

EXTENDED ABSTRACT

Educational Differences in the Rate of Cognitive Decline

Kristen Suthers and Eileen Crimmins

Background

Persons with higher education are less likely to be cognitively impaired in old age. (Christensen, Hofer, MacKinnon, Korten, Jorm, et al., 2001; Butler, Wesson, & Snowdon, 1996). More years of education and subsequent cognitive stimulation may enable individuals to develop greater “cognitive reserve” or neurological alterations in the brain that act as a protective mechanism against cognitive decline (Stern, 1999). Previous studies have demonstrated that well-educated older adults begin with higher baseline cognitive scores and take longer to reach the same lower level of performance as older adults with less education (Butler et al., 1996; Wechsler, 1981). Yet, whether education changes the rate of cognitive decline is still not known.

In the United States, race and ethnic status have also been related to cognitive test performance, however, educational attainment differs markedly by race (Whitfield, 2001). Black and Hispanic older Americans perform more poorly on cognitive tests compared to non-Hispanic White Americans, even when controlling for level of education (Whitfield, 2001; Black et al., 1999). Although it has been suggested that differences by race are attenuated when educational level is adjusted for academic quality, it remains unclear whether race and lack of education result in a cumulative disadvantage in the rate of cognitive decline in old age (Manly et al., 2002).

The purpose of the current analysis is to determine how early life educational attainment affects the trajectory of cognitive decline in old age, and whether there are significant differences in this relationship between racial groups. Specifically, this analysis will determine whether the level of education changes the rate of cognitive decline in old age. By utilizing data from a nationally representative sample of community-dwelling Americans aged 70+, we will determine whether a relationship between education and cognitive decline exists, and whether this relationship differs markedly for the two large racial groups of older adults in the U.S.: blacks and Hispanics.

Methods

Sample

Data from the first four waves of the Assets and Health Dynamics of the Oldest Old (AHEAD), a biennial nationally representative dataset collected by the Survey Research Center at the University of Michigan, is used for this analysis (Soldo, Hurd, Rodgers, & Wallace, 1997). Of the original 7,443 baseline respondents, respondents with two or more interviews as self-respondents are included in this analysis (N=5,540), while respondents who had only one interview as a self-respondent and therefore do not have longitudinal data are not included in these analyses (N=1,905).

The mean age for the sample (N=5,540) at baseline is 76.6; the youngest respondent age is 70, while the oldest age is 103. The gender distribution at baseline is about one third men (36 %) and two-thirds (64%) women. The average level of education for the sample is 11.3 years. Blacks comprise 9% (weighted proportion) of the sample and Hispanics comprise 3% (weighted proportion) of the sample. The sample is weighted so the demographic composition is proportionate to their population representation in the United States.

Measures

Cognitive function is a network of abilities that can be grouped into general categories of memory, conceptualization, attention, language, knowledge, and spatial ability, each of which is influenced by environmental and biological circumstances (Albert, 1994). The cognitive tests included in these analyses include the Telephone Interview for Cognitive Status (TICS) to assess knowledge, language, and orientation skills, the Serial 7's to assess working memory, as well as tests of delayed and immediate verbal recall. Cognitive testing is administered at each data collection point in AHEAD, resulting in four scores for each cognitive test. Each set of scores is separated by approximately two-year intervals. Person-period trajectories of cognitive function are based on these scores. Since exposure to the cognitive test may affect future performance, earlier exposure is controlled in the analysis.

Education is indicated by the years of school completed. Age, gender, and being of African American or Hispanic origin are included in the equations in order to examine their independent effects as well as their interactions with education.

Statistical Analysis

This analysis estimates growth curves based on the hierarchical linear modeling approach. A considerable body of literature exists in the social sciences on how to most appropriately model changes in cognition over time (Bryk & Raudenbush, 1992; Littlell, Milliken, Stroup, & Wolfinger, 1996; Rogosa, Brandt, & Zimowski, 1982). Growth curve models are used to model individual change in cognition as a function of time (Reynolds, Gatz, & Pedersen, 2002). What is unique about this type of approach is that it not only provides an estimate of the average path of change in cognitive function for the entire sample, but characterizes individual paths based on unique intercepts and slopes for each respondent, and the subsequent variance between these paths (Wilson et al., 2002).

Results

Higher levels of education equal higher baseline cognitive scores on each cognitive test: the word recall tests, serial 7's test, and the TICS. When we add interaction terms for education and time to measure the effect on cognitive decline, we find that for each additional year of education, the rate of cognitive decline on each test slows, with the exception of the Serial 7's. The relationship between education and the rate of decline on the Serial 7's task is positive; as the number of years of education increases, the rate of decline on the Serial 7's increases. This finding is likely explained by floor effects of the Serial 7's test, and a more narrow score range (0-5) on this test, compared to the other cognitive tests (0-10). On the verbal recall tests and the TICS, a significant relationship between education and the rate of cognitive decline is observed; the effect is constant as respondents age.

Blacks score almost one point lower at baseline on each of the cognitive tests. Black ethnicity is related the rate of decline on the immediate word recall and the Serial 7's tasks, but not to the delayed recall or the TICS. When an interaction term for education and black ethnicity is added to the model, no statistically significant effect on the rate of cognitive decline is found. Being black does not change the relationship between education and cognitive decline.

Hispanics also score lower at baseline on each of the cognitive tests, but the size of the difference is smaller than for Blacks. Hispanic ethnicity is related to the rate of

cognitive decline as measured by the TICS; being Hispanic is not related to the rate of decline on the verbal recall or the Serial 7's task. No significant relationship between education, Hispanic ethnicity, and cognitive decline is observed. The effect of education on cognitive decline is not contingent upon Hispanic ethnicity.

Higher education slows the rate of decline on specific cognitive tasks among older Americans. The relationship between education and the rate of cognitive decline is not contingent upon ethnicity. Ethnicity determines the rate of decline on some cognitive tasks, but the relationship depends on which ethnicity and cognitive task is under study. These findings are the first to demonstrate a differential effect of race and education on the rate of cognitive decline among older Americans.