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A Model of Racial Residential History and Its Association with Self-Rated Health and Mortality Among Black and White Adults in the United States

Erin Ruel and

Department of Sociology, Georgia State University, Atlanta, Georgia, USA

Stephanie A. Robert

Department of Social Work, University of Wisconsin-Madison, Madison, Wisconsin, USA

Abstract

We construct a dynamic racial residential history typology and examine its association with self-rated health and mortality among black and white adults. Data are from a national survey of U.S. adults, combined with census tract data from 1970–1990. Results show that racial disparities in health and mortality are explained by both neighborhood contextual and individual socioeconomic factors. Results suggest that living in an established black neighborhood or in an established interracial neighborhood may actually be protective of health, once neighborhood poverty is controlled. Examining the dynamic nature of neighborhoods contributes to an understanding of health disparities.

There has been increasing attention to examining how neighborhood context might contribute to the health and well-being of residents. Most of this research has examined the socioeconomic context of neighborhoods, with much less research examining the racial/ethnic context of neighborhoods. This relative inattention to the neighborhood racial context is particularly striking because: (1) racial disparities in health persist in this country across almost every health outcome, and (2) racial/ethnic minority groups live, on average, in very different types of neighborhoods than do the white majority. It is likely that race and neighborhood context interact in complex ways to impact health over the life course.

Although attention to neighborhood racial context and health is sparse, some research has examined the association between racial residential segregation and health. Most of this research has used traditional racial residential segregation measures (i.e., Index of Dissimilarity and the Isolation Index) at the city, metropolitan statistical area (MSA), or county level, and has found ecological associations with mortality rates (Bird 1995; Collins and Williams 1999; Guest, Allgren and Hussey 1998; LaVeist 1989; Polednak 1993; 1996; Shihadeh and Flynn 1996).

Recent research has attempted to extend these findings by using multilevel models to examine whether racial residential segregation is associated with individual-level health and mortality, net of neighborhood and individual variables (Grady 2006; Robert and Ruel 2006; Subramanian, Acevedo-Garcia, and Osypuk 2005). Two studies using multilevel analyses with large national probability samples have demonstrated, at best, weak associations of very small magnitude between racial residential segregation at the county and MSA level and individual level self-rated health among adults (Robert and Ruel 2006; Subramanian et al. 2005). These

weak associations may represent a true weak relationship between racial segregation and health, or they may result from a number of conceptual and methodological limitations to those analyses. In particular, Subramanian et al. (2005) and Robert and Ruel (2006) both suggest that future research should examine racial residential segregation at the neighborhood level rather than at larger levels such as the MSA or county level, when examining its association with individual health. Moreover, previous research on neighborhood context and health has considered static characteristics of neighborhood context at one point in time, rather than considering the dynamic nature of neighborhoods longitudinally.

In this study, we focus on the neighborhood level (census tracts) in order to examine how racial residential context at the local neighborhood level is associated with the self-rated health and mortality of residents. Moreover, we draw upon locational attainment and racial residential succession literatures to develop a dynamic typology of racial residential history. This typology characterizes flows of blacks and whites in and out of neighborhoods between three points in time: 1970, 1980, and 1990. We test whether this dynamic typology or racial residential history is associated with individual health and mortality. We use the first wave (1986) of the Americans Changing Lives survey (ACL), along with mortality follow-up over 14 years, and U.S. census tract data from 1970, 1980, and 1990.

BACKGROUND

There are large racial disparities across many indicators of health. For eight out of the ten leading causes of deaths, Blacks have a greater mortality rate compared to whites (National Center for Health Statistics 2000). Keppel, Percy and Wagener (2002) found that for all-cause mortality, and mortality from heart disease, lung cancer, breast cancer, stroke, and homicide, the rates for blacks were greater than that of other racial groups by factors ranging from 2.5 at the lowest to almost 10 at the greatest difference in both 1990 and 1998.

Racial residential segregation is a basic or fundamental cause of racial health disparities as it captures the effects of institutional racism on many life course outcomes including health (Williams 1997; Williams and Collins 1999). One important pathway from racial residential segregation to health is through its influence on socioeconomic status at both the individual and neighborhood levels. Segregation isolates and separates people into specific neighborhoods and thus, interferes with access to the best schools, the best job opportunities (Massey and Denton 1993), access to good medical care, parks (Yen and Kaplan 1998), grocery stores (Morland et al 2001), which in turn, limits the social mobility of blacks and creates institutional barriers for engaging in healthy behaviors. Institutional racism also results in increased stress (Dressler, Oths and Gravlee 2005), and perceptions of institutional and interpersonal racism are associated with poor health status and mortality (Williams, Neighbors, and Jackson, 2003; Barnes et al., 2007).

Health studies have found that racial residential segregation is associated with both adult and infant mortality rates (Bird 1995; Collins and Williams 1999; Guest et al. 1998; LaViest 1989; 1993; Polednak 1993; 1996; Shihadeh and Flynn 1996). To date, most of this research has been conducted at the ecological level and has measured racial segregation using indices such as the Index of Isolation or the Dissimilarity Index, which have traditionally been used as outcomes to describe the levels of segregation that exist in cities and MSAs across the U.S. (James and Taeuber 1985; Massey and Denton 1988; 1989). These indices are cross-sectional summary measures of relative dispersion or inequality in MSAs or cities --two ecological levels removed from the individual. Individuals are nested within neighborhoods, which, in turn, are nested within a larger geographic unit, such as an MSA or county.

