; Herzog & Wallace, 1997; Leveille et al., 1998; Whitfield et al., 2000). A recent longitudinal analysis with limitations in ADLs as the measure of disability found a gap between Black and White elderly people, but, controlling for various socioeconomic and health variables, the researchers found that the trajectories of disability by race were not statistically different (Kelley-Moore & Ferraro, 2004). The researchers concluded that the evidence supported "persistent inequality." In our analysis, with different measures of activity limitations, there was some widening of the differential on several measures. The differences in mean cognitive scores reflected higher relative frequencies of very low scores and scores in the lower middle range for Blacks, other non-Whites, and Hispanics than for Whites. Differences in relative frequency at the upper range of scores did not differ according to race or ethnicity.

On appropriateness of the cognitive measures, other well-controlled studies using other measures of cognitive function, such as the Blessed Dementia Scale (Proctor et al., 1997) and the Short Portable Mental Status Questionnaire, including apolipoprotein E genotype (Fillenbaum, Heyman, Prosnitz, & Burchett, 1999; Fillenbaum et al., 2001), also obtained significant differences in cognitive performance by race.

Cross-sectional differences in cognitive performance between Blacks and Whites have been attributed to poorer physical health for Blacks, as measured by higher prevalence of diseases known to affect cognition, such as hypertension, diabetes mellitus, high cholesterol, myocardial infarction, and lower levels of physical activity and fitness (Dustman, Emmerson, & Shearer, 1994; Izquierdo-Porrera & Waldstein, 2002). However, when we included self-reports of mental and physical health, we still found Black–White differences. Including physical health measures reduced the measured disparities but did not eliminate them; this result is consistent with evidence from studies on more limited populations, such as patients discharged from a hospital (Proctor et al., 1997).

Several study limitations should be acknowledged. First, although we have documented patterns of racial and ethnic disparities, we could not sort out reasons for the cross-sectional and longitudinal patterns we documented. The term *racial disparities* is widely used, but what role race plays in empirical analysis critically depends on what else is held constant. Our analysis controlled for many other factors associated with race or ethnicity.

Second, this study was based on a single cohort. Particular cohorts have unique characteristics that reflect their life cycle experiences in part. For example, many Blacks in our study grew up under Jim Crow. All persons experienced the Great Depression or its aftermath and World War II as children. Many Hispanics and persons of other races were recent immigrants to the United States. Some empirical evidence suggests that disparities in cognitive performance among elderly people between Blacks and non-Blacks may be declining over time (Freedman et al., 2002), a pattern not reflected in our analysis of a single cohort but perhaps present over several cohorts.

Third, we have assumed that effects of various covariates on cognitive status are unidirectional. In fact, cognitive performance may have important effects on income, wealth, and health (Adams et al., 2003). Although our fixed effects analysis somewhat mitigates the effects of reverse causality, it does not eliminate this source of bias entirely. For any individual, a decrease in cognitive performance could lead to a reduction in income for the person's household or possibly the reverse if income transfers are included. Understanding the dynamics among health, wealth, income, and cognition is an important task for future research.

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