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THE RELATIONSHIP BETWEEN NEIGHBORHOOD RACIAL CONCENTRATION AND VERBAL ABILITY: AN INVESTIGATION USING THE INSTITUTIONAL RESOURCES MODEL

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Abstract

Relatively few studies examine the relationship between racial residential segregation and educational or cognitive outcomes. Using data from the National Longitudinal Study of Adolescent Health and the institutional resources model of neighborhood effects, I investigate one account of how macrostructural arrangements between race, neighborhood segregation, and school quality interact to produce inequalities in test scores. Consistent with the institutional resources model, results suggest that school quality varies across neighborhoods based, in part, on their degree of racial concentration. Indeed, school quality and other school characteristics mediate the relationship between racial concentration and verbal skills, particularly among black males. These findings have implications not only for inequalities in cognitive skills among blacks across residential space, but also between blacks and whites given high levels of residential segregation in the United States. In sum, findings illustrate yet another way in which residential segregation contributes to, and not merely reflects, racial inequalities.

Keywords

Neighborhood Segregation; Institutional Resources; Verbal Ability; School Quality; Fixed Effects; Test Score Gap

1. Introduction

A broad sociological literature has developed around the causes and consequences of the separation of race and ethnic groups in residential space. Traditionally, sociology has been concerned with the association between a racial or ethnic group's socioeconomic status and its degree of segregation from whites (Park 1952; Massey and Mullan 1984; Massey and Denton 1985). However, of growing concern is whether residential segregation has important consequences for the well-being of individuals, particularly for minority-group members. This question serves as an extension of sociology's interest in the degree and form

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of residential segregation because it seeks to understand whether differences in residential location translate into racial inequalities in other spheres of social organization.

Although myriad studies have identified residential segregation as a culprit in the exacerbation of racial inequality in the United States, relatively few have systematically analyzed its relationship to educational or cognitive outcomes. This gap in our knowledge is regrettable for many reasons, the most obvious of which are the longstanding education gaps between blacks and whites (Jencks and Phillips 1998), coupled with the fact that educational attainment is an important means by which racial inequalities in a host of other areas can be reduced. In this paper, I utilize the *neighborhood institutional resources model* to investigate the cognitive and learning consequences of residential segregation. I do so by testing whether school characteristics mediate between neighborhood composition and cognitive skills, in particular, verbal ability.¹ I argue that segregation differentially affects the outcomes of black and white children *indirectly* via the quality of the schools that serve minority neighborhoods compared to those that serve predominantly white communities. That is, variation in school characteristics, including their quality, across predominantly black and white neighborhoods is a mechanism through which segregation works to contribute to racial inequalities in skills, with implications for inequalities in education.

I draw on the collective insights of three literatures for support for this argument. One, I use the residential segregation literature to describe how sorting by race across residential space shapes the composition and quality of the neighborhoods in which black and white children reside. Second, I draw on the neighborhood effects literature to illustrate how the composition and quality of neighborhoods impact their institutional resources, in this case, the quality of their schools. And third, I rely on the school effects literature that demonstrates the importance of school quality for cognitive and learning outcomes. By analyzing the mechanisms through which neighborhood segregation may affect such outcomes, I seek to contribute to a body of research on the ways in which the social contexts of neighborhoods and schools work together, *interactively*, to differentially shape outcomes for advantaged and disadvantaged groups, in this case, for blacks and whites.

Below, I trace a theoretical and empirical path from residential segregation to neighborhood conditions, then from neighborhood conditions to institutional resources, with potential implications for racial inequality in cognitive and learning outcomes. Along the way, I review prior studies that investigate the relationship between neighborhood segregation and individual-level educational outcomes that pay particular attention to the role that schools may play in that relationship. I then formulate hypotheses informed by the institutional resources model regarding the ways in which race, residential segregation, and school quality jointly contribute to black-white gaps in cognitive outcomes, and describe an analytical framework for testing them.

¹Cognitive abilities include verbal comprehension as well as a number of other specific skills, such as general reasoning, for example (see Guilford 1959). All references to cognitive skills or abilities herein are intended to denote the specific cognitive ability of verbal comprehension.

1.1 The Neighborhood Institutional Resources Model

Among the mechanisms through which neighborhoods impact children identified in the literature (see Jencks and Mayer (1990); Ellen and Turner (1997)), institutional resources are of particular interest here. Jencks and Mayer argue that neighborhoods influence children's outcomes through the quality of the social institutions that exist within neighborhoods, a proposition advanced by Wilson (1987, 1996), Connell and Halpern-Felsher (1997) and others.² Neighborhood institutions are affected by neighborhood residents and nonresidents alike. Residents structure the quality of institutions as a function of their ability to secure high-quality services. At the same time, neighborhood institutions are shaped by nonresidents who hold positions of authority and who make decisions about the allocation of resources across neighborhoods (Hirsch 1983), as well as residents in other neighborhoods who compete for them. Thus, to understand the impact of neighborhoods, we must take assessment of both their population composition and the resources that exist within them.

Despite the theoretical appeal of the institutional resources model—that social institutions bridge the space between neighborhoods and the individuals who live within them—there is relatively little empirical support for it (Leventhal and Brooks-Gunn 2000). That is, few studies demonstrate that institutional resources mediate between neighborhood context and individual outcomes (Duncan 1994). Nevertheless, Leventhal and Brooks-Gunn (2000) suggest it is the best model for investigating neighborhood effects on educational outcomes in general, and I argue it is the best model for understanding the effects of neighborhood racial concentration on such outcomes in particular. That is, schools, as social institutions, may serve as transmitters of neighborhood advantage and disadvantage— advantage that residential segregation concentrates in the neighborhoods of whites and disadvantage that it builds into the neighborhoods of blacks (Massey and Denton 1993).

Support for this possibility comes from work on the extent of segregation between blacks and whites and the relationship between segregation and neighborhood conditions. In 2009, the average level of segregation in U.S. metropolitan areas as measured by the index of dissimilarity was 0.63 (Logan and Stultz 2010), indicating a high degree of segregation in the country despite declines over previous decades (Farley and Frey 1994). By concentrating race in neighborhoods, segregation concentrates all of the advantages and disadvantages associated with race in the United States. Black and white neighborhoods, then, become differentially shaped by social problems given the existence of racial inequality in such areas as earnings (Grodsky and Pager 2001), wealth (Oliver and Shapiro 1995; Conley 1999), poverty (DeNavas-Walt, Proctor, and Smith 2009), and crime and incarceration (Shihadeh and Flynn 1996; Western 2006). Moreover, by both contributing to and concentrating unemployment and joblessness in black neighborhoods (Mouw 2000; Wilson 1996), segregation also contributes to the concentration of poverty in black communities (Massey,

²The term “social institution” refers to “the structural components of a society through which all the main concerns and activities are organized, and social needs... are met” (Marshall 1998: 317-18). Schools and grocery stores, then, are examples of social institutions in that they comprise clear social roles (i.e., students, teachers, clerks, shoppers) and behaviors (learning, teaching, selling, buying) that operate together to meet important societal needs (i.e., distribution of knowledge, socialization, distribution of food) (see also Theodorson and Theodorson 1969: 206). Other entities that are readily found in neighborhoods but that do not meet important social needs (e.g., coffee shops, bars, movie theaters) fall outside the concept of social institution.

Gross, and Eggers 1991).³ Consequently, blacks and whites reside in vastly different residential contexts.

There are a number of reasons to believe that segregation lowers the quality of social institutions in black neighborhoods, particularly schools. One, given that public schools tend to draw their students from the local residential environment, the concentration of poverty in black neighborhoods is mirrored in schools (Massey and Denton 1993). The negative effect of poverty on achievement (Brooks-Gunn and Duncan 1997) means that low achievement becomes concentrated in the schools that serve black neighborhoods (Wilson 1996). Two, due to myriad reasons, such as less economic capital and political power held by blacks and less competition for entry into black communities, black neighborhoods tend to have lower property values compared to white residential areas. The marriage between property values and school funding ensures that schools in black neighborhoods receive less funding than schools in white areas. Moreover, racially-concentrated and poor neighborhoods have difficulty attracting and retaining businesses, which further undercuts their property tax base (Connell and Halpern-Felsher 1997; Jencks and Mayer 1990). Fourth, such neighborhoods may also have more difficulty attracting high-quality teachers and other school personnel who reside in other neighborhoods, but who fear traveling to poor, racially-concentrated neighborhoods due to accounts of and perceptions about dangers in such places (Connell and Halpern-Felsher 1997). Thus, segregation may create black neighborhoods that contain schools that are low in both economic resources and expertise.