Due to the advancement of multilevel modeling statistical techniques, we can now assess the relationship between these segregation indices at multiple levels (at the city, county or MSA level) with individual level health. However, two recent multilevel studies found only weak relationships between racial segregation and health (Robert and Ruel 2006; Subramanian, Acevedo-Garcia, and Osypuk 2005). Subramanian et al. (2005) conducted a multilevel study of racial residential segregation and self-rated health using the 2000 March Supplement of the Current Population Survey, with a sample of over 50,000 non-Hispanic white and black adults residing in U.S. MSAs. Despite the large sample size, they found only a weak association of small magnitude between MSA level racial residential segregation (Isolation Index) and poor self-rated health, for black adults; none of the other segregation measures were significant. Robert and Ruel (2006) conducted a multilevel study of residential segregation and self-rated health among older adults using the Americans Changing Lives (ACL) study and the National Survey of Families and Households (NSFH) and found weak associations between racial residential segregation (Index of Dissimilarity) and poorer self-rated health among *white* older adults in the NSFH, but no associations between racial residential segregation and self-rated health among older adults in the ACL. The magnitudes of the associations in these studies are quite small and suggest that while the associations might be statistically significant, the effect sizes are not large.

It is possible, however, that the lack of substantively meaningful associations in this recent multilevel work is due to the use of segregation measures that are both static and at a very high level of geography (MSA and county levels). A measure of segregation that is more proximate to the individual may be more closely associated with individual health and mortality risk (see LaViest, 2003). We argue for a measure of neighborhood racial context that is measured independently of the respondent, represents a neighborhood context that is proximate to the individual, and accounts for the dynamic nature of neighborhood racial change over time. We draw on racial residential succession and locational attainment theories to create a dynamic, neighborhood-level typology of racial residential history, and then we examine its association with health and mortality.

Locational Attainment and Racial Residential Succession Theories

Blacks and whites live in very different neighborhoods in the United States due to a combination of racial discrimination and lower SES. According to locational attainment theory, individuals convert individual-level SES into the best possible neighborhoods (Alba, Logan and Stults 2000; Logan et al. 1996). That is, people select into and out of neighborhoods based on their human capital (e.g. income, education) (Alba and Logan 1991, South and Crowder, 1998, Tolnay, Adelman and Crowder 2002). The place stratification model modifies this theory by arguing that minorities, especially black people, are restricted from gaining the best possible neighborhoods due to institutionalized discrimination (Alba and Logan 1991). After controlling for human capital, blacks continue to have significantly worse locational attainment than do whites (Alba and Logan 1991; Tolnay et al. 2002). Further, Logan et al. (1996) found that blacks have, by far, the worst locational attainment compared to whites, while the locational attainment of Asians and Hispanics is in between whites and blacks. A consequence, consistent with the place stratification model, is that African Americans are restricted to poorer and more segregated neighborhoods (Alba and Logan 1993).

Adelman, Tsao, Tolnay, and Crowder (2001) found that high-status non-Hispanic blacks are unable to access neighborhoods similar in quality to those that even low-status, non-Hispanic whites are able to access. Black people are more likely to live in lower socioeconomic neighborhoods even when compared to white people with the same income level (Adelman et al. 2001; Fischer 2003; Jargowsky 1997). Furthermore, black people with higher income are as likely as those with lower income to live in more racially segregated neighborhoods

(Adelman 2004; Alba and Logan 1993; Fischer 2003; Massey and Denton 1988; Massey and Fischer 1999). Adelman (2004) found that among the middle class in 1990, blacks lived in neighborhoods with over two times as much poverty, over four times as many boarded-up homes, and twice as many female-headed households as whites. This body of literature demonstrates that racial residential segregation produces and reinforces the economic segregation of black people (Adelman 2004; Alba and Logan 1993; Jargowsky 1997; Massey and Denton 1993; Massey and Denton 1989; 1988).

In contrast, racial residential succession models focus not on how individuals select into neighborhoods by race, but how neighborhoods themselves change over time—particularly focusing on how American cities became racially segregated over time, particularly in Northern and Midwestern industrial cities. The racial residential succession model describes the replacement of one population group by another, and was originally derived to explain the residential settlement of the massive in-migration of blacks from South to Northern cities (Duncan and Duncan 1957; Taeuber and Taeuber 1965). Between 1910 and 1970, approximately 7 million African Americans migrated from the rural South to the industrialized Northern and Midwestern cities, creating the first urban black communities (Frey 2004). These in-migrating blacks settled into already existing black neighborhoods in Chicago, which Duncan and Duncan labeled ‘piling-up’ neighborhoods. These neighborhoods became densely populated thus forcing native Northern blacks out. This process continued with native blacks first entering white tracts in very small numbers, then crossing some threshold to ‘invade’ a traditionally white area (black entry tracts); whites began to move out (black transition area) initiating a process of succession that culminated in highly segregated, black established tracts.

