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Research Article

Race Inequity in School Attendance Across the Jim Crow South and Its Implications for Black–White Disparities in Trajectories of Cognitive Function Among Older Adults

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Abstract

Objectives: Although education is a key determinant of cognitive function, its role in determining Black–White disparities in cognitive function is unclear. This may be due, in part, to data limitations that have made it difficult to account for systemic educational inequities in the Jim Crow South experienced by older cohorts, including differences in the number of days Black students attended school compared to their White counterparts or Black peers in better-funded southern states. We determine if accounting for differential rates of school attendance across race, years, and states in the Jim Crow South better illuminates Black–White disparities in trajectories of cognitive function.

Methods: We linked historical state-level data on school attendance from the 1919/1920 to 1953/1954 Biennial Surveys of Education to the Health and Retirement Study, a nationally representative, longitudinal study of U.S. adults older than age 50. We restricted our sample to Black and White older adults who attended school in the Jim Crow South and began primary school in/after 1919/1920 and completed primary/secondary school by 1953/1954 (n = 4,343). We used linear mixed models to estimate trajectories of total cognitive function, episodic memory, and working memory.

Results: Self-reported years of schooling explained 28%–33% of the Black–White disparity in level of cognitive function, episodic memory, and working memory. Duration of school, a measure that accounted for differential rates of school attendance, explained 41%–55% of the Black–White disparity in these outcomes.

Discussion: Our study highlights the importance of using a more refined measure of schooling for understanding the education–cognitive health relationship.

Keywords: Education, Historical data, Life course, School segregation

Stark and persistent Black–White disparities in cognitive function, cognitive impairment, and dementia are well documented (Díaz-Venegas et al., 2016; Gross et al., 2015; Mehta et al., 2004; Weuve et al., 2018). For example, using data from the Chicago Health and Aging Project, Weuve et al. (2018) found that Black adults 65 years and older had scores one half to one standard deviation lower on measures of cognitive function, episodic memory, and executive function than their White counterparts. Black adults are also two to three times more likely to have dementia (Chen & Zissimopoulos, 2018) and live more of their life with dementia than White adults (i.e., 1.6 years for White women vs. 3.9 years for Black women; Garcia et al., 2021), even when comparing within educational levels (Farina et al., 2020).

Educational attainment is a key determinant of cognitive function and one of the strongest protective factors against cognitive impairment and dementia (Alley et al., 2007; Langa et al., 2017; Livingston et al., 2017; Reuser et al., 2011; Wilson et al., 2009). Because Black older adults, on average, completed fewer years of school than their White counterparts, educational attainment is a common explanation for why Black older adults have worse cognitive function and higher rates of cognitive impairment and dementia than White older adults. Adjustment for educational attainment, however, does not fully explain these disparities (Díaz-Venegas et al., 2016; Garcia et al., 2018; Peterson et al., 2021; Weuve et al., 2018; Zahodne et al., 2016). This may be due, in part, to the reliance on an education measure—years of schooling—that ignores the political and cultural context in which schooling took place and led to large race inequities in school term length and school attendance, particularly in the Jim Crow South. The purpose of our study is to determine if accounting for state and racial variation in school attendance better explains Black–White disparities in cognitive function among older adults who resided in the Jim Crow South compared to self-reported years of schooling.

Background

According to the Lancet Commission's life course model for dementia risk, lower education is a key predictor of dementia (Livingston et al., 2017). Researchers posit that education is strongly related to cognitive function and dementia because cognitive stimulation that occurs during early schooling changes brain structure via increasing the number of synapses or the extent of vascularization, thereby creating cognitive reserve (Beydoun et al., 2014). Cognitive reserve allows individuals to more effectively cope with increased brain pathology as they age, resulting in preserved cognitive functioning and the delayed onset of clinical symptoms of cognitive impairment (Lenehan et al., 2015; Mungas et al., 2018). Early schooling may also influence cognitive function through risk and protective factors in middle and later life, including cognitive and social engagement, health behaviors, and chronic diseases (Livingston et al., 2017).

Although education appears to play a critical role in maintaining cognitive function and reducing the risk of cognitive impairment and dementia, a substantial amount of the Black–White disparity in cognitive health often remains after accounting for race differences in educational attainment. In a study of older Chicagoans, years of schooling explained about 35% of the Black–White disparity in cognitive functioning; however, because education was more strongly and positively associated with cognitive function among Black adults, more of the race disparity was explained at higher levels of schooling (i.e., 17% at 12 years of schooling, 58% at 16 years of schooling; Weuve et al., 2018). This sample, however, was fairly well-educated and may not represent the U.S. older adult population; the average Black participant had completed 12 years of schooling and the average White participant had completed 14 years of schooling. Using the nationally representative Health and Retirement Study (HRS), Diaz Venegas et al. (2016) found that education accounted for 17% of the Black–White disparity in cognitive function. Other community-based samples have similarly found that education explains around one fifth of the Black–White disparity in cognitive function (Peterson et al., 2021).