To be sure, not all black neighborhoods suffer from the kinds of institutional weaknesses implied by the connection between segregation and neighborhood quality. Owens and Wright (1998) report on majority-black neighborhoods in nine metropolitan areas with large black populations. They find substantial diversity among black neighborhoods, with middle- and high-income neighborhoods comparing favorably to their larger metropolitan areas on a host of socioeconomic indicators. Still, even middle-class black neighborhoods are challenged by issues of neighborhood poverty and lower-than-expected school quality due to their economic diversity (Pattillo 2007; Ascher and Branch-Smith 2005) and spatial proximity to poor black neighborhoods (Pattillo-McCoy 1999, 2000; Massey and Denton 1993), both of which are consequences of residential segregation and serve to burden black middle-class communities with social problems that white middle-class neighborhoods are largely spared.

Despite growing evidence about the negative consequences associated with racial residential separation, relatively few studies have systematically analyzed its effects on education, a primary vehicle for social and economic mobility. Using data from the Children of the NSLY, Chase-Lansdale and Gordon (1996) investigate a variety of neighborhood influences on verbal ability, reading ability, and behavioral measures. They estimate the effect of “racial similarity” on these outcomes, defined as the proportion of individuals in a neighborhood who belong to the same race as the child. For black children, the “racial

³Although debate surrounds the relationship between segregation and neighborhood poverty, principal parties to it agree that segregation is implicated in the creation of poverty-concentrated neighborhoods (See Massey 1990; Massey and Eggers 1990; Massey, Gross, and Eggers 1991; Wilson 1996:42). Quillian (1999) reconciles differences between competing perspectives.

similarity” variable is proportion black, and for white children it is proportion white. The authors find a positive effect of racial similarity on verbal ability, but only for children in the Midwest and Northeast regions. These findings suggest that racial concentration promotes educational outcomes.

However, those results were for their full sample, leaving open the question of whether the relationship between racial similarity and educational outcomes varies by race. It may be that white children benefit from living in racially-concentrated neighborhoods, while blacks do not given the ways segregation concentrates advantages in white neighborhoods and disadvantage in blacks ones. They find no evidence to support this possibility primarily, it seems, because of sample size and problems with multicollinearity among their neighborhood measures. Yet, support for this interpretation is suggested by other work by these authors in which they find race differences among young children in the effects of residing in ethnically *diverse* neighborhoods. Greater neighborhood ethnic diversity (i.e., neighborhoods in which whites are *less* concentrated) is associated with lower verbal ability scores for white children, but is unrelated to the scores of blacks (Chase-Lansdale, Gordon, Brooks-Gunn, and Connell 1997).

Datcher (1982), using data from the Panel Study of Income Dynamics, finds no effect of neighborhood percent white on the number of years of schooling acquired by either black or white males by the time they reached their twenties and early thirties in 1978. Cutler and Glaeser (1997), using 1970 PUMS data, show that blacks in highly segregated cities are more likely to drop out of high school than blacks in less segregated cities, while segregation is unrelated to graduation among whites. Charles, Dinwiddie, and Massey’s (2005) analysis of data from the National Longitudinal Survey of Freshman shows that residing in a segregated neighborhood as a child has long-lasting academic consequences, as it is associated with lower grades in college.

Like Datcher (1982), Duncan (1994) uses PSID data to estimate neighborhood effects on completed years of schooling. He finds that racial concentration negatively affects educational attainment for a group of black men. Unfortunately, he, like all of the studies mentioned above, save that by Charles and colleagues (2005), is unable to ascertain the mechanisms through which it works. Because these studies lack information about the schools their respondents attended, they are unable to determine whether segregation operates through school quality to worsen outcomes. The need for school information in studies that assess the effects of neighborhood conditions on educational outcomes is a concern Duncan (1994) recognizes when he writes that “[o]nly when measures of both neighborhood and school environments are available can we hope to obtain a truly comprehensive picture of the process of adolescent attainments” (p. 49).

Using information on family, school, and neighborhood characteristics from the National Education Longitudinal Study of 1988 (NELS:88), Ainsworth (2002) estimates the effects of several neighborhood characteristics on math and reading test scores, among them the effects of racial/ethnic diversity. Although he is specifically interested in identifying the mechanisms through which neighborhood characteristics impact educational outcomes, he is primarily focused on school atmosphere as the mediating school characteristic.

Consequently, he does not test whether other school characteristics in his study, some of which measure school quality, mediate the relationship between neighborhood racial/ethnic composition and test scores.

Goldsmith (2009), too, brings data from NELS:88 to an investigation of the consequences of segregation, and extends his consideration to Latinos. But like Ainsworth, Goldsmith treats school characteristics as controls rather than mediators. That is, we do not know the relationship between neighborhood segregation and outcomes prior to controlling for school characteristics. Thus, his analytical strategy does not ascertain whether school characteristics serve as a mechanism through which neighborhood segregation affects educational outcomes. To be sure, the authors of prior studies had their own objectives in mind for which they designed their analytical strategies. In most cases, findings from longitudinal studies suggest a connection between residential segregation and negative educational outcomes. So, too, do studies that employ quasi-experimental and experimental designs.

The Gautreaux program arose from lawsuits against the Chicago Housing Authority and the Department of Housing and Urban Development (HUD) in 1969 for having operated and funded a racially-discriminatory system of public housing. As compensation for violations of their constitutional rights, attorneys for black public-housing residents (and applicants) sought and obtained a housing mobility program that would use the federal government's Section 8 program to permit plaintiffs to relocate either to better neighborhoods in Chicago or to predominantly white neighborhoods in the city's suburbs. Because Section 8 vouchers were divided between those for use in the city and those for use in the suburbs, combined with a long waiting list, plaintiffs were relocated to new neighborhoods either in the city or the suburb in a non-systematic fashion. That is, although plaintiffs may have voiced preferences for residence in the city or the suburbs, they could do little to influence their placement, as to pass on a voucher because it did not meet their preference placed them at great risk for receiving no voucher at all (Polikoff 2006). Thus, the majority of plaintiffs accepted the voucher offered to them, with about half of the more than 7000 participants agreeing to move to the suburbs. This constellation of factors gives the Gautreaux program a quasi-experimental design.⁴

Studies of Gautreaux participants indicate that families who relocated to middle-class, white, suburban neighborhoods experienced substantial improvement in neighborhood conditions, both over their previous neighborhoods and over improvements gained by participant families who relocated to neighborhoods within the city of Chicago (Rubinowitz and Rosenbaum 2000). Moreover, the children of families who relocated to the suburbs evidenced better educational outcomes than did city movers; they had lower dropout rates, higher academic achievement, were more likely to be in their school's college track, and more likely to attend college, including four-year colleges (Kaufman and Rosenbaum 1992; Rosenbaum 1995). Thus, improvements in neighborhood quality appear to have produced improvements in children's educational outcomes. Most relevant for my purposes is evidence from Gautreaux that suggests the relationship between neighborhood conditions and educational outcomes is mediated by school quality. Indeed, Rosenbaum (1995) reports

⁴See Rosenbaum and DeLuca (2000) for more details on the design of the Gautreaux program.

improvements in school quality that followed movement to suburban neighborhoods. Mothers reported that schools in their new neighborhoods were more challenging than those in their previous neighborhood, but also that suburban schools had smaller classes and more helpful teachers. Data from the state's Department of Education confirmed the higher quality of schools attended by participant families in the suburbs compared to those attended by participant families in the city, as indicated by significantly higher ACT and standardized reading test scores.

The Moving to Opportunity (MTO) program was inspired by the positive results that emerged from Gautreaux. It is a federal housing mobility program that uses an experimental design to evaluate whether the movement of low-income families from high- to low-poverty neighborhoods would produce improvements in individual outcomes. About forty-six hundred (4,608) participant families were divided into three groups: an experimental group whose members were offered housing vouchers to relocate to new, low-poverty neighborhoods; a "Section 8 group" whose members were also offered housing vouchers but who could use them to relocate to any neighborhood they wished, and a control group whose members remained in public housing. MTO operated in five cities—Baltimore, Boston, Chicago, Los Angeles, and New York.

With respect to children's educational outcomes, results from MTO provide less support for neighborhood effects than do those from Gautreaux. Though initial analyses suggested academic improvement among children in Baltimore (Ludwig, Duncan, and Ladd 2003), longer-term analyses show no effects on education that are related to movement to low-poverty neighborhoods (Sanbonmatsu, Kling, Duncan, and Brooks-Gunn 2006).⁵ In an effort to make sense of those unexpected results, Sanbonmatsu and colleagues (as well as Briggs, Ferryman, Popkin, and Rendon 2008) point to school quality, noting that they "suspect that one of the most important factors behind the stagnant test scores is that improvements in neighborhood conditions enjoyed by experimental group families were accompanied by much more modest improvements in the schools attended by their children" (p. 684). It is likely that increases in school quality did not follow increases in neighborhood quality because the majority of experimental and Section 8 families continued to reside in the same school district in which they lived prior to their MTO-associated move (Orr et al. 2003; Briggs et al. 2008).