Taeuber and Taeuber (1965) extended this line of research by analyzing succession in ten cities located in both the North and South from 1950 to 1960. They found that over time, as the migration ended, natural increases in the black population rather than migration played a more dominant role in residential patterns, but the residential patterns remained quite consistent (densely populated black concentrated neighborhoods). Further, they found that succession patterns found in northern cities were not as strong in southern cities because in the South, at that time, blacks and whites were often tied economically. Thus, there was less geographic segregation and more social segregation in the South. The residential succession pattern needed to be modified to include stable interracial neighborhoods to account for the greater variability in other cities.

Massey and Mullan (1984) and Massey, Condran, and Denton (1987) have applied typologies based on racial residential succession theory to black/white disparities in several spatial and life course opportunity outcomes. Massey and Mullan (1984) found that non-Hispanic blacks are highly concentrated in few neighborhoods of a city compared to non-Hispanic whites and Hispanics, and thus experience different assimilation patterns. Massey, Condran and Denton (1987) measured segregation as a typology of neighborhoods between 1980 and 1990 and created the following neighborhood types: white, black entry, black transitioning, black established, and declining neighborhoods. They found that high status blacks are able to convert their individual-level SES into residing in white tracts or in black entry tracts (highest status neighborhoods), while low status blacks are found in black established tracts (lowest status neighborhoods). Overall, they found that over 90% of blacks lived in black transition or established black neighborhoods, suggesting that this typology captures residential segregation well at the neighborhood level. Furthermore, they found that living in black transition or established black tracts is associated with higher crime rates, adult death rates, infant mortality rates, and high school dropout rates.

These bodies of literature suggest that shifting to a dynamic, neighborhood-level typology of racial context may improve our understanding of how neighborhoods contribute to racial

disparities in health. At the neighborhood level, these segregation processes have a negative impact on the spatial and economic attainment of African Americans, which may in turn, affect health. As discussed earlier, segregation processes can affect health not only through shaping individual and neighborhood socioeconomic context, but also by increasing residents' exposure to racial discrimination or racial conflict that can affect acute and chronic stress levels and ultimately, health.

We examine neighborhood racial composition over time (1970, 1980, and 1990) by creating a neighborhood racial residential history typology that categorizes census tracts (neighborhoods) as: primarily white, established black, established interracial, black transitioning, black entry, gentrifying, or declining. Our first hypothesis is that residents of the neighborhoods with the largest concentration of blacks for the longest periods of time (established black and transitioning black) will have worse health and mortality compared to residents of neighborhoods that have more recently increased their population of black residents (black entry), and compared to residents of primarily white or established interracial neighborhoods. Our second hypothesis is that residents of higher poverty neighborhoods will report worse health outcomes, and that neighborhood poverty will at least partly mediate the association between neighborhood racial residential history and health outcomes. Our third hypothesis is that the associations between neighborhood racial residential history and health outcomes will remain even after controlling for individual-level race and neighborhood-level poverty. We expect that racial segregation may have some pathways to health through its impact on stress rather than only through its impact on economic attainment or economic neighborhood context. Finally, our fourth hypothesis is that individual-level SES will explain much, but not all, of the associations between health and both racial residential history and neighborhood poverty.

DATA AND METHODS

Individual-level data are from the Americans' Changing Lives (ACL) survey. The ACL is a multistage, stratified area probability sample of the non-institutionalized population age 25 years or older, including an over-sample of blacks and older adults, living in the coterminous United States, and consists of 3,617 respondents (House 1989). Data on individual-level demographics and SES control variables were taken from the 1986 wave 1 survey. Data on self-rated health were taken from the wave 1 survey, and mortality was examined over 14 years, ending at wave 4 (2001/2). To compare our research with earlier work on residential segregation and health, which has focused on comparing black and white urban/suburban respondents, we restrict our sample to people reporting their race as non-Hispanic black or white, and to respondents living in urban or suburban areas, which limits our sample size to 2,461 respondents.

We use census tracts as proxies for neighborhoods. We identify the census tract of each respondent at W1 of the ACL, in 1986, and match that census tract to data about that tract in 1970, 1980, and 1990, using census extract files (Adams, 1992). This allows us to see how a particular census tract changed over time rather than considering neighborhoods as static. Indeed, even in previous research on residential succession, only two points in time were used (see Massey et al. 1987). With a third time point, we have been able to assess trends over time.

Census tracts, on average, contain about 4,000 residents, but can range from 2,500 to 8,000 residents. They were originally created to be homogeneous in terms of various population and socioeconomic characteristics and living conditions (US Census Bureau 2000). Over time, as populations grow within census tracts, the tracts are split into two or more census tracts. Thus, although someone may not move, s/he may be classified in different census tracts over time. For the majority of the census tracts included in our sample, matching census tracts between

1970 and 1980 was clear and direct, but for 616 respondents, their census tracts did not match between decades. Most of these 1980 census tracts could be aggregated back into the larger 1970 census tracts to make them comparable. The Neighborhood Change Database 1970–2000 was used for this purpose (Geolytics and the Urban Institute 2001). However, for 193 respondents, their tracts could not be matched between 1970 and 1980 and they were eliminated, giving us a sample size of 2,268. An additional 9 census tracts had census-suppressed population information and thus could not be incorporated into the analysis leaving a sample of 2,259. The creation of the racial residential history construct, which is discussed in detail below, ultimately eliminated another 714 respondents for substantive purposes, leaving us with a final sample size of 1,545 cases for our analyses. Table 1 compares our subsample to the full, nationally-representative sample. Despite reducing the sample by over half, our subsample does not differ substantially from the full sample in terms of health outcomes or our independent controls.