Educational attainment may only partially explain Black–White disparities in cognitive health due to data limitations that make it challenging to accurately measure the amount of schooling *actually* attained by older cohorts. This is an important limitation because public education changed substantially during the early to mid-twentieth century, including as it relates to the time students spent in school, the amount of funding directed to public schools at the federal and state level, and the differential investment in schools based on race (Cottrol et al., 2003; Liu, Manly et al., 2015; Pearson & Fuller, 1969; Southern Education Reporting Service, 1967; U.S. Department of Education, 2003). Nowhere are these differences in public education more evident than in the Jim Crow South—the period from 1877—1960s when the U.S. South and some border states enacted laws that required the separation of Black and White individuals in public spaces (Krieger, 2012). Before the U.S. Supreme Court ruled in *Brown v. Board of Education* (1954) that racially segregated schools were unconstitutional, states in the U.S. South *and* Missouri legally mandated school segregation (Southern Education Reporting Service, 1967). This *de jure* school segregation not only resulted in racially separate schools but also led to large racial disparities in the allocation of educational resources, particularly as it relates to term length and how many days of instruction students received when they attended Black- or White-segregated schools (Bell, 2005; Carruthers & Wanamaker, 2017; McNeill & Rowley, 2019).

In the Jim Crow South, annual school terms were, on average, 50%–100% longer for White students than Black students (Glymour & Manly, 2008). Furthermore, Black students consistently attended fewer days of schooling than White students. A Black South Carolinian enrolled in public school in 1920 would have attended, on average, 60 days of school, whereas their White counterpart would have attended, on average, 100 days of school, which corresponds to 40% less time in school where they could build cognitive reserve (Department of the Interior, 1923). For example, longer school terms were associated with higher levels of cognitive function among older Alabamans, but only among individuals who completed 12 or fewer years of school (Crowe et al., 2013).

Importantly, almost 80% of Black older adults who completed school prior to *Brown v. Board of Education* were educated in the U.S. South (Ruggles et al., 2020). Current research that considers the explanatory role of educational attainment in Black–White disparities in cognitive outcomes proceeds under the assumption that a year of schooling is equivalent across race, state of residence, and birth cohort. Yet, this assumption is quite tenuous. Our study addresses this gap in the literature by using historical data on Black- and White-segregated schools located in the U.S. South that legally mandated racially segregated schooling. We examine if accounting for differential rates of school attendance among Black and White students explains more of the Black–White disparities in trajectories of cognitive function, episodic memory, and working memory among older adults than reported years of schooling.

Method

Data

Individual-level data come from the HRS, a nationally representative, longitudinal study of U.S. adults older than age 50 (Sonnega & Weir, 2014). Since 1992, the HRS has conducted core interviews with age-eligible respondents and their spouses approximately every 2 years; data collection is ongoing. The HRS is a multistage area probability sample of age-eligible households selected from primary sampling units chosen from U.S. Metropolitan Statistical Areas (MSAs) and non-MSA counties, with an oversampling of minorities and the oldest old. Using a steady-state design, the HRS sample is replenished with younger cohorts about every 6 years.

State-level data on school attendance and school term length come from the 1919/1920 to 1953/1954 Biennial Surveys of Education (BSE) of the United States compiled by the U.S. Department of Health, Education, and Welfare. Data were reported separately for White- and Black-segregated schools. We linked BSE data to HRS via a single measure that asked respondents the state they lived in most of the time they were in primary/secondary school or, for respondents who did not attend school, around age 10. The BSE reported data for the 18 states/territories that legally mandated segregated schools (Southern Education Reporting Service, 1967): Alabama, Arkansas, Delaware, the District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. We excluded Missouri from our study because our restricted data agreement prevents us from reporting HRS data at a geographic level below the census division, and Missouri is the only state that is located in the West North Central census division.

Sample

We restricted our sample to Black and White HRS respondents who reported residing in the U.S. South when they were school-aged, began primary school in or after 1919, and completed their primary/secondary schooling by 1954 (n = 4,727). We present in Supplementary Table 1 selected examples of who is included in our sample given these restrictions. Next, we excluded respondents who did not provide a cognitive measure from 1995/1996 to 2016 (n = 299) or were missing a sampling weight (n = 85). Those missing cognitive health data differed from the analytic sample on several observed characteristics (Supplementary Tables 4 and 5); however, given the small number of excluded respondents, we do not expect this to bias our estimates. Our final analytic sample included 4,343 older adults (2,950 White adults, 1,393 Black adults) providing 25,737 person-period observations (mean observations = 5.9).