A second possible reason is the lack of racial integration in the neighborhoods into which MTO families moved. Unlike the Gautreaux program, members of the experimental group in MTO were not required to move to neighborhoods that were low on black racial concentration. Sanbonmatsu and colleagues suspect that minority neighborhoods, even those with low poverty rates, may not provide children with access to high-quality schools. This suspicion is effectively one about the quality of the institutional resources available in racially-concentrated neighborhoods and their effects on the academic performance of youth

⁵Sanbonmatsu and colleagues (2006) found positive treatment effects for black children in Baltimore, but they caution against interpreting this as strong evidence of an effect of MTO due to sampling variability and because no other MTO location produced such results.

who reside within them. Unfortunately, that explanation remains in the realm of suspicion due to Sanbonmatsu and colleagues' inability to test it.

The objective of the current study is to investigate whether the relationship between neighborhood racial concentration and cognitive outcomes is mediated by institutional resources. By taking advantage of rich data on adolescents' family socioeconomic background, neighborhoods and schools, along with a suitable modeling strategy, I attempt to ascertain whether institutional resources form a mechanism through which disadvantaged neighborhood conditions are associated with depressed cognitive outcomes.

1.2 Hypotheses

The literature reviewed above and the institutional resources model suggest the following hypotheses

H 1: that racial concentration is negatively associated with cognitive outcomes, net of family socioeconomic background.

H 2: that the negative relationship between racial residential concentration and verbal test scores operates through the concentration of poverty in black neighborhoods; an alternative explanation to the institutional resources model.

H 3: that the negative relationship between racial residential concentration and test scores operates through the quality of the schools that serve black neighborhoods; this forms my test of the institutional resources model.

H 4: that by depressing test scores, particularly among black compared to white youth, racial concentration contributes to the black-white test score gap.

2. Materials and Methods

I use data from the National Longitudinal Study of Adolescent Health (Add Health) (Harris, Halpern, Whitsel, Hussey, Tabor, Entzel, and Udry 2009). Add Health is a nationally-representative sample of U.S. schools and adolescents in 7th through 12th grades. A sample of 80 high schools and 52 middle schools was selected with unequal probability of selection. Incorporating systematic sampling methods and implicit stratification into its study design ensured that the sample is representative of U.S. schools with respect to region of country, urbanicity, school size, school type, and ethnicity (Harris et al. 2009). Add Health features information on individuals, families, neighborhoods, and schools. Data on adolescents and their families come from in-home interviews and in-school surveys. Teachers and school administrators provided data on schools; data on neighborhoods come from parents and outside sources like the U.S. Census Bureau. Data for this study are taken from Wave I, collected in 1994-95. I include respondents of the Wave I in-home interview in my analytic sample if (1) they were non-Hispanic black or non-Hispanic white, (2) had valid information on the dependent variable, and (3) had valid information on stratification and their sample weight.⁶ Of the 20,745 respondents in Wave I, 13,332 comprise my analytic sample. Of the 7,413 cases excluded from my sample, some were lost due to attrition and some due to the sample selection criteria used.⁷

In effect, this study uses cross-sectional data. Consequently, there are limitations to what can be gained from this investigation of the relationship between neighborhood racial concentration and verbal test scores, as well as my test of the institutional resources model. Most critically, the cross-sectional design constrains my ability to make causal claims because I cannot observe the process by which families enter neighborhoods and children enter schools. This leaves open the possibility that some endogenous factor is responsible both for why some families reside in racially-concentrated neighborhoods and why their children have poor cognitive outcomes. Therefore, this study can only document the association between racial neighborhood concentration, school quality, and cognitive skills should one exist.

It is worth noting, however, that even longitudinal studies can suffer from this weakness, though they have other important advantages over those that use cross-sectional designs. Longitudinal studies typically do not capture the processes by which families are sorted into neighborhoods. Only those that do, mostly likely via an experimental design, can most confidently make causal claims. However, there are very few opportunities for social scientists to randomly assign families to neighborhoods in order to study their effects on adult and child outcomes; the Gautreaux and Moving to Opportunity housing mobility programs are valuable exceptions.

Nevertheless, the current research endeavor remains worthwhile. Findings from this study may provide evidence to suggest that a relationship between neighborhood racial composition and verbal ability exists and, more importantly, that such a relationship is driven by the quality of the schools that serve minority neighborhoods. Such findings would offer tentative support for the institutional resources model of neighborhood effects. This explanation for neighborhood effects is not often investigated, though a notable exception to this pattern is the 2007 study by Pong and Hao in which they use the institutional resources model (among others) to understand how neighborhood and school factors contribute to race, ethnic, and generation differences in school performance among adolescents. Although they do not investigate the effects of neighborhood racial concentration on educational achievement, they demonstrate that relationships between several neighborhood characteristics (e.g, relative deprivation, collective socialization, and monitoring) and GPA are mediated by school quality. Unlike Pong and Hao, my objective is not to investigate neighborhood effects writ large, but specifically to understand whether the effects of living in racially-segregated neighborhoods are mediated by school quality, a question they do not confront. Findings may point the direction for future research in understanding the social consequences of racial residential segregation. Below, I describe the variables and analytical strategy I use.

⁶Respondents in the Add Health data set were given the opportunity to identify as belonging to more than one racial group. For respondents who identified as multiracial, the race variable reflects the racial group the respondent indicated “best” described his or her racial background.

⁷In particular, 31 cases (0.42%) have no information on race; 4,636 respondents (62.54%) are neither non-Hispanic black nor non-Hispanic white; 1,032 cases (13.92%) were excluded because of the lack of test scores; and 1,714 cases (23.12%) have either no Wave I weight or information on stratification. Only 18,924 of the 20,745 in-home interview respondents have weights, and information on stratification is necessary to properly estimate standard errors (Chantala and Tabor 1999).

2.1 Variables

All variables come from Wave I of Add Health. The sole standardized measure of an educational or cognitive outcome in Add Health comes from scores on the revised edition of the Peabody Picture Vocabulary Test (PPVT-R), which serves as the dependent variable. The PPVT-R measures “listening comprehension for spoken words in standard English and [is] a screening test of verbal ability” or receptive vocabulary (American Guidance Service 2003). Test scores are age-standardized, range between 13 and 146, have mean of 100, and a standard deviation of 15 for the full Add Health sample.⁸

The neighborhood characteristic of interest is its degree of black residential concentration. I measure it with a categorical variable that indicates the percentage of residents who are black in the census block group in which each adolescent resides. Categories are (a) 0-24.9%, (b) 25-49.9%, (c) 50-74.9%, and (d) 75% or more. Neighborhood poverty is measured with a categorical variable, which indicates that (a) 0-19.9%, (b) 20-39.9%, and (c) 40.0% or more of neighborhood residents have incomes below the 1989 poverty line (following Jargowsky 1997; Quillian 1999; Rankin and Quane 2000).

The school context is captured with variables that measure their organizational characteristics, their academic quality, and peer environment. School organization is measured by whether the school is public or private, its regional location, urbanicity, size, and average class size.⁹ Private schools may not be neighborhood institutions in the same way that public schools are, but I include them in the analysis because private schools, on average, are expected to produce better prepared students than public schools. Access to private schools is not determined solely by a family’s ability to pay tuition, but also on having physical access to them. Geographic proximity to private schools may vary as a function of the racial composition of neighborhoods, such that youth from racially-concentrated (black) neighborhoods may be farther from private schools than youth from more integrated neighborhoods.¹⁰ Although region and urbanicity can reflect elements of students’ out-of-school environment, I use these variables as measures of school quality and characteristics because school climate and organizational features vary by region (Dinkes, Kemp, and Baum 2009) and urbanicity (Lee, Bryk, and Smith 1993).

School quality is ascertained with six variables, two of which measure how successful schools are at teaching students, two reflect teacher credentials and experience, and two others measure each school’s peer environment. The first two variables generally reflect how well schools prevent youth from falling behind academically and how well schools succeed in enrolling youth in courses that facilitate subsequent postsecondary educational attainment. To that end, I measure (a) the percentage of students who perform at their grade

⁸Given concerns that standardized tests may be culturally biased against blacks, particularly those that measure verbal skills, there may be disadvantages to using the PPVT-R. Washington and Craig (1992) suggest that it underestimates the verbal ability of low-income black children. However, Jencks and Phillips (1998:107) report that there is little evidence that PPVT-R scores for black children are affected by either the race of tester or the tester’s use of Black English to administer the test. If the PPVT-R underestimates blacks’ verbal skills, then it is possible that such measurement error is correlated with the degree of racial concentration in their neighborhoods. However, whether the PPVT-R underestimates blacks’ verbal ability is still an open question, as is whether such measurement error is correlated with neighborhood racial concentration.