Measures

Dependent variables—We examine both self-rated health at wave 1 (1986) and mortality over 14 years, between waves 1 and 4. Self-rated health is a subjective, multidimensional measure of overall well-being. It has been shown to be a predictor of mortality, and it has been described as a powerful measure that encompasses many health domains (Idler and Benyamini 1997). The self-rated health question in the ACL asks, “*How would you rate your health at the present time? Would you say it is Excellent (1), Very Good (2), Good (3), Fair (4) or Poor (5)?*” We treat self-rated health as a continuous outcome. In both the subsample and the full sample, the average report was 2.5, half way between very good and good.

Deaths between wave 1 (1986) through the end of 2000 were identified using both informants and information from the National Death Index, and were verified using death certificate reviews. We treat mortality as a dichotomous variable, and also create a survival time until death variable defined as number of months lived through end of 2000. Respondents alive by wave 4 were censored at 176 months. Table 1 presents descriptive statistics on the dependent variables and the individual-level covariates for our analytic sample and for the full ACL sample. Twenty percent of our subsample was reported or confirmed dead by 2000 while in the full sample 19.4 percent were confirmed dead.

Independent variables--covariates—We control for race (black=1 and white =0), sex (female=1 and male=0), age, education, logged family income, and assets. We use the term “black” rather than African American because respondents reported that they were black but were not provided the opportunity to specify whether they were African American or from another country. Education is defined as the number of years of schooling completed. Family income (total income from the respondent and his/her spouse/partner) is included as a continuous measure. We create three dummy measures of wealth: greater than \$10,000 in assets, less than \$10,000 in assets (reference) and missing data on assets. Table 1 shows that the subsample does not deviate much from the full, representative sample. The percent female is the same at 53 percent, as is average age, years of education and average income. African Americans are slightly overrepresented in the analytic sample (13 percent black versus 11 percent black). Members of the analytic sample also were more likely to have at least \$10,000 in assets compared to the full sample (51 percent compared to 49 percent). These slight differences should not significantly bias the results.

Racial residential history and neighborhood SES—We created a measure of neighborhood SES that is measured by the proportion of persons living in the 1980 census tract that are below the poverty line.

We created the racial residential history typology based on the original definitions from racial residential succession theory (Duncan and Duncan 1957; Taeuber and Taeuber 1965), but added elements to better represent contemporary residential processes (see Massey, Condran and Denton 1987; Massey and Mullan 1984). The typology is primarily based on 1970 and 1980 census data, but for census tracts that appeared to be established or non-changing between 1970 and 1980, we also used 1990 census data to examine whether or not these neighborhoods were indeed non-changing.

First, following Massey, Condran and Denton (1987), we eliminated respondents living in tracts with large populations (at least 250 persons in 1980) of minorities who were not black; reducing our sample from 2,259 to 1,613.¹ Next, we split the census tracts between white tracts and black tracts. Following procedures established by Duncan and Duncan (1957) and Taeuber and Taeuber (1965), we defined white tracts as tracts having less than 250 black residents in 1980.² This means that black tracts are defined as those with a minimum of 250 blacks. We then decomposed the black tracts into several mutually exclusive types classified in a hierarchical scheme: established black, black entry, established interracial, and black transitioning neighborhoods. Established black neighborhoods had a population that was at least 70 percent black in 1970, 1980 and 1990.³ Black entry neighborhoods are those just beginning to develop a sizeable black population. These neighborhoods were less than ten percent black in 1970 and up to forty percent black in 1980. Next, for all census tracts that were not defined as either established black or black entry, we separated them into either established interracial, black transitioning, or gentrifying neighborhoods. Established interracial neighborhoods are defined as between 10 and 70 percent black in 1970, with a mixed composition of whites and blacks that showed a less than five percent increase or decrease in both the black and white compositions of the neighborhood between 1970 and 1980 and between 1980 and 1990. Black transitioning neighborhoods had a sizeable black population in 1970 (at least 250 blacks), but less than 70 percent black in 1970, and that grew by at least 5 percent between 1970 and 1980, while the white population declined between 1970 and 1980. Gentrifying neighborhoods had a declining black population between 1970 and 1980, while the white population grew by at least 5 percent. Many of the gentrifying neighborhoods showed an increasing white population and a very slightly declining black population. Because the distributions were very similar to the established interracial type, we combined these two rare neighborhood types. There were a number of neighborhoods that did not have a linear trend over time, with some showing an increase between 1970 and 1980 in black population and decrease between 1980 and 1990, or vice versa. Since these neighborhoods did not fit any of our types, they were dropped from the analysis leaving us with a final sample of 1,545 persons

¹We primarily eliminated heavily Hispanic neighborhoods. As census tracts have grown and changed since the earlier racial residential succession studies were conceptualized and performed, we replicated the typology eliminating first tracts with 500 and then 1,000 non-whites and non-blacks. Under these conditions, we found that black entry and black transitioning neighborhoods increased in quantity compared to the white and established neighborhoods as we allowed the number of non-white and non-black minorities to increase. Thus, blacks are entering white neighborhoods, but they are also entering neighborhoods with large Hispanic populations. At this point we are unwilling to equate white dominated neighborhoods and Hispanic dominated neighborhoods, thus we eliminated tracts with 250 or more non-whites and non-blacks.