Measures

Cognitive outcomes

All respondents were administered four subcomponents of the Telephone Instrument for Cognitive Status (TICS) to assess cognitive function at each interview either by phone or face-to-face. The cognitive assessment consists of tests that evaluate the respondent's memory, using 10-word immediate and delayed recall, and attention and processing speed, using a serial 7s subtraction test of working memory and counting backward. We assessed *cognitive function* by summing across all items, resulting in scores ranging from 0 to 27. We assessed *episodic memory* by summing items across immediate and delayed 10-word recall, resulting in scores ranging from 0 to 20, and *working memory* by summing items across the serial 7s subtraction test and counting backward, resulting in scores ranging from 0 to 7.

Education

We used several measures to construct the education variables we include in our models. First, respondents were asked how many years of schooling they had completed (range 0–17) as well as their highest degree attained. We top-coded years of schooling at 12 years because the BSE provided data on days attended and term length for primary and secondary schools only. This indicator reflects *self-reported years of schooling*. To account for respondents who completed postsecondary school but were top-coded at 12, our models include degree attainment categorized as no degree, GED, high school diploma, or some college or more. To examine the implications of top-coding years of schooling, we reestimated models using the original (non-top-coded) variable. These results were similar to those we present (Supplementary Table 2).

Next, we created a *duration in school* measure, which we calculated as:

$$x_i = \frac{\Sigma\, b_{rst}}{\Sigma\, z_t} \times c_i \qquad (1)$$

where x_i is the duration in school for respondent i, $\Sigma\, b_{rst}$ is the sum of school days attended for students in the racially segregated school system r in state s over time t, t is the years that respondent i attended primary and/or secondary school, $\Sigma\ z_t$ is the sum of the maximum number of school days a student in the U.S. South could have attended school during time t derived from school term length, and c_i is self-reported years of schooling for respondent i, top-coded at 12.

To calculate b_{rst}, we assumed respondents started primary school 6 years after birth and attended school for the number of days students of their race, on average, attended school in their state of residence for each year they attended school. For selected examples based on BSE data, see Supplementary Table 3.

Because school term length varied significantly across states, racially segregated school systems, and over time (Supplementary Figure 1), we used the longest mandatory term length across *all* Southern schools (regardless of whether the longest term occurred in White- or Black-segregated school systems) for each year a respondent attended school to calculate $\Sigma\ z_t$. Doing so normalized the measure and facilitated Black–White comparisons. For example, the total maximum number of school days White or Black students who attended school in the U.S. South *could* have attended if they were born in 1914 and completed 8 years of school was 1,676 (Supplementary Table 3).

Covariates

Our models include several covariates that may be associated with education or cognitive outcomes. These include race (non-Hispanic Black or non-Hispanic White), gender (female or male), education cohort (completed primary/secondary school by 1939, 1940–1948, or 1949–1954), interview mode (face-to-face or phone), state of residence when the respondent was school-aged (included as dummy variables), and the highest level of education completed by either parent (<8 years, ≥8 years of schooling).

Missing Data

From 1919/1920 to 1953/1954, five of the 17 Southern states did not report data on the average number of school days attended and term length in some years: Kentucky (1919/1920–1927/1928), Mississippi (1919/1920, 1931/1932, 1941/1942), Oklahoma and Texas (1919/1920–1921/1922), Tennessee (1919/1920–1925/1926), and West Virginia (1921/1922, 1927/1928, and 1931/1932). To assess patterns of item nonresponse, we visually inspected the data for each state by year. Next, using linear regression, we estimated predicted values for days attended or term length separately by state. In these models, we used reported data on each variable, respectively, to predict estimates for the missing years and modeled time as either linear or quadratic based on model fit. We considered using multiple imputation, but given the low levels of nonresponse and small sample size (n = 17 states), these models would not converge.

In addition to item nonresponse, BSE reports data biennially; thus, we did not have data in school years that ended in an odd number (e.g., 1920/1921). Visual inspection of the data indicated a linear or quadratic pattern for each state with little variation over time. We therefore chose to interpolate data for the odd years using data from the two adjacent years in each respective state.

Complete data were available on HRS covariates except for parents' education, which had 12% missing. Prior work indicates that HRS respondents with missing data on parents' education have similar economic and health profiles as those whose parents completed less than 8 years of schooling (Montez & Hayward, 2011, 2014). We therefore coded respondents with missing values on parents' education as less than 8 years of schooling.