⁹The school size variable is provided by Add Health and cannot be manipulated by the researcher.

¹⁰Findings reported here are unaffected by the presence or absence of private schools in the sample.

level and (b) the percentage of students in the school's highest grade who are enrolled in academic programs (versus general or other programs). The third school quality variable measures teacher quality by reflecting the percentage of teachers who hold at least a master's degree. I also include a measure of the percentage of teachers who are new to the school (i.e., teachers who were not at the school during the previous year). The peer environment in schools is measured by a scale that reflects the degree to which students reported having trouble once a week or more with teachers, other students, paying attention in class, and completing homework ($\alpha=.77$). The second variable reflects the percentage of students who expect to graduate from college. To facilitate interpretation, I divide all percentage variables by 10 so that their coefficients represent effects on test scores that are associated with a 10-percentage point change in these variables.

Individual and family variables, which serve mainly as controls, measure adolescents' race, family socioeconomic background, parental educational aspirations, and youth's own educational expectations. Family social and economic background is measured with household income in 1994 (logged), maternal education, and paternal education. Parental education variables are in categorical form, indicating a completed education of (a) high school degree or less, (b) some postsecondary education, (c) college degree.¹¹ I include measures of parental educational aspirations for their children and student educational expectations to capture aspects of individual motivation and, perhaps, behaviors that may influence verbal skills. For example, parents who have high educational aspirations for their children may interact with them in ways that improve their verbal skills, while students who have high educational expectations may be more motivated than students with lower expectations to improve their skills. Parents' educational aspirations are measured with the question "How disappointed would you be if [child's name] did not graduate from college?" Response categories are: (a) "Not disappointed," (b) "Somewhat disappointed," and (c) "Very disappointed." Students provided information on their own educational expectations, which were ascertained with the following question: "On a scale of 1 to 5, where 1 is low and 5 is high, how likely is it that you will go to college?" I treat this variable as a continuous measure, with low values indicating low educational expectations. To facilitate readability, I refer to these family socioeconomic background, parental aspirations and student expectation variables as simply "family background."¹²

I imputed missing data on predictor variables that measure respondents' family socioeconomic background, parental aspirations and respondents' own educational expectations via multiple imputation using $m=5$ data sets (Carlin, Galati, and Royston 2008; Royston 2004, 2007). I control for missing school and neighborhood data via the dummy-variable method.¹³ I estimated OLS regression models with a set of *survey* commands available in Stata that use Taylor-series linearization methods to correctly estimate standard errors from complex survey data. (See Appendix A for a description of the amount of clustering in the sample). If any bias arises from the use of the Stata *survey* commands, it is

¹¹The category 'some postsecondary education' includes vocational and trade schools, as well as colleges and universities.

¹²Two other variables, age and family structure, were explored. Their bivariate relationships to verbal ability were fully accounted for by other sociodemographic variables. Because they contribute little to the goal of controlling for respondents' social and economic family background, I exclude them from the analysis in an effort to create "parsimonious yet informative [regression] models" (Powers and Xie 2000:23).

towards larger standard errors, which tend to produce more conservative significance tests (StataCorp 2001). Nevertheless, a concern about standard errors remains given that neighborhoods were not part of the Add Health sampling design. Therefore, it is possible that the standard errors produced by the survey commands are still too small. To check this possibility, I re-estimated models with HLM cross-classified models. I use cross-classified models because students are nested within neighborhoods and schools, schools draw students from multiple neighborhoods, and neighborhoods send youth to multiple schools.¹⁴ I present the OLS results because the HLM results are consistent with them and the use of sampling weights and multiple imputation are not yet permitted with cross-classified models (Raudenbush, Bryk, and Congdon 2000). Lastly, I examined the data for indications of multicollinearity given the multiple measures of neighborhood, school, and family background variables employed in the analysis. Although there is some measure of correlation among the variables given their conceptual relationships, none are highly correlated nor violate guidelines for evaluating problematic multicollinearity (Chatterjee, Hadi, and Price 2000; Hamilton 2008).

2.2 Analytical Strategy

I estimate a series of nested models to test the four hypotheses articulated above. Models A and B assess the relationship between racial residential concentration and test scores, as well as that relationship net of family background. Model C adds neighborhood poverty to assess whether the relationship between racial neighborhood concentration and test scores operates through poverty concentration in black neighborhoods. Models D and E test whether the negative relationship between racial concentration and test scores operates through school characteristics; that is, through institutional resources.

Due to the richness of the Add Health data set, I can test the latter hypothesis in two ways. In the first, I control for school quality with specific indicators of the context of the schools youth attend. The advantage of this approach is that it may identify particular features of schools that serve as mechanisms through which racial concentration operates to lower test scores. The disadvantage is that I risk failing to capture other relevant aspects of youths' schools through which racial concentration may depress verbal skills. Thus, I employ an alternative, more conservative, approach in which I use school-level fixed-effects models that capture the unobserved heterogeneity that exists between the schools that serve black and white neighborhoods. School fixed-effects models are estimated by replacing substantive school variables with dummy variables for schools in the analytical sample.¹⁵

¹³Although I prefer to treat all missing data by imputing missing values (Little and Rubin 1987), I did not do so for missing school and neighborhood variables because there is substantial overlap in the missing school and neighborhood data. That is, much of the missing data on school characteristics is due to two schools in the analytic sample, and much of the missing neighborhood data is due to only three neighborhoods (i.e., block-groups). The two schools with missing data on the variables of interest also have missing data on other variables that one might use to impute measures of school quality and organization. The same is true for neighborhood-level data.

¹⁴See discussion by Pong and Hao (2007) who use HLM cross-classified models for the same reason.

¹⁵This strategy controls for other school characteristics in addition to features that reflect quality. The strategy, however, does not control for the quality and other characteristics of the schools youth attended prior to attending the schools in which they are observed in the Add Health data, such as their elementary schools.

I estimate all of the aforementioned models separately by race and gender. Race-specific models allow me to ascertain whether there is a stronger relationship between racial concentration and the verbal skills of black than white youth. Gender-specific models permit the relationship between racial concentration and test scores to vary by gender. Entwisle, Alexander, and Olson (1994) suggest that the educational outcomes of boys may be more affected by neighborhood conditions than are the outcomes of girls due to gender differences in *exposure* to neighborhoods. Their study of boys and girls in Baltimore revealed that boys spent more time than girls outside the home, both literally (e.g., playing outside, in out-of-home childcare arrangements, or at work outside of the home) and figuratively (e.g., playing with nonfamily members). The greater independence afforded to boys versus girls provides boys the freedom to spend more time away from home and in the neighborhood where they directly experience, for better or for worse, the social forces present in their neighborhoods. Finally, to assess the ability of these models to explain the black-white gap in verbal skills, I estimate the race gap in verbal scores using the full sample and a dummy variable that indicates the race of respondents. In a separate step, I estimate the test score gap by gender among blacks with a categorical variable that identifies all whites, black female adolescents, and black male adolescents.

3. Results

3.1 Descriptive Statistics

Table 1 provides descriptive statistics for the analytic sample. There is a 12.7 point gap in test scores between black and white youth, indicating a disadvantage among blacks in receptive vocabulary. With a standard deviation of 13.9 (not shown), a gap of this size is substantial. In addition to a test-score gap, Table 1 documents racial disparities in the social and economic resources embedded within the families of black and white youth, in their school contexts, and neighborhood conditions. For example, black youth come from families with considerably less household income and parental education. Yet despite these resource deficits, parents of black youth express higher aspirations for their children's educational attainment than did the parents of white youth. Black adolescents, themselves, expressed slightly lower educational expectations than their white counterparts. Almost twice as many whites as blacks attend private schools. Black youth also learn, on average, in somewhat larger classes than their white counterparts. Moreover, black adolescents attend schools that have, on average, smaller percentages of students who participate in academic programs but larger percentages of students who report problems than do the schools that whites attend.