²Duncan and Duncan (1957), as well as Taeuber and Taeuber (1965), used 250 as a definitional cut-off for black and white tracts. This seems quite arbitrary, but actually pertains to the Census' confidentiality procedures. The census suppressed counts of minorities in areas where there were less than 250. A better method now might be to base the cut-offs on relative numbers such as percent black in a census tract. We used 250 as the initial cut-off between white and black, but then used percents to distinguish between the black neighborhood types. We performed sensitivity analyses by using various other cutoffs and found that increasing the cutoff means we have more white neighborhoods and less black neighborhoods. Decreasing the cutoff to 100, means reducing white neighborhoods, and primarily increasing the number of established interracial neighborhoods. Analyses on self-rated health and risk of death are similar with a cutoff of 100 compared to a cutoff of 250 African Americans in white neighborhoods.

³Causally, it may appear that our dependent variable and our independent variable are not in the proper time order. Self-Rated health was measured in 1986 and our typology uses information from 1970, 1980 and 1990. We included 1990 because three time points are necessary to determine if there is a trend. Information from 1990 was used solely to see if the trend that was begun in 1970 and extended through 1980 remained. Thus, we argue that the neighborhood typology was established prior to 1986 and is relatively stable (Davis, 1985) and thus is temporally prior to our health outcomes.

in 339 census tracts across the U.S. The typology was entered into our models as a series of dummy variables with consistently white tracts as the reference category. Although the neighborhood typology represents neighborhood dynamics over time, it is measured by dummy variables characterizing the dynamic trajectory of these neighborhoods to date.⁴ The neighborhood effect can be interpreted as a baseline neighborhood effect that demonstrates baseline exposure to a neighborhood type.

We rigorously examined our neighborhood typology. First, we examined the racial composition of the typology. Figure 1 shows the census tract-level percent of blacks living in each neighborhood type from 1970 to 1990. Established black neighborhoods had less than 10 percent white in each decade and more than 90 percent black in each decade. White tracts were the opposite with at least 90 percent white and less than 10 percent black in each decade. Established interracial neighborhoods had between 30 and 20 percent black in each decade. For the transitioning neighborhood types, black entry and black transitional, the percent black increased across the three decades for both neighborhood types. The trend is consistent for black entry neighborhoods demonstrating there is little misclassification error.

The bottom of Table 1 describes the distribution of ACL respondents in the neighborhood typology. The sample consists primarily of people in consistently white neighborhoods (174 census tracts). Established black neighborhoods contain 67 census tracts. Black transitioning neighborhoods are represented by 44 census tracts.

Analysis

Using SAS 9.13, we estimated generalized estimating equations (GEE) regression models for self-rated health, which allows us to adjust standard errors to account for the autocorrelation due to the stratified sampling procedure. A Cox proportional hazards regression model was used to calculate the hazard of death by 2000, and we again calculated robust standard errors to adjust for the stratified sample design of the ACL. We used centered sample weights in our models to correct for sample selection probabilities. Neighborhood effects are quite distal from individual level outcomes and thus, small in size. One needs a large sample to have enough power to capture these small effects, even if they exist. Given the medium sample size, large number of variables included in the analyses, and small number of respondents in some of the neighborhood types, we highlight marginally statistically significant associations at $p \leq .10$.

RESULTS

Table 2 presents regression estimates for models of self-rated health. Model 1 first demonstrates that, as expected, black respondents report worse self-rated health than white respondents, net of age and sex. Model 2 introduces racial residential history, but also removes individual-level race. Model 2 tests hypothesis 1 that residents of established black and black transitioning neighborhoods would experience worse health than residents of white and established interracial neighborhoods. This hypothesis is partially confirmed as the relationship holds true for established black neighborhoods ($b=0.28$) compared to established white neighborhoods. Residents of black transitioning ($b=0.16$) and black entry ($b=0.20$) neighborhoods also report worse self-rated health than residents of white neighborhoods, but these associations are not statistically significant. Model 3 adds individual-level race back into the model. Residents of established black neighborhoods continue to report worse self-rated health ($b=0.25$) than residents of white neighborhoods, net of individual-level race. However, the association is attenuated and significant only at the $p < .10$ level. Notably, when racial residential history is

⁴Because we include a long duration for the measure of mortality, we re-ran our analyses including a dummy indicator for moving after 1986. When we include this dummy variable, our associations between the neighborhood racial context and mortality are actually slightly stronger. Thus, the results we present here are on the conservative side.

included in the model, there is no longer a statistically significant association between individual-level race and self-rated health.