Analytic Approach

We estimated linear mixed models to account for the nonindependence of observations and varying number of observations per person. Age represents time and was centered at age 73, the mean age of respondents across the observation period, and divided by 10 such that each unit increase in age represents change over a decade. We interacted age with all variables included in our models to assess whether these factors were associated with the rate of change in our cognitive outcomes. Linear mixed models included a random-intercept assumed to be normally distributed with mean zero and independent of within-person error and all model covariates. A model that specified age as a random term produced similar estimates and inferences as the random-intercept model. We used person-level weights from respondents' baseline interview to account for selection into the sample and the complex survey design, although unweighted analyses yielded comparable results. All analyses were estimated using *mixed* in Stata, version 17 (StataCorp LP, College Station, Texas).

We estimated three models for each cognitive outcome (cognitive function, episodic memory, and working memory). Our first model adjusted for demographics, parental education, and dummy variables for childhood state of residence. Model 2 included self-reported years of schooling (top-coded at 12) and degree attainment. Model 3 replaced self-reported years of schooling with the duration in school measure. We compared the race coefficient from Model 2 to Model 1 to determine how much of the Black–White disparity in the cognitive outcome was explained by years of schooling and degree attainment. We then compared the race coefficient from Model 3 to Model 1 to determine how much of the Black–White disparity was explained by duration in school and degree attainment.

Before estimating our models, we plotted the means for the three cognitive outcomes across age and by race. These plots suggested a linear age specification, which we confirmed by estimating random-intercept models that included age and age-squared terms. Although the quadratic age coefficient was significant across the three cognitive outcomes, plots of the predicted values indicated that these models overfit the data. We determined that a linear specification of age fit the data best, and that the choice of a linear age term did not change our inferences.

Results

State-Level School Data

Prior to linking the BSE data to HRS, we examined state and period variation in the proportion of the school term attended for students attending Black- versus White-segregated schools from 1919/1920 to 1953/1954 in the Jim Crow South. We show this variation in Figure 1. We find greater period variation in the proportion of the school term attended among students attending Black- versus White-segregated schools. Black students also attended less of the school term than White students, on average. We also present figures that show this variation across years in Supplementary Figure 2.

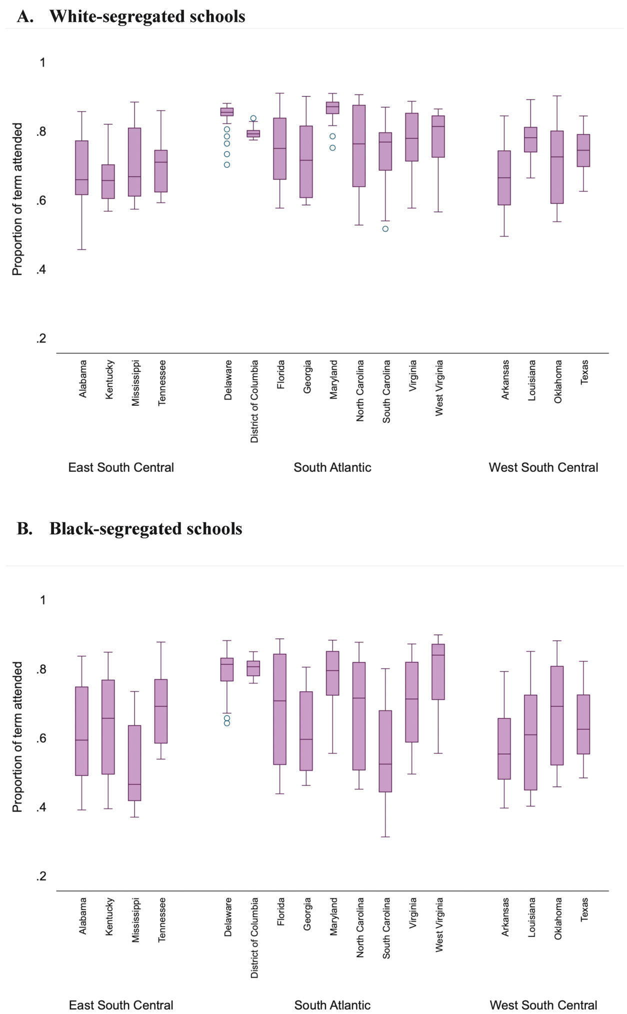

Figure 1. Proportion of the school term attended for a student attending a White-segregated school (A) and a Black-segregated school (B) in the U.S. South by state (n = 17), Biennial Survey of Education, from 1919/1920 to 1953/1954. *Notes:* Proportion of the school term attended is calculated as the average number of days attended as reported by the state divided by the maximum school term length in the U.S. South in that year. The average number of days attended is reported separately for White-segregated and Black-segregated schools. Full color version is available within the online issue.