Substantial differences also characterize the neighborhood contexts of black and white youth. The overwhelming majority of white teens (83.4%) live in neighborhoods with a poverty rate of no more than 20 percent, while only 39.9% of black youth reside in such neighborhoods. Another substantial portion (23.3%) of black youth reside in high poverty neighborhoods in contrast to less than 3% of whites. The starkest difference between blacks and whites, however, lies in the racial composition of their neighborhoods. The overwhelming majority of white teens (92.9%) live in neighborhoods in which blacks represent no more than 25 percent of residents.¹⁶ A small fraction of white adolescents (4.0%) live in neighborhoods that are 25 to 50 percent black. As expected, black teens are

more evenly distributed across the categories of racial concentration that I use here. Almost 24 percent of them reside in neighborhoods that are less than 25% black; smaller proportions of them live in neighborhoods that are between 25 and 75 percent black. However, a full 41 percent of black youth live in neighborhoods that are highly racially concentrated; that is, 75% or more black.

Table 2 provides a description of the differences in individual, family, school, and neighborhood characteristics across levels of black residential concentration. (Results are provided for blacks only, as relatively few whites reside in neighborhoods of high black concentration). The early indication from this table is that families with fewer economic (e.g., household income) and social (e.g., parental education, educational expectations) resources tend to reside in the most racially-concentrated neighborhoods. As established by prior research, poverty is more concentrated in racially-concentrated neighborhoods. Similarly, students in racially-concentrated neighborhoods attend schools that are, on average, of lower quality or have less advantaged features (e.g., public schools, peer environment, class size) than the schools attended by students in integrated neighborhoods. To be sure, not all variables point to disadvantages for majority-black neighborhoods compared to the most integrated ones (e.g., see percentage of teachers new to a school). Moreover, average differences between integrated and concentrated neighborhoods in school quality and organizational features appear modest when examined as individual variables. Yet, small differences accumulated across multiple dimensions of school quality can collectively make for qualitatively different schools. To understand whether these variables collectively help to explain differences in verbal skills across levels of racial concentration, I turn to the multivariate results.

3.2. Multivariate Results

Table 3 contains estimates for whites, all blacks, black female and black male adolescents. Model A shows the overall relationship between racial residential concentration and verbal test scores. Recall that neighborhoods that are 0 to 24.9% black comprise the reference category. Racial concentration has no significant association with the test scores of whites. To be more precise, it is unlikely that the test scores of whites have no relationship to neighborhood racial concentration, but rather that there are too few white respondents in the sample who live in racially-concentrated black neighborhoods to estimate that relationship with confidence. Recall that the majority of white adolescents (92.9%) reside in neighborhoods that are less than 25% black. For this reason, the remaining discussion is focused primarily on the results for blacks.

Black youth from racially-concentrated neighborhoods score lower on the Peabody Picture Vocabulary Test than black youth from more integrated places. Specifically, the scores of youth who reside in neighborhoods that are 25 to 49.9% black are, on average, 2.9 points lower than the scores of blacks from more integrated neighborhoods. Youth from neighborhoods in which blacks represent more than half of all residents score, on average, between 5.4 and 5.9 points lower on the PPVT-R than youth from less concentrated

¹⁶This statistic obscures the fact that more than three quarters of white youth live in neighborhoods with black populations that represent less than five percent of all residents.

neighborhoods. Despite expectations, the relationship between racial concentration and verbal skills does not vary significantly by gender.¹⁷

Model B shows that family background variables reduce the magnitude of the relationship between racial residential separation and test scores among blacks. Controlling for these measures reduces the size of the coefficients for racial concentration by 25.0 to 46.1 percent. Nevertheless, black youth of both genders who live in racially-concentrated neighborhoods evidence lower verbal performance compared to youth from more racially-integrated places, net of differences in family background. Together, Models A and B provide support for the first hypothesis—that racial residential concentration is negatively associated with verbal test scores.

Model C tests whether neighborhood poverty is a mechanism through which racial residential separation may affect verbal skills. The verbal scores of whites vary significantly by neighborhood poverty. White youth who live in neighborhoods in which 20 to 39.9% of residents are poor score, on average, 1.2 points lower on the vocabulary test than white youth who live in more affluent places. A larger reduction in scores is observed for white youth who live in areas of extreme poverty.¹⁸ In contrast to whites, the scores of black youth are not significantly related to neighborhood poverty, net of racial concentration and family background.¹⁹ Despite this, controlling for neighborhood poverty somewhat reduces the magnitude of the relationship between racial concentration and verbal skills among blacks, particularly at the very highest level of racial concentration, which is no longer statistically significant.

Models D and E comprise my two-part strategy for testing whether the negative relationship between neighborhood racial concentration and verbal ability operates through school characteristics. I first measure school characteristics with a set of variables that capture specific quality and organizational features of schools (Model D). These include school sector, region, urbanicity, size, average class size, measures of student performance, teacher quality and experience, and the peer environment. I then broaden my approach by using school fixed-effects models that allow me to capture the unobserved heterogeneity in school characteristics that may exist across schools, which is particularly relevant if unmeasured aspects of quality vary among schools that serve more versus less racially-concentrated neighborhoods (Model E).

¹⁷Tests of differences between the coefficients for black female and male adolescents are not statistically significant at conventional levels.

¹⁸Less than three percent of white adolescents in the analytic sample live in extremely poor neighborhoods (i.e. those in which more than 40% of residents are poor). See Table 1.

¹⁹There is a significant *bivariate* relationship between neighborhood poverty and test scores among both blacks and whites. Family background accounts for a substantial part of that relationship among both groups, and fully accounts for it among black male adolescents. The remaining association between of neighborhood poverty and test scores disappears for black females when racial concentration is controlled. This suggests that the source of the remaining variation in test scores across poor and non-poor neighborhoods among black female adolescents is related to the racial composition of neighborhoods rather than their socioeconomic mix. This pattern of results is consistent with my argument (and that by Massey, Condran and Denton 1988) regarding variation in institutional resources across black and white neighborhoods. On the other hand, racial concentration has little power to explain the relationship between neighborhood poverty and test scores among whites because so few whites reside in neighborhoods with a substantial black presence.

Model D shows that school quality and other characteristics are instrumental to the receptive language skills of blacks, particularly as reflected by school size, percentage of students who perform at grade level, percentage of teachers with no prior experience at the school, as well as the educational expectations of and frequency of trouble among its students. Overall, this set of school variables narrows the gap in scores between youth from moderately-concentrated neighborhoods (those 25-74.9% black) and more integrated places, especially among black male adolescents for whom no significant differences across levels of neighborhood racial concentration remain. However, school variables do little to explain the adverse relationship between *highly* racially-concentrated neighborhoods and vocabulary scores among black female adolescents. In fact, these particular school controls serve only to increase the strength of the relationship between very high levels of racial concentration and scores, as evidenced by the slightly larger coefficient for neighborhoods that are 75% or more black across Models C and D.

However, before we conclude that school characteristics do not mediate the relationship between high levels of racial concentration and verbal test scores, let us undertake a more thorough accounting of school characteristics via school fixed-effects models (see Model E). Recall that for these models, dummy variables that identify all schools in the sample replace the substantive variables used in Model D that control for particular features of schools. As such, comparisons between youth in less versus more racially-concentrated neighborhoods are drawn within schools. Therefore, the question addressed by these models is whether youth from racially-concentrated neighborhoods score lower than their counterparts in more integrated places when both groups attend the same school (i.e., have the same level of school quality and share other school characteristics). That is, when variation in school quality and other characteristics is removed, do youth from racially-concentrated residential environments score lower on verbal tests than youth from the most integrated neighborhoods?

This second approach to capturing differences in school quality and other characteristics proves fruitful, as results from Model E show that even the relationship between high levels of racial concentration and verbal skills is reduced in the presence of comprehensive school controls. That is, unobserved differences between schools that serve more and less racially-concentrated neighborhoods contribute to the negative relationship between racial separation and verbal test scores. When differences in school characteristics are removed, gaps in the test scores of black male adolescents from neighborhoods of various levels of racial concentration are reduced to less than 1 point (and remain nonsignificant). The gap in scores between black female adolescents from highly-concentrated neighborhoods and those from more integrated places is similarly smaller in light of the more thorough accounting of school quality differences between neighborhoods across Models D and E. However, there remains a significant negative relationship between racial concentration and test scores for black female adolescents, suggesting that this relationship is not fully mediated by school quality and other school characteristics.

The results of Models D and E, thus, support the institutional resources model. As predicted by the model, disadvantages in the verbal skills of youth from racially-concentrated neighborhoods are related to their institutional resources. When the school resources

accessed by black youth from racially-concentrated neighborhoods are on par with those enjoyed by black youth in the most integrated neighborhoods, differences in verbal comprehension between the two groups is substantially reduced and, in the case of males, fully eliminated.

However, an alternative explanation for the lack of a statistically significant relationship between racial concentration and verbal scores in Model E is that there is insufficient variation in racial concentration within schools to estimate it. There is little support in the data for this interpretation. To be sure, there are schools that have little variation in racial residential concentration. However, such schools are in the minority. Based on the values for racial concentration within each school in the sample, the average minimum value for racial concentration is 0.60 while the average maximum value is 47.24, producing an average range across all schools that is 46.64 percentage points wide. The average value for the interquartile range, a more conservative measure, is 16.98 percentage points. Additionally, the persistent statistically significant results for black female adolescents lend further support that lack of variation in racial concentration within schools is unlikely responsible for the absence of statistically significant results for black male adolescents, as there is little reason to assume that black male and female adolescents systematically attend different schools.

Figure 1 provides a graphical representation of the relationship between racial residential concentration and verbal test scores for blacks by gender across the five models estimated. Each line describes the gap in scores between the least racially-concentrated neighborhoods (i.e., the reference category of 0-24.9% black) and more racially-concentrated neighborhoods. Two aspects of the figure are of note. One, the two most racially-concentrated neighborhoods are rather similar in the average test scores of their adolescent residents, suggesting a possible threshold beyond which the relationship between racial concentration and verbal ability becomes no stronger.²⁰ Second, the set of models I have estimated do a better job of explaining the relationship between neighborhood racial concentration and verbal skills among black males than among black females. Not only is there no statistically significant relationship in the school models for black males, but those from racially-concentrated neighborhoods score as well on the verbal comprehension test as males from the most integrated neighborhoods (see Model E). In contrast, only black female adolescents in neighborhoods that are 25-49.9% black reach parity with their counterparts in the most integrated neighborhoods.

Finally, I assess how much of the race gap in test scores can be explained by my final model (Model E). Recall from Table 1 that the total black-white gap in scores is 12.7 points. It is 13.0 points between black female adolescents and whites, and 12.3 points between black males and whites. Controlling for racial neighborhood concentration, family background, neighborhood poverty, school quality and other school characteristics reduces the test score gap by 35.1% between black female adolescents and whites to 8.4 points. The gap between black male adolescents and whites is reduced by 44.3% to 6.9 points. Clearly, the black-

²⁰See Ellen and Turner's (1997:844) discussion of the need to explore nonlinear neighborhood effects and thresholds.

white gap in verbal skills is a function of other factors in addition to the specific family, neighborhood, and school variables considered here.

4. Discussion and Conclusions

In light of prior research on the negative consequences of racial residential segregation, I have sought to evaluate whether adolescents who live in racially-concentrated neighborhoods evidence lower cognitive skills than youth from more integrated neighborhoods. I, then, sought to understand whether the institutional resources model of neighborhood effects could explain the negative relationship between racial concentration and cognitive skills. That is, I evaluated whether the negative relationship between racial concentration and verbal test scores is mediated by the institutional resources that are available to residents in black neighborhoods compared to those in less racially-concentrated places.

Results are consistent with the contention argued and demonstrated in prior studies that blacks incur negative consequences to restrictions placed on their residential mobility. Black youth from racially-concentrated neighborhoods evidence lower test scores than black youth from more integrated places, net of differences among them in family background. Indeed, because aspects of respondents' family socioeconomic background (i.e., family income) are likely negatively affected by racial neighborhood concentration (Mouw 2000), estimates of the relationship between racial concentration and verbal skills may be conservative.²¹ The results further suggest that school characteristics are implicated in the negative relationship between neighborhood racial concentration and verbal skills, especially for black males. For black females, the persistent negative relationship between racial concentration and test scores indicates that differences in the schools that serve black versus white neighborhoods is an important but incomplete explanation for how racial concentration relates to their verbal skills. Additional research should further explore the mechanisms through which racial concentration may lower verbal and other cognitive skills of African-American girls.

An important implication of this research is that the connection between neighborhood racial concentration and verbal skills represents for blacks yet another structural disadvantage that must be overcome to achieve parity with whites on a cognitive outcome that has implications for educational and occupational achievement. Although racial concentration may very well be associated with lower test scores among white youth, that so few whites reside in racially-concentrated black neighborhoods means that, for the group as a whole, the impact of segregation is minimized. To be sure, racial neighborhood concentration *alone* is not responsible for the black-white gap in test scores. However, it is one of a number of institutional structures that exist outside the domain of student and parental agency that may substantially reduce the skills of blacks, but not whites. In this way, the findings reported here contribute to a body of work on the ways in which residential segregation, itself, may exacerbate other forms of racial inequality.

²¹See discussions by Jencks and Mayer (1990), Crane (1991), Brooks-Gunn and colleagues (1993), and Harding (2003) about the potential for downward bias of estimates of neighborhood effects when controlling for family socioeconomic background. But see Ellen and Turner (1997) for a discussion of possible upward bias.

Neighborhoods, like individuals, possess different resources, whether due to the differential ability of residents across neighborhoods to secure them or because authority figures differentially allocate resources to neighborhoods. Whatever the underlying cause, the quality of institutional resources varies across neighborhoods, something every homeowner and home buyer knows well. In this case, it appears that school characteristics, including their quality, vary across neighborhoods based, in part, on their degree of *racial* concentration, thereby exposing youth who live in majority-black neighborhoods to lower quality schools compared to youth who reside in predominately-white neighborhoods.

Although the school fixed-effects analysis cannot, by its nature, identify the specific school characteristics that mediate the relationship between neighborhood racial concentration and verbal test scores, the results point to one troubling scenario—that the organization of racial groups in residential space, combined with the allocation of educational resources at state and local levels, create the various residential and school contexts in which black youth perform at lower levels compared to their white peers who live and learn in more privileged places. These findings are consistent with other research that suggest black youth, generally, attend schools of lower quality than do whites (Berends, Lucas, and Penaloza 2008; Currie and Thomas 2000; Fryer and Levitt 2004). The current analysis suggests one reason for this — differences in the quality of the schools that serve black versus nonblack *neighborhoods* (e.g., see Massey, Condran and Denton 1988). Consequently, the “housing-school nexus” (see McKoy and Vincent 2008, but also Reardon, Yun, and Eitle 2000; Reardon and Yun 2005; Saporito and Sohoni 2006) may be better described as the “race-housing-school nexus;” for it is at the intersection of race, neighborhoods, and schools that black youth, particularly black males, may experience the negative consequences of residential segregation.

With that said, there are several limitations to this study that warrant discussion. The first arises from my use of cross-sectional data. As discussed above, such data constrain my ability to conclude that neighborhood racial concentration causes lower verbal ability, given that the process through which families entered neighborhoods and youth entered schools is not observed. Because such sorting of families and youth across neighborhoods is not random, it is possible that the same characteristics of families that lead them to reside in racially-concentrated neighborhoods also suppress their children’s verbal skills. Consequently, this study can only document the association between racial neighborhood concentration and verbal test scores, though its contribution to the literature is to show that institutional resources within neighborhoods mediates that relationship.

A related limitation is this study’s lack of information on the duration of exposure of adolescents to racially-concentrated neighborhoods. Recent critiques of the MTO experiment (Clampet-Lundquist and Massey 2008, but also Ellen and Turner’s review (1997)) make clear that analyses that incorporate duration of exposure to neighborhood conditions are preferable to those that do not, as it is only through sufficient exposure to the neighborhood condition of interest can it affect individual outcomes. At the same time, Sharkey’s (2008) analysis of the neighborhood conditions in which families live across generations indicates surprisingly little intergenerational “contextual mobility,” defined as substantive changes in residential conditions. He finds that the overwhelming majority

(72%) of blacks who lived in the poorest neighborhoods as children reside in the poorest neighborhoods as adults. This translates into half (52%) of all black children residing in the poorest neighborhoods during both their childhood and adult years, which contrasts sharply with the corresponding value of 7% for whites (p. 953-54). These findings, combined with existing knowledge about the mechanisms in the U.S. that make high levels of residential segregation a persistent feature of the American landscape and the African-American experience (Massey and Denton 1993), suggests that observing blacks in neighborhoods at one point in time via cross-sectional data may not misrepresent their neighborhood contextual trajectories as much as we fear.

A third limitation concerns the caution one must take in interpreting school fixed-effects models. Although we can be confident that all variation in school characteristics are controlled with such models, we are less confident that *only* school characteristics are controlled. School fixed-effects may, for example, control for individual, family, and/or neighborhood characteristics not already in the model but that are associated with the schools students attend. To jeopardize the findings reported here, such nonschool factors would need to meaningfully account for variation in verbal test scores above that which is accounted for by a fairly comprehensive set of family background variables and neighborhood poverty, while being correlated with the schools youth attend. One such variable might be family wealth, which has been shown to have an effect on cognitive test scores that is distinct from family income (Orr 2003; Yeung and Conley 2008) and that can be used to purchase higher quality schooling.

With such cautions in mind, the findings of this research intersect with and may have implications for those on the black-white test score gap. Like previous work (e.g., Card and Rothstein 2007 at the macro level), it empirically demonstrates a relationship between neighborhood segregation and test scores. But unlike other studies, its findings suggest that institutional resources may mediate the relationship between neighborhood racial concentration and educational or cognitive outcomes. That racial residential concentration has greater implications for blacks than whites means that it serves as another underlying source of the black-white test score gap.

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Appendix A: Clustering in Analytic Sample

Sample Sizes

Number of Respondents = 13, 332

Number of Schools = 132

Number of Neighborhoods = 3,203

Respondents in Neighborhoods

Mean = 4.1

Range = 1 to 112

Respondents in Schools

Mean = 101.0

Range = 14 to 786

Schools in Neighborhoods

Mean = 1.2

Range = 1 to 3

Neighborhoods in Schools

Mean = 29.3

Range = 1 to 189

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Figure 1.
Changes in the Relationship between Racial Residential Concentration and Verbal Test Scores Across Models for Black Female and Male Adolescents.

Table 1

Means, Standard Deviations, and Percentage Distributions of Sample Respondents by Race across Explanatory Variables, Weighted. (Unweighted n=13,332)

Variable	Blacks		Whites	
	Mean/ Pct.	S.D.	Mean/Pct.	S.D.
<i>Dependent Variable</i>				
Verbal Test Score	91.93	14.74	104.59	12.66
<i>Explanatory Variables</i>				
<i>Sociodemographic Variables</i>				
Gender				
Men	49.68		50.78	
Women	50.32		49.22	
Median Household Income	\$22,000		\$44,000	
Pct. Missing	29.28		19.24	
Mother's Education				
High School Graduate or Less	44.70		39.37	
Some College	22.48		26.95	
College Graduate	12.64		20.60	
Missing ^a	20.18		13.08	
Father's Education				
High School Graduate or Less	24.82		31.70	
Some College	10.09		20.16	
College Graduate	6.98		21.40	
Missing ^a	58.11		26.75	
Parental Aspirations				
'Not Disappointed'	11.84		16.77	
'Somewhat Disappointed'	29.83		41.20	
'Very Disappointed'	42.04		32.43	
Missing	16.29		9.60	
Educational Expectations	4.02	1.19	4.17	1.18
Pct. Missing	0.49		0.23	
<i>School Variables</i>				
Public	96.26		92.73	
Private	3.74		7.27	
Region				
South	62.57		34.00	
Northeast	7.74		14.79	
Midwest	23.36		38.03	
West	6.33		13.18	
Urbanicity				
Urban	31.77		18.84	
Suburban	55.24		62.20	

Variable	Blacks		Whites	
	Mean/ Pct.	S.D.	Mean/Pct.	S.D.
Rural	12.99		18.96	
School Size				
1 – 400	17.59		18.92	
401 – 1000	51.21		46.78	
1001 – 4000	31.19		34.30	
Average Class Size	26.21	4.76	24.64	4.77
Pct. Missing	1.30		2.74	
Percent of Students Performing at Grade Level	42.57	32.28	43.56	33.82
Pct. Missing	1.30		2.74	
Percent of Students in Academic Program	40.35	32.63	45.41	31.38
Pct. Missing	1.30		2.74	
Percent of Teachers with Master's Degrees	48.56	22.80	51.18	25.00
Pct. Missing	1.38		3.04	
Percent of Teachers Who are New to School	10.59	13.48	9.51	14.58
Pct. Missing	1.30		2.74	
Percent of Students Who Report Having Trouble	45.04	7.11	40.87	5.88
Pct. Missing	2.88		5.00	
Percent of Students Who Expect to Graduate from College	76.31	10.21	77.46	8.26
Pct. Missing	2.88		5.00	
<u>Neighborhood Variables</u>				
Percent of Blacks in Neighborhood				
0 – 24.9%	23.51		92.93	
25 – 49.9%	17.86		3.98	
50 – 74.9%	16.53		1.55	
75% or More	41.12		0.31	
Missing	0.97		1.24	
Percent of Residents in Poverty				
0 – 19.9%	39.90		83.37	
20 – 39.9%	35.80		13.04	
40% or More	23.29		2.35	
Missing	1.01		1.24	
Sample Size	3,811		9,521	

Data: The National Longitudinal Study of Adolescent Health, 1994/95.

^a Category is comprised of two types of missing cases: (1) cases in which the parent-respondent reported having no current spouse or partner, and (2) cases in which the parent-respondent did not report the educational attainment of the current spouse or partner. Among blacks, 1.29% of parent-respondents reported having no female spouse or partner, and 1.78% of whites reported the same. Also, 38.23% of black parent-respondents reported having no male spouse or partner, whereas 14.15% of whites did so. The mean test scores reflect both types of missing data categories.

Table 2

Means, Standard Errors, and Percentage Distributions for Black Respondents Across Levels of Black Residential Concentration, Weighted. (Unweighted n=3,811)^f

Variable ²	Black Residential Concentration			
	0-24%	25-49%	50-74%	75-100%
<i>Dependent Variable</i>				
Verbal Test Score	95.70	92.80	89.79	90.30
<i>Explanatory Variables</i>				
Gender				
Men	52.41	47.32	46.88	50.04
Women	47.59	52.68	53.12	49.96
Median Household Income	\$28,000	\$20,000	\$20,000	\$20,000
Mother's Education				
High School Graduate or Less	37.45	49.00	48.70	45.45
Some College	26.23	21.33	22.03	21.15
College Graduate	17.70	10.41	10.13	11.69
Father's Education				
High School Graduate or Less	23.18	22.88	28.02	24.86
Some College	14.28	11.25	9.23	7.55
College Graduate	11.06	5.50	7.19	5.36
Parental Aspirations				
'Not Disappointed'	12.25	8.23	12.73	12.91
'Somewhat Disappointed'	30.94	35.98	31.58	25.42
'Very Disappointed'	41.96	39.92	39.57	44.19
Educational Expectations	4.04 (1.17)	4.01 (1.25)	4.06 (1.18)	3.99 (1.19)
School Sector				
Public	94.40	95.91	95.70	97.60
Private	5.60	4.09	4.30	2.40
Region				
South	55.33	63.20	75.12	60.87
Northeast	9.42	10.69	8.68	5.20
Midwest	18.90	21.08	12.79	31.55
West	16.36	5.03	3.41	2.38
Urbanicity				
Urban	34.24	32.76	34.85	29.01
Suburban	51.29	60.73	41.76	60.92
Rural	14.46	6.51	23.39	10.07
School Size				
1 – 400	13.85	17.97	17.30	19.69
401 – 1000	42.33	50.16	53.74	55.34
1001 – 4000	43.83	31.87	28.97	24.96
Average Class Size	25.68 (4.91)	25.34 (4.15)	26.30 (4.51)	26.84 (4.95)

Variable ²	Black Residential Concentration			
	0-24%	25-49%	50-74%	75-100%
% Students Who Perform at Grade Level	42.18 (34.25)	38.68 (29.51)	38.11 (34.12)	46.26 (30.90)
% Students in Academic Program	45.27 (29.27)	38.17 (30.62)	38.34 (29.33)	39.06 (36.07)
% Teachers with Master's Degrees	25.68 (4.91)	25.34 (4.15)	26.30 (4.51)	26.84 (4.95)
% Teachers Who are New to School	11.26 (16.09)	9.68 (13.32)	8.67 (7.35)	11.37 (13.78)
% Students in Trouble at School	42.55 (6.37)	45.17 (7.33)	44.66 (6.73)	46.51 (7.20)
% Students Who Expect to Grad. College	76.32 (9.78)	77.01 (10.00)	74.93 (9.45)	76.56 (10.77)
Neighborhood Poverty	13.26 (11.70)	22.07 (14.19)	29.58 (14.41)	35.76 (18.51)
0 – 19.9%	77.62	52.15	26.38	19.39
20 – 39.9%	18.95	36.01	51.61	39.83
40 – 100%	3.42	11.61	22.01	40.79
Sample Size	997	647	640	1497

¹ All footnotes from Table 1 apply. Standard deviations are presented in parentheses.

² Percentages do not sum to 100 because missing data are not represented. See Table 1 for extent of missing data across explanatory variables.

Table 3

Nested OLS Regression Models that Predict Verbal Test Scores, Weighted.^a

Variable	Whites			Blacks					
				Total			Females		
	b	SE		b	SE		b	SE	Males
Model A:									
Racial Residential Concentration									
25-49.9% Black	-0.141	1.172		-2.899*	1.204		-2.978*	1.428	-2.806
50-74.9% Black	-1.461	1.401		-5.902***	1.191		-6.555***	1.413	-5.157**
75% or More Black	-8.135	6.068		-5.399**	1.830		-5.540**	2.088	-5.257*
Constant	104.665***	0.470		95.696***	0.713		95.669***	1.018	95.721***
F statistic	1.00			8.21***			7.40***		2.89*
Model B:									
Racial Residential Concentration									
25-49.9% Black	0.095	0.891		-1.562	1.097		-2.481	1.356	-0.780
50-74.9% Black	-0.174	1.209		-4.428***	0.986		-5.590***	1.251	-3.404*
75% or More Black	-5.633	4.848		-3.773*	1.586		-4.607*	1.886	-3.150
Family Socioeconomic Background									
Household Income (ln)	1.834***	0.301		1.889***	0.547		1.237	0.781	2.478**
Mother's Educ.: Some Postsecondary	2.210***	0.429		4.304***	0.852		3.855**	1.264	4.599***
Mother's Educ.: College Graduate	4.281***	0.564		5.674***	0.876		4.228**	1.290	6.955***
Father's Educ.: Some Postsecondary	2.495***	0.540		3.296*	1.110		3.519**	1.220	2.902
Father's Educ.: College Graduate	3.567***	0.633		4.502**	1.341		4.964**	1.592	4.088*
Parental Asp.: 'Somewhat Disappointed'	2.355*	0.927		4.445	2.994		3.530	1.887	5.386
Parental Asp.: 'Very Disappointed'	2.717**	0.945		4.364	3.147		3.873	2.021	4.867
Student Educational Expectations	1.665***	0.240		1.365***	0.385		1.771***	0.507	1.132**
Constant	85.557***	1.654		76.049***	4.321		77.531***	3.986	74.203***
F statistic	28.43***			19.80***			16.53***		12.99***
Model C:									
Racial Concentration									
25-49.9% Black	0.465	0.877		-1.389	1.177		-2.260	1.434	-0.661

Variable	Blacks					
	Whites		Total		Males	
	b	SE	b	SE	b	SE
50-74.9% Black	0.867	1.280	-4.078***	1.250	-5.119***	1.495
75% or More Black	-3.982	4.955	-3.332	2.054	-3.931	2.394
Family Socioeconomic Background						
Household Income (ln)	1.678***	0.294	1.820**	0.565	1.123	0.776
Mother's Educ.: Some Postsecondary	2.155***	0.425	4.302***	0.851	3.880**	1.263
Mother's Educ.: College Graduate	4.226***	0.559	5.650***	0.875	4.236**	1.308
Father's Educ.: Some Postsecondary	2.414***	0.542	3.291*	1.109	3.481**	1.216
Father's Educ.: College Graduate	3.505***	0.633	4.479**	1.332	4.921**	1.556
Parental Asp.: 'Somewhat Disappointed'	2.394*	0.926	4.437	3.006	3.460	1.861
Parental Asp.: 'Very Disappointed'	2.786**	0.937	4.387	3.150	3.867	2.018
Student Educational Expectations	1.638***	0.242	1.357***	0.384	1.764***	0.504
Neighborhood Poverty						
20-39.9% Poor	-1.186*	0.534	-0.627	0.898	-0.734	1.236
40% or More Poor	-3.466***	1.058	-0.889	1.530	-1.509	1.949
Constant	86.473***	1.742	76.456***	4.451	78.162***	3.706
F statistic	26.41***		69.80***		35.18***	
Model D:						11.63***
Racial Residential Concentration						
25-49.9% Black	0.110	0.857	-1.128	1.061	-1.887	1.405
50-74.9% Black	0.488	1.452	-3.445***	1.038	-4.718***	1.207
75% or More Black	-1.787	4.114	-4.266**	1.333	-5.147***	1.285
Family Socioeconomic Background						
Household Income (ln)	1.204***	0.269	1.409**	0.484	0.616	0.645
Mother's Educ.: Some Postsecondary	1.949***	0.437	3.717***	0.787	2.789*	1.237
Mother's Educ.: College Graduate	3.826***	0.569	4.958***	0.891	3.550**	1.304
Father's Educ.: Some Postsecondary	2.162***	0.537	2.943*	1.075	3.432*	1.337
Father's Educ.: College Graduate	2.851***	0.643	3.219*	1.157	3.267*	1.270
Parental Asp.: 'Somewhat Disappointed'	2.124***	0.568	2.721*	1.326	2.636	1.533
Parental Asp.: 'Very Disappointed'	2.384***	0.590	2.131	1.308	2.596	1.464

Variable	Blacks					
	Whites			Total		
	b	SE		b	SE	
Student Educational Expectations	1.408***	0.173	0.890***	0.259	1.270***	0.350
Neighborhood Poverty						
20-39.9% Poor	0.856	0.587	0.608	0.724	0.647	1.103
40% or More Poor	-1.795	1.094	0.449	1.151	0.229	1.307
School Quality						
School Sector: Public	-0.776	1.173	-0.351	1.646	-1.214	2.003
Region: Northeast	0.511	1.013	-2.078	1.931	-2.483	2.196
Region: Midwest	0.845	0.579	6.151***	1.198	6.725***	1.142
Region: West	0.143	0.883	-0.306	1.173	-0.557	1.452
Urbanicity: Suburban	-0.116	0.794	-1.156	1.077	-1.631	1.138
Urbanicity: Rural	0.723	0.902	-0.136	1.558	-1.132	1.982
School Size: 400-1000 Students	3.101***	0.893	3.670**	1.271	3.216**	1.145
School Size: 1001-4000 Students	3.083***	0.904	2.649	1.554	2.283	1.631
Average Class Size	-0.067	0.083	0.172	0.121	0.142	0.128
Pct. Students Testing at Grade Level ^b	0.172	0.107	0.369**	0.119	0.172	0.126
Pct. Students in Academic Program ^b	-0.121	0.170	-0.008	0.185	-0.069	0.215
Pct. Teachers with Master's Degrees ^b	-0.046	0.121	0.074	0.239	0.102	0.286
Pct. Teachers Who are New to the School ^b	-0.076	0.119	-0.585*	0.227	-0.870**	0.292
Pct. Students Who Report Trouble at School ^b	0.467	1.050	-2.584***	0.724	-3.294***	0.798
Pct. Students Who Expect to Graduate from College ^b	2.829**	1.076	3.728***	0.775	3.648***	0.744
Constant	66.149***	11.693	57.306***	8.758	65.820***	7.801
F statistic	29.09***		106.40***		71.24***	34.25***
Model E: ^d						
Racial Residential Concentration						
25-49.9% Black	0.135	0.845	0.348	1.032	-0.191	1.292
50-74.9% Black	1.846	1.363	-1.893*	0.928	-3.589**	1.313
75% or More Black	2.956	4.223	-1.507	1.059	-3.092*	1.228
Family Socioeconomic Background						

Variable	Blacks					
	Whites		Total		Males	
	b	SE	b	SE	b	SE
Household Income (ln)	1.196***	0.255	1.517**	0.487	0.897	0.624
Mother's Educ.: Some Postsecondary	1.804***	0.381	3.175***	0.765	2.562	1.310
Mother's Educ.: College Graduate	3.578***	0.504	4.966***	0.856	3.943**	1.290
Father's Educ.: Some Postsecondary	2.291***	0.531	2.720*	1.046	2.935*	1.300
Father's Educ.: College Graduate	3.052***	0.622	3.568**	1.131	3.668**	1.302
Parental Asp.: 'Somewhat Disappointed'	1.617***	0.481	1.480	1.234	2.025	1.530
Parental Asp.: 'Very Disappointed'	2.260***	0.523	1.122	1.267	2.102	1.478
Student Educational Expectations	1.364***	0.158	0.857***	0.259	1.081**	0.374
Neighborhood Poverty						
20-39.9% Poor	0.847	0.496	0.170	0.624	0.783	1.043
40% or More Poor	-0.949	1.376	0.605	1.146	1.228	1.335
School Quality						
Dummies for Each School in Sample ^c						
Constant	65.647***	0.989	63.643***	1.546	62.963***	2.123
Unweighted n	9521		3811		2033	
						1778

^aNotes: Standard errors are adjusted for sample design.

^bPercentages are divided by 10; coefficients represent changes in verbal test scores that are associated with a 10-percentage-point change in the explanatory variable.

^cCoefficients and standard errors not shown for dummy variables used to identify schools in the analytic sample.

^dModel fit statistics could not be calculated. The fixed-effects model exceeds the number of parameters that can be simultaneously constrained to zero in the analytical sample.