

**RESIDENTIAL MOBILITY ACROSS LOCAL AREAS IN THE UNITED STATES AND
THE GEOGRAPHIC DISTRIBUTION OF THE HEALTHY POPULATION**

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Abstract

Determining whether population dynamics provide competing explanations to place effects for observed geographic patterns of population health is critical for understanding health inequality. We focus on the working-age population where health disparities are greatest and analyze detailed data on residential mobility collected for the first time in the 2000 US census. Residential mobility over a 5-year period is frequent and selective, with some variation by race and gender. Even so, we find little evidence that mobility biases cross-sectional snapshots of local population health. Areas undergoing large or rapid population growth or decline may be exceptions. Overall, place of residence is an important health indicator; yet, the frequency of residential mobility raises questions of interpretation from etiological or policy perspectives, complicating simple understandings that residential exposures alone explain the association between place and health. Psychosocial stressors related to contingencies of social identity associated with being black, urban, or poor in the U.S. may also have adverse health impacts that track with structural location even with movement across residential areas.

Keyword: place and health, residential mobility, race and health, SES, urban, rural

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Introduction

The possibility that the relationships between socioeconomic position or race/ethnicity and health are influenced by geographic and community conditions that structure and contextualize them has garnered great interest over the past decade or more (Davey Smith et al. 1998a; Hayward et al. 1997; Geronimus 2000; Diez Roux 2001; Nordstrom et al. 2004; Cozier et al. 2007; Freedman et al 2010). A resurgence of interest in the health impact of residence in *high-poverty urban* areas, in particular, has been notable among public health researchers (Galea and Vlahov 2005; Fitzpatrick and LaGory 2011), and also among sociologists who study residential areas characterized by urban decay, concentrated poverty, and racial segregation (Massey and Denton 1993; Wilson 1996). After reviewing the growing evidence on poverty, race, place, and health, Fitzpatrick and LaGory (2010) concluded: “until the public’s view of health encompasses a basic understanding that where we live affects how we live and die, the health status of certain segments of the population cannot improve.”

Geronimus et al. (1996,1999, 2001, 2011) analyzed differences in adult disability and mortality rates across a regionally diverse set of black and white, urban and rural, high-poverty and more affluent local populations, finding great variation in these rates across population types. Cause of death analyses from 1980 through 2000 documented a substantial and entrenched burden of chronic disease among working-age black men and women living in high-poverty areas (Geronimus, Bound, Colen 2011). Black adults in high-poverty urban areas faced extremely disadvantageous mortality schedules through middle and old age, not only in comparison to white or black national averages or to black residents of more affluent communities, but also compared to black residents of high-poverty rural communities. For example, age-standardized mortality ratios in 2000 for 18-64 year old black men or women in

Southside Chicago and Delta Louisiana – two study populations in which 46% of families lived below the poverty line (and where high school and college graduation rates were substantially lower in the Louisiana compared to the Chicago population) – were greater than 3 times the national average in Chicago, yet only about 2 times the national average in Louisiana.

Standardized mortality rate differences between high-poverty urban and high-poverty rural areas suggest that place characteristics may have impacts on health above and beyond the effects of the sociodemographic characteristics of local populations. It may be reasonable to hypothesize that characteristics of urban areas undermine longevity or that aspects of rural areas confer protection. However, because most studies of place effects on health use cross-sectional data (Beard et al 2009; Diez-Roux 2007; Osypuk, et al. 2008; Shih et al 2011)¹, this interpretation implicitly assumes static local populations. Yet, local populations are in fact dynamic, and health may be associated with population shifts over time. Thus, observed geographic patterns of health could also reflect the influence of health-related migration on the geographic distribution of the healthy population. These patterns underlie the *health selective migration hypothesis*, that differences in health profiles across distinct areas may arise, in part, because the residentially mobile may be more or less healthy than those who do not move. For example the 50% higher excess mortality in the poor black South Chicago population compared to the poor black Louisiana Delta population could be because of differences in place characteristics between the areas (including environmental exposures); it could be because of differences in populations between the two areas; or it could be because of a net out-migration of

¹ Some epidemiological studies follow sample members for two or more time points; however, samples are often selective, including healthy participants at baseline in order to note whether their disease status changes over the course of the study.

the healthy from the Chicago or a net in-migration of the healthy into the Delta population (selective migration).