Sample Characteristics

Table 1 presents the characteristics of our HRS sample. Across the period of observation, White adults had an average TICS score within the normal cognition range (mean = 14.0, SE = 0.04; a score of 12 or above indicates normal cognition), whereas Black adults had an average TICS score at a level considered cognitively impaired (mean = 10.4, SE = 0.06; a score of 7–11 indicates cognitive impairment and a score of 0–6 indicates dementia). Black adults, on average, also scored lower on episodic memory (mean = 7.0, SE = 0.04) and working memory (mean = 3.4, SE = 0.03) than White adults (mean = 8.8, SE = 0.03; mean = 5.2, SE = 0.01, respectively). White adults were slightly older (74.2 years) than Black adults (73.5 years, $p < .05$). Most Black adults attended school in a state within the South Atlantic division (52.7%), whereas White adults were a bit more evenly split across divisions (though 43.3% also attended school in the South Atlantic division; see Author Note 1).

White adults also completed more years of primary/secondary schooling—whether measured by self-report or duration in school—than Black adults. On average, White adults completed 10.5 years of schooling (top-coded at 12) when assessed using the self-reported measure, but 7.9 years in school when assessed using the duration in school measure. Black adults completed 8.8 years (self-reported) and 5.8 years (duration) of schooling, respectively. Approximately 17% of White adults completed at least some college, whereas about 7% of Black adults did so.

Linear Mixed Models

Table 2 presents estimates from linear mixed models predicting cognitive function, episodic memory, and working memory. Figure 2 shows the predicted values across age by race when all covariates were held constant at their mean. At age 73, Black adults scored 3.44 points lower on cognitive function than White adults—a disparity that was consistent across age—after adjustment for demographics and parental education (Model 1; Table 2 and Figure 2A). Years of schooling was positively associated with cognitive function at age 73 (b = 0.54, SE = 0.04), but adults with more schooling experienced a faster rate of cognitive decline (b = −0.08, SE = 0.03; Model 2; Table 2). Across age, years of schooling explained 30%–32% of the race disparity (Table 3). Duration in school, in comparison, yielded a smaller Black–White disparity at age 73 (b = −1.88, SE = 0.15; Model 3 in Table 2) and explained 45% of the race disparity across age (Table 3). Duration in school was also positively associated with cognitive

Table 1. Sample Characteristics of Black and White Older Adults Who Resided in the U.S. South During School, Weighted Estimates, Health and Retirement Study (n = 4,343)

	White n = 2,950	Black n = 1,393
	Mean (*SE*) or %	Mean (*SE*) or %
Cognitive health[a]		
Cognitive functioning[b]	14.0 (0.04)	10.4 (0.06)
Episodic memory[b]	8.8 (0.03)	7.0 (0.04)
Working memory[b]	5.2 (0.02)	3.4 (0.03)
Age (years)[a,b]	74.2 (0.06)	73.5 (0.09)
Women	57.3%	59.1%
Schooling cohort [b]		
≤1939	33.2%	36.8%
1940–1948	36.9%	34.8%
1949–1954	29.9%	28.4%
Census division[b,c]		
South Atlantic	43.3%	52.7%
East South Central	25.5%	24.2%
West South Central	31.2%	23.1%
Parent's schooling ≥8 years	61.1%	41.3%
Years of schooling[d]		
Self-reported[b]	10.5 (0.05)	8.8 (0.10)
Duration in school[b]	7.9 (0.04)	5.8 (0.08)
Degree attainment[b]		
No degree	35.6%	65.3%
GED	5.6%	3.8%
High school diploma	41.7%	23.6%
Some college or more	17.1%	7.2%
Interview mode[a,b]		
Face-to-face	41.7%	43.9%
Phone	58.3%	56.1%

[a]Mean estimates across years of observation reported.
[b]Race differences significant at $p < .05$.
[c]Per our restricted data agreement, we can only report individual-level data no lower than the Census division level.
[d]Years of primary or secondary schooling (does not include postsecondary schooling).

function at age 73 (b = 0.70, SE = 0.05), but unrelated to rate of cognitive decline.

For episodic memory, the Black–White disparity at age 73 was 1.79 points. Black adults experienced a slower rate of decline (b = 0.26; Model 1, Table 2) in episodic memory than White adults (b = −1.16). As such, the race disparity was larger at younger ages and narrowed over time (Figure 2B). Self-reported years of schooling was positively associated with episodic memory at age 73 (b = 0.29, SE = 0.03, Model 2 in Table 2), but was associated with a faster rate of decline in episodic memory (b = −0.06, SE = 0.03). Adjusting for self-reported years of schooling explained 33% of the race disparity (Table 3). Duration in school was also positively associated with episodic memory (b = 0.38, SE = 0.04; Model 3), but unrelated to rate of decline, and explained 45%–55% of the race disparity across age.