In Model 4, we introduce neighborhood-level poverty. Model 4 confirms our second hypothesis that neighborhood poverty is associated with poor self-rated health, and this remains true net of racial residential history ($b=1.31$). Including neighborhood poverty in the model also eliminates the association between self-rated health and living in established black neighborhoods (compared to white neighborhoods). Thus, we reject our third hypothesis that there are independent associations between racial residential history and self-rated health net of neighborhood poverty.

Model 5 introduces controls for individual-level SES, and shows that the association between neighborhood poverty and self-rated health is attenuated, but still marginally statistically significant ($p \leq .10$) supporting Hypothesis 4. Unexpectedly, net of individual-level SES, members of established interracial neighborhoods report significantly better health than residents of white neighborhoods (but at the $p \leq .10$ level). Thus, to some extent, differences in individual-level SES may suppress the protective effect of living in established interracial neighborhoods on self-rated health. Based on model fit statistics, Model 5 is also the best fitting model, which suggests that SES, both at the individual and neighborhood level, is an important predictor of self-rated health beyond racial residential history.

Table 3 presents estimates from Cox's proportional hazards models on hazards of death by the end of 2000. Model 1 demonstrates that net of age and sex, black respondents have a greater hazard of mortality than do whites (Hazard ratio= 1.76). Model 2 tests the first hypothesis, and shows that residents in black transition neighborhoods have a greater hazard of mortality (Hazard ratio=1.86) than residents in white neighborhoods. However, this association disappears after controlling for individual race in Model 3. There is weak support for our initial hypothesis that neighborhood racial residential history typology is associated with mortality.

In Model 4, we introduce neighborhood poverty, and find that net of racial residential history, for each one percent increase in neighborhood poverty the hazard of death is significantly increased by 350 percent (Hazard ratio=3.50), confirming Hypothesis 3 about the importance of neighborhood poverty to mortality. However, neighborhood poverty does not greatly attenuate the effect of individual race; black adults continue to have a greater hazard of death net of both racial residential history and neighborhood poverty (Hazard ratio=1.85). In addition, we again see a suppressor effect of neighborhood poverty. Net of individual-level race and neighborhood poverty, residents of established black neighborhoods have about 47 percent *lower* hazard of death relative to residents of white neighborhoods (Hazard ratio=.47). This goes against our hypothesis that living in established black neighborhoods is associated with greater mortality risk than living in white neighborhoods

Introducing individual-level SES in Model 5 completely attenuates the associations between the hazard of death and both individual-level race and neighborhood poverty. Residents of established black neighborhoods, however, continue to have a significantly lower hazard of death relative to residents of white neighborhoods (Hazard ratio=0.48), even net of individual and neighborhood SES. In fact, residents of established interracial neighborhoods also have lower hazards of death (Hazard ratio=0.58) relative to residents of white neighborhoods, after controlling for individual race and SES and for neighborhood poverty, though at the $p \leq .10$ level. This protective effect of living in established interracial neighborhoods is similar to results for self-rated health.

DISCUSSION

Our study contributes to the literature on neighborhoods and health and on race and health by constructing a dynamic, racial residential history typology and examining its association with adult self-rated health and mortality among black and white adults in the U.S. Our typology describes census tract changes in racial composition between 1970 and 1990, and characterizes neighborhoods as: established black, black transition, black entry, established interracial, or white. Applying this typology extends prior research on racial residential segregation and health by focusing on a smaller level of geography—the neighborhood—and by examining neighborhood racial context as dynamic rather than static.

We first note that our results show that the black disadvantage in self-rated health is no longer statistically significant after considering racial residential history. The types of neighborhoods that people live in help explain racial disparities in self-rated health. However, black disadvantage in mortality remained even after controlling for both racial residential history and neighborhood poverty, and the risk even increased slightly. Further controls for individual SES eliminated the race disparities in mortality. Black adults have worse mortality risk no matter where they live, with neighborhood residence more strongly associated with self-rated health than with mortality. Racial disparities in mortality are explained primarily by a combination of both individual SES and neighborhood socioeconomic context.

Our examination of the racial residential history typology and its associations with self-rated health and mortality demonstrates interesting but complex results. We expected that residents in both established black and black transitioning neighborhoods would have worse self-rated health and mortality risk (compared to residents of white neighborhoods), but found mixed results. Living in black transitioning neighborhoods (compared to white neighborhoods) was not associated with either self-rated health or mortality risk, which may be due to the small number of respondents living in this type of neighborhood ($n=83$). However, living in an established black neighborhood was associated with worse self-rated health (compared to living in a white neighborhood), but not after further controlling for neighborhood poverty. Although we cannot examine causal processes here, these latter results are consistent with an interpretation that living in an established black neighborhood may be associated with poor self-rated health through its impact on neighborhood poverty context as a more proximate determinant of access to material and social resources that affect health (Acevedo-Garcia, et al. 2003; Collins and Williams 1999; LaViest 1993; Polednak 1993; 1996; Schultz et al., 2002; Williams 1997).