Gaining purchase on whether selective migration is an important competing explanation to place effects or to static compositional effects for health differences observed across local areas is critical for identifying the most promising future directions for research on racial/ethnic and socioeconomic inequalities in health and for policy to eliminate them. Considerable work has been done to explore the impact of selective migration on health among immigrants to and from the US, particularly in the context of the Hispanic Health Paradox (Palloni and Arias, 2004). Some UK studies have documented the important impact of selective migration on the health profiles of more and less distressed areas in that country (Brimblecombe et al. 1999, 2000; Norman et al, 2005). To our knowledge, we are the first researchers to address the health selective migration hypothesis in the context of residential mobility within the US.

The few investigators who have considered the relationship between local population health and residential mobility patterns within the U.S. have asked a different question, whether health influences the mobility decisions of those at or near retirement (Halliday and Kimitt 2008; Findley 1988; Longino et al. 1991, 2008; Speare et al. 1991). They do not focus on health disparities or the younger working-age population in which health disparities are greatest (Elo and Preston 1996; Geronimus 1992; Geronimus et al 2001, 2006, 2007) and do not consider the impacts of selective migration for the association between place and population health.

Health and Migration in the U.S.

There is reason to postulate that health and residential mobility may be associated. Several theoretical perspectives on residential mobility across neighborhoods in the U.S. highlight the importance to mobility decisions of the demographic and life-cycle characteristics

of nuclear household heads – including age, sex, and marital status (South et al. 2005; Tolnay 2003). To the extent that the demographic and life-cycle characteristics influencing residential moves are associated with current or future health status, it is reasonable to hypothesize that residential moves are systematically related to health.

Few data sets link residential population health and migration. Investigators of intra-urban mobility, per se (i.e., without a health and place component) have often analyzed data from the Panel Study of Income Dynamics (PSID). The strength of the PSID is its longitudinal dimension. However, due to the nature and size of its sample, researchers need to aggregate respondents residing in high-poverty areas across the nation, and, thus, cannot focus on geographically defined local environmental exposures. Recent investigations on the longitudinal effects of neighborhood stratification on educational or developmental outcomes in children use this aggregated approach (Jackson and Mare 2007; Wodke et al 2011).

Although its time horizons are proscribed, and, like the PSID, its health data are limited, the U.S. Census yields large sample sizes making estimates highly reliable, and it provides residential population data, uniquely allowing local geographic places to be delineated to observe the nature and extent of moves within, into, and out of specific local areas and their net effect on population health.

Research Questions

Considering blacks and whites separately, and where population size allows, men and women separately within each race, we explore whether observed geographic patterns of health reflect the influence of health-related migration through these research questions:

- 1) What is the extent of residential mobility flows into or out of a diverse set of local areas?
If we find little evidence of residential mobility, or in mobility between types of areas with very different health profiles, these findings alone would cast doubt on the health-selective migration hypothesis.
- 2) To what extent is residential mobility between local areas associated with either health-induced functional limitations or with socio-demographic characteristics associated with health more broadly, such as age and education? If the associations are insignificant, this would also weaken the plausibility of the health-selective migration hypothesis.
- 3) If residential mobility and health-induced functional limitation are associated, does such selection affect cross-sectional estimates of local area prevalence of health-induced functional limitation? By comparing local area health profiles in 2000 to what they would have been had no migration occurred, we will garner evidence on the quantitative impact of health-selective migration on cross-sectional snapshots