Black adults also scored lower on working memory at age 73 (b = −1.64, SE = 0.07; Model 1 in Table 2) and experienced a faster rate of decline (b = −0.16, SE = 0.05) than White adults. Thus, the disparity in working memory widened as respondents aged (Figure 2C). Years of schooling was positively associated with working memory (b = 0.25, SE = 0.01; Model 2 in Table 2) and explained 28%–29% of the Black–White disparity across age. Years of schooling was unrelated to the rate of decline in working memory. Duration in school was also positively associated with working memory (b = 0.31, SE = 0.02; Model 3 in Table 2), but unrelated to rate of decline, and explained 41%–44% of the race disparity (Table 3).

Discussion

In this study, we aimed to determine if accounting for differential rates of school attendance between Black and White older adults who grew up in the Jim Crow South explained more of the race disparity in cognitive outcomes than a traditional measure of education—years of schooling. Consistent with the literature, we found that years of schooling explained about a third of the race disparity in cognitive outcomes, whereas our constructed measure of *duration in school* explained approximately half of the race disparity. We found this pattern across multiple domains of cognition, including total cognitive function, episodic memory, and working memory.

Although education—either measured as years of schooling or duration in school—attenuated Black–White differences in level of cognitive function, episodic memory, and working memory, only years of schooling was related to rate of decline in cognitive function and episodic memory. Prior research also finds that years of schooling is consistently related to level, but less consistently related to rate of cognitive decline (Beydoun et al., 2008; Lenehan et al., 2015; Lövdén et al., 2020; Walsemann & Ailshire, 2020). It is possible that the inconsistency in the relationship between years of schooling and cognitive decline lies in the use of an imprecise measure that serves as a proxy for social and racial stratification rather than (or in addition to) early educational experiences. The education measure we created—*duration in school*—better aligns with the amount of instruction a student likely received and may tap into those skills that build cognitive reserve in early life (Glymour & Manly, 2008; Hendrie et al., 2018; Peterson et al., 2021) and preserve cognitive performance later in life (Liu, Glymour et al., 2015). Our measure also accounts for institutionalized racial inequity in the amount of instruction provided to Black students during the Jim Crow era and, in so doing, allows us to more accurately adjust for race differences in *quantity* of education. Our findings may, therefore, better reflect the relationship between early schooling and cognitive functioning in older adulthood and

Table 2. Estimates From Linear Mixed Models Predicting Cognitive Function, Episodic Memory, and Working Memory Among Black and White Older Adults Who Resided in U.S. South During School, Health and Retirement Study (*N* = 4,343)[a,b]

	Model 1		Model 2		Model 3	
	At 73 *b* (*SE*)	Age[c] *b* (*SE*)	At 73 *b* (*SE*)	Age[c] *b* (*SE*)	At 73 *b* (*SE*)	Age[c] *b* (*SE*)
Cognitive function						
Black	−3.44* (0.15)	0.11 (0.11)	−2.37* (0.13)	0.06 (0.11)	−1.88* (0.15)	0.06 (0.12)
Years of schooling[d]			0.54* (0.04)	−0.08* (0.03)		
Duration in school[e]					0.70* (0.05)	−0.05 (0.05)
Constant	12.44* (0.26)	−1.27* (0.20)	13.03* (0.24)	−1.63* (0.22)	14.50* (0.24)	−1.74* (0.22)
Episodic memory						
Black	−1.79* (0.10)	0.26* (0.09)	−1.20* (0.10)	0.18 (0.09)	−0.93* (0.11)	0.17 (0.10)
Years of schooling[d]			0.29* (0.03)	−0.06* (0.03)		
Duration in school[e]					0.38* (0.04)	−0.04 (0.04)
Constant	7.75* (0.18)	−1.16* (0.16)	8.05* (0.18)	−1.46* (0.17)	8.85* (0.18)	−1.55* (0.17)
Working memory						
Black	−1.64* (0.07)	−0.16* (0.05)	−1.17* (0.06)	−0.12* (0.05)	−0.95* (0.07)	−0.11* (0.05)
Years of schooling[d]			0.25* (0.01)	−0.02 (0.01)		
Duration in school[e]					0.31* (0.02)	0.00 (0.02)
Constant	4.76* (0.11)	−0.04 (0.08)	5.02* (0.10)	−0.16* (0.08)	5.69* (0.10)	−0.16* (0.08)

[a]All models adjust for gender, education cohort, state of childhood residence (dummies), parental education, and mode of interview. Models 2 and 3 adjust for degree attainment.
[b]Number of person-period observations = 25,737. Mean number of observations = 5.9.
[c]Age is divided by 10.
[d]Self-reported and top-coded at 12 years.
[e]Proportion of school term attended multiplied by self-reported years of schooling top-coded at 12 years.
*$p < .05$.

provides additional support that early schooling helps to *maintain* cognitive functioning for both Black and White adults, but does little to slow the *rate* of cognitive decline (Levine et al., 2018).