In contrast, and contrary to our hypotheses, living in an established black neighborhood was associated with *lower* mortality after controlling for neighborhood poverty or for both neighborhood poverty and individual SES. If this represents a true relationship, it would be consistent with a small literature that suggests that living in ethnic enclaves, and/or among people of the same race/ethnicity is protective of health (Fang et al. 1998; Smaje 1995). After controlling for the detrimental effects of living in lower SES neighborhoods, there may be a suppressed positive effect that emerges due to potential protective effects of living in an ethnic enclave. However, since we did not find this same association for self-rated health, we are hesitant to over-interpret this finding. Moreover, our data do not allow us to establish whether this effect holds for both black and white residents of established black neighborhoods.

An unexpected finding was that residents of established interracial neighborhoods had both better self-rated health and lower mortality risk, compared to the residents of white neighborhoods, after controlling for both individual and neighborhood SES. There may be some added value to health for those residing in a diverse neighborhood (Ellen 2000). Again, we cannot account for the role of selection effects and other causal processes, but clearly

examining whether diverse neighborhoods provide unique material or social resources to promote health should be explored further.

Finally, our analyses confirm that neighborhood poverty level is strongly associated with both self-rated health and mortality, and that neighborhood poverty is a more consistent predictor of self-rated health and mortality than is our racial residential history typology. These results are consistent with previous research using more static measures of racial segregation (Cagney, Browning, and Wen 2005; LeClere et al. 1998; Robert and Ruel 2006; Robert 1998; Subramanian et al. 2005). It remains difficult to examine the reciprocal and overlapping effects of neighborhood racial and socioeconomic characteristics, selection effects of people into and out of neighborhoods based on race, SES, and other characteristics, and causal processes from neighborhood racial and socioeconomic contexts to individual socioeconomic and health outcomes. Much additional work is needed to tease out these causal processes.

One advantage of using the ACL data for this study is that we had access to geographic identifiers that we could match to three decades of census data to examine neighborhood change over time. However, a limitation is that the ACL sample was a national probability sample that was not designed to take representative samples from each neighborhood, so we do not have a large number of respondents within each census tract. Future work needs to replicate these analyses using larger national datasets with more individuals sampled within each census tract, or using a local sample of a large number of people within each of multiple neighborhoods.

There are three main caveats regarding our racial residential history typology. First, we began the analysis using a cutoff of 250 blacks as the basis for splitting white and black neighborhoods, following the procedures used by Duncan and Duncan (1957) and Taeuber and Taeuber (1965) for their analyses of 1940–1950 and 1950–1960 changes. It could be argued that basing the split on the relative distribution of blacks rather than the absolute numbers might be preferable. Fortunately, census tracts tend to average about 4,000 persons (ranging from 2,500 to 8,000), thus using an absolute number both makes our results somewhat comparable across census tracts and allows us to use a typology that replicates earlier work. As Figure 1 demonstrates, there are clear differences in the racial distribution within each neighborhood type, suggesting this procedure produced little or no misclassification bias. A second issue is that census tracts have increased in size over time and perhaps 250 is too limiting a number for an analysis from 1970 to 1990. In analyses not shown, we replicated the typology using 500 blacks as the basis for the cut. Doing this simply increases the number of white tracts at the expense of black tracts, thus we stayed with 250 blacks as the cutoff between white and black neighborhoods.

A third issue is that we eliminated all tracts with more than 250 residents that are neither black nor white, which means we primarily eliminated heavily Hispanic neighborhoods (see earlier note 1). Clearly, theory and research each needs to better account for these neighborhood changes, such as adding multiracial neighborhoods, and various neighborhood types that are transitioning from one racial minority to another racial minority (Frey and Farley 1996; South, Crowder and Chavez 2005). We did not address these important issues in this study because we were limited in the racial/ethnic diversity of the ACL sample, and because we wanted to be able to compare our neighborhood typology to results of prior work focusing on black and white people and neighborhoods.

The typology framework needs to be expanded, refined, and tested. Beyond including different types of neighborhood transitions by race/ethnicity, future typologies could simultaneously incorporate socioeconomic transitions of neighborhoods. The distribution of our data did not allow us to examine this. Moreover, although our research looked at how *neighborhoods* transition, we did not attend to how *individuals* transition between neighborhoods. A growing

literature on residential mobility and racial residential segregation (South and Crowder 1998), including some that focuses on agent-based dynamic processes (Bruch and Mare 2003; Clark 1991), would be interesting to integrate into studies on health outcomes.

In order to understand the complex processes that lead to and perpetuate racial disparities in health, future research must also attend to social and economic processes in rural areas. Since studies such as this one that focus on racial segregation include only urban/suburban areas, the large racial disparities in health that exist in rural areas get ignored (Robert and Ruel 2006), and the processes creating and maintaining them remain understudied.

This study demonstrated that when examining the impact of neighborhood racial context on health, research needs to go beyond examining neighborhoods as static entities. We demonstrate that understanding the dynamic nature of neighborhoods over time may contribute to our understanding of how neighborhood context contributes to health, and specifically, to racial disparities in health in the U.S.

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Note: Est. Black stands for Established Black neighborhoods, Est. Interracial stands for Established Interracial Neighborhoods, Transition stands for Black Transitioning Neighborhoods, Black Entry stands for Black Entry Neighborhoods and White stands for White Neighborhoods.

Figure 1.

Census Tract Percent Black in Each Neighborhood Type from 1970 –1990

Table 1

Descriptive Statistics (weighted) of Health Outcomes and Independent Variables for the Analytic Subsample and for the Full ACL Sample^a

	Subsample (n=1,545)	Full Sample (N=3,617)	
	Mean/Percent (Std. Dev.)	Mean/Percent (Std. Dev.)	Range
Health Outcomes:			
Self-rated Health	2.52 (1.14)	2.51 (1.14)	1–5
Mortality (from 1986–2000)	20 %	19.4 %	0–1
Individual-level Covariates			
Black	13 %	11 %	0 – 1
White (ref.)	87 %	89 %	0 – 1
Female (ref.)	53 %	53 %	0 – 1
Male	47 %	47 %	0 – 1
Age	54.24 (17.68)	53.6 (17.62)	24 – 95
Years of Education	11.53 (3.23)	11.47 (3.47)	0 – 17
Family Income	22,904	23,351	2,500–110,000
Family Income (logged)	(21,626)	(21,984)	7.83–11.61
\$10K assets or more	51 %	49 %	0–1
Missing assets	6 %	6 %	0–1
Less than \$10K asset (ref.)	43 %	45 %	0–1
Racial Residential History			
	# of tracts per neighborhood type		
Established Black	67		
Black Transition	44		
Black Entry Tracts	30		
Established Interracial	24		
White Tracts (Ref)	174		

^a % distribution presented or means with standard deviations. For later multivariate analyses, all continuous variables were centered.

Table 2

Self-Rated Health Regressed on Individual-level Characteristics, Racial Residential History and Neighborhood Poverty (standard errors)

	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	2.41*** (.05)	2.39*** (.06)	2.39*** (.06)	2.54*** (.08)	4.53*** (.50)
<u>Individual-level covariates</u>					
Sex: Female	-.02 (.07)	-.02 (.07)	-.03 (.07)	-.05 (.07)	-.10 (.07)
Age	.02*** (.002)	.02*** (.002)	.02*** (.002)	.02*** (.002)	.02*** (.002)
Race: Black	.19** (.07)		.04 (.12)	-.06 (.12)	-.10 (.13)
Years of Education					-.04** (.02)
Logged Family Income					-.19** (.05)
Assets: \$10,000 or more					-.14 (.09)
Assets: missing					-.11 (.11)
<u>Neighborhood-Level</u>					
Established Black		.28** (.09)	.25+ (.15)	-.001 (.15)	-.02 (.16)
Black Transition		.16 (.12)	.13 (.16)	-.04 (.14)	-.09 (.15)
Black Entry		.20 (.15)	.19 (.16)	.17 (.15)	.14 (.14)
Established Interracial		-.06 0(.10)	-.07 (0.10)	-.08 (0.09)	-.015+ (0.09)
Percent tract in Poverty				1.31** (0.40)	0.63+ (.33)
Model DF	1541	1538	1537	1536	1532
Log Likelihood	-2537.43	-2533.87	-2533.82	-2522.59	-2468.09

N=1,545

+ p<.10

* p<.05

** p<.01

*** p<.0001

Note: The omitted dummy variables are male, white, <\$10,000 in assets, and white neighborhood.

Table 3
Multivariate Cox Proportional Hazard Analysis of Time until Death (Standard Errors) [Hazard Ratio]

<u>Individual-level Covariates</u>	<u>Model 1</u>	<u>Model 2</u>	<u>Model 3</u>	<u>Model 4</u>	<u>Model 5</u>
Sex: Female	-.99*** (.13) [1.37]	-.99*** (.13) [1.37]	-.98*** (.13) [1.38]	-.98*** (.13) [1.38]	-1.15*** (.13) [1.32]
Age	.12*** (.01) [1.12]	.126*** (.01) [1.12]	.12*** (.01) [1.12]	.12*** (.01) [1.12]	.11*** (.01) [1.12]
Race: Black	.57** (.17) [1.76]		.74* (.26) [2.09]	.62* (.27) [1.85]	.26 (.27) [1.29]
Years of Education					-.04+ (.02) [.96]
Logged Family Income					-.31** (.09) [.74]
Assets: \$10,000 or more					-.44** (.16) [.64]
Assets: missing					-.10 (.22) [.90]
<u>Neighborhood-Level</u>					
Established Black		.13 (.25) [1.14]	-.49 (.33) [.61]	-.75* (.35) [.47]	-.73* (.34) [.48]
Black Transition		.62* (.27) [1.86]	.08 (.34) [1.08]	-.11 (.36) [.89]	-.06 (.34) [.94]
Black Entry		.06 (.23) [1.06]	.00 (.24) [1.00]	-.07 (.24) [.93]	.02 (.24) [1.02]
Established Interracial		-.40 (.33) [.67]	-.44 (.33) [.65]	-.49 (.33) [.61]	-.55+ (.33) [.58]
Percent tract in Poverty				1.25* (.56) [3.50]	.61 (.60) [1.84]
Model DF used	3	6	7	8	12
Likelihood χ^2	741.11***	738.95***	746.34***	750.79***	799.05***

N=1,582

+ p<.10

* p<.05

** p<.01

*** p<.001