Our study adds to a growing body of literature that documents poorer cognitive outcomes, including dementia-related mortality, among older adults who were born (Gilsanz et al., 2017; Glymour et al., 2011; Topping et al., 2021) or grew up in the U.S. South (Lamar et al., 2020; Liu, Glymour et al., 2015). For example, among a community sample of Black older adults living in the Chicago area, those who were born or resided in the U.S. South at age 12 had lower cognitive function than their peers who were born or lived in non-Southern regions at age 12 (Lamar et al., 2020). Similarly, Gilsanz et al. (2017) documented higher dementia incidence among older adults who were born in high stroke mortality states (most of which were located in the U.S. South) regardless of race/ethnicity, though their sample was restricted to older adults enrolled in a Health Maintenance Organization in Northern California. Another study considered variation in state of school attendance to understand Black–White disparities in cognitive function using a national and NY-based sample and found that state of school attendance explained 1%–14% of Black–White disparities in level of cognitive function (Liu, Glymour et al., 2015). Because these estimates were derived by comparing states nationally, however, they may conflate the higher poverty found in the U.S. South with this region's entrenched racial caste system because a disproportionate percentage of Black older adults were born in the South compared to White older adults (i.e., 80% vs. 30%, respectively; Ruggles et al., 2020). Black older adults may have experienced even poorer cognitive outcomes than their White counterparts as a result of "southern" birth due to the pernicious Jim Crow racial caste system that limited economic and social opportunities (as evidenced in our study by the significantly fewer days of school attendance reported in Black-segregated schools). Rather than merely controlling for "southern" exposure, our measure of schooling duration leverages the racially heterogeneous nature of southern disadvantage by incorporating the significant state and racial variation in school attendance present in the south during this historical period. Our findings point to the importance of examining state-level differences in education policies and practices rather than an average measure of school attendance for the U.S. South.

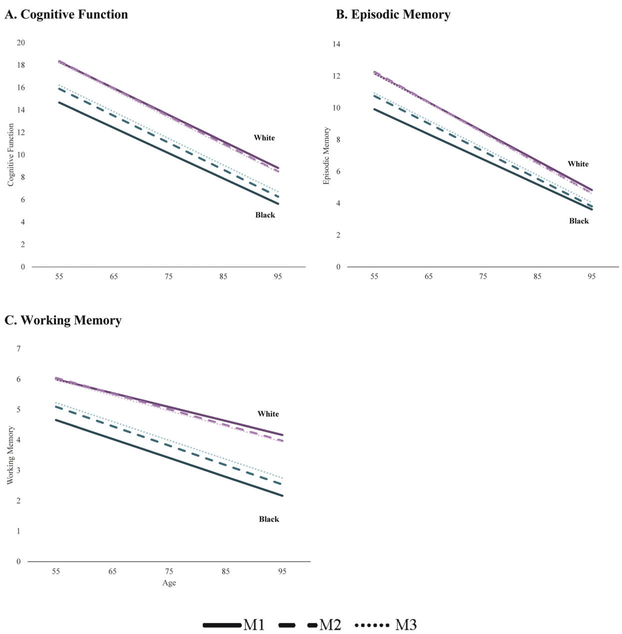

Figure 2. Trajectories of cognitive function (A), episodic memory (B), and working memory (C) by age and race among Black and White older adults who resided in U.S. South during school, Health and Retirement Study (n = 4,343). *Notes:* Predicted values when all covariates held constant at their *mean* and schooling is held constant at 10. Predicted values estimated using *margins* in Stata 17. All models adjusted for gender, education cohort, state of childhood residence, parental education, and mode of interview. M1 = Model 1, M2 = Model 2, M3 = Model 3. Full color version is available within the online issue.

Our results are cohort-dependent and reflect the historical context in which our cohort's schooling took place. Jim Crow segregation was unique in that it created separate schools *by law*. This de jure school segregation resulted in significant underinvestment in Black students, though this varied across states. Most Black adults who attended

Table 3. Percent of the Black–White Disparity Explained at Selected Ages for Each Cognitive Health Outcome by Education Measure (Self-Reported Years of School vs. Duration in School), Health and Retirement Study (n = 4,343)

	Cognitive function		Episodic memory		Working memory	
	Self-report	Duration	Self-report	Duration	Self-report	Duration
Age 55	32%	45%	33%	45%	29%	44%
Age 65	31%	45%	33%	47%	29%	43%
Age 75	31%	45%	33%	48%	29%	42%
Age 85	30%	45%	33%	51%	28%	41%
Age 95	30%	45%	33%	55%	28%	41%

Notes: Self-report = self-reported years of schooling, top-coded at 12. Duration = duration in school accounting for proportion of school term attended. Estimates based on a model that adjusted for gender, education cohort, state of childhood residence, parental education, mode of interview, and degree attainment. Percent of race disparity explained is calculated as $(b_1 – b_m)/b_1 \times 100$, where b_1 is the race difference in the predicted values at each age from Model 1 (estimated using *margins* in Stata 17), b_m is the race difference in the predicted values at each age from either Model 2 (self-report) or Model 3 (duration).

primary and secondary school before 1954 attended southern schools and were therefore disproportionately affected by state heterogeneity in the duration of time spent in school, which explained about half of the Black–White disparities in level of cognitive outcomes in our study. Even so, by the end of this period, term length and rates of daily attendance had become more standardized across the United States, and race disparities in these school outcomes had been reduced (U.S. Department of Education, 2003).

Importantly, race inequities in school resources continued to exist after *Brown v. Board of Education,* but they were more commonly found for other aspects of education (e.g., school quality, content, and context) rather than term length or attendance (Orfield & Lee, 2005; Walsemann et al., 2013). Thus, scholars interested in understanding the role of education in shaping Black–White disparities in cognitive function among more recent cohorts of older adults may need to consider these other aspects of schooling. A nascent body of work indicates such factors may be independently associated with level of cognitive function, with some studies showing differences by cohort (Aiken-Morgan et al., 2015; Crowe et al., 2013; Lamar et al., 2020; Moorman et al., 2019; Sisco et al., 2015; Walsemann & Ailshire, 2020). For example, among a national sample of U.S. older adults, participating in language or creative arts and taking college preparatory coursework were associated with higher levels of cognitive function, though the relationship appeared stronger for cohorts born after 1930 (Walsemann & Ailshire, 2020). Sisco et al. (2015) also found that a summated measure of educational quality was positively associated with level of cognitive performance and executive function and a slower decline in cognitive performance and memory among older Black residents of New York City. To unpack the relationship between education and cognitive health across race, place, and cohort, more data are needed that accurately measure the early educational experiences of older adults.

Limitations

Our study includes several limitations. First, to create the duration in school measure from school attendance data, we assumed that each respondent attended school for the average number of days reported by the state. Thus, our measure is downwardly biased for respondents who attended the entire term and upwardly biased for a respondent who rarely attended school. Second, we linked state data to the HRS based on the state where they lived most of the time they were in school or around age 10. Respondents may have moved across state lines during schooling, but could not be accounted for in our analysis. This should not substantially affect our results, however, given 92% and 85% of Black and White adults born in the South lived in their state of birth when they were school-aged. Third, other aspects of *de jure* segregation or Jim Crow might also be related to cognitive function. To account for this possibility, we adjusted for state of childhood residence in our models. Finally, although the HRS collects information from proxy respondents when respondents were unable to complete the TICS, we cannot incorporate this information into the summated cognitive scores. Thus, our trajectories follow respondents until they are unable to complete the TICS and therefore likely provide lower bound estimates of Black–White disparities in cognitive outcomes.

Conclusion

We find that years of schooling does not fully account for Black–White disparities in level of cognitive function among older adults who attended primary/secondary school in the Jim Crow South, in part because a year of schooling was not equivalent for these two populations. This finding is likely cohort- and context-specific. Length of school attendance between Black and White students was reaching parity around the time of *Brown v. Board of Education* and most states had similar term lengths by that time. Thus, disparities in *quantity* of schooling may be less important for cohorts who attended school after Jim Crow ended, whereas disparities in educational *quality*, *context*, and *content* may be more important. Our findings highlight the importance of using historically informed measures of schooling when examining the role of education in shaping the cognitive health of older adults.

Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

Author Note

1. Per our restricted data agreement, we can only present individual-level data no lower than the Census Division.

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Conflict of Interest

None declared.

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Author Contributions

K. M. Walsemann planned the study, conducted the data analysis, and wrote the paper. S. Ureña and M. P. Farina contributed to writing and revising the paper. J. A. Ailshire helped to plan the study and contributed to writing and revising the manuscript.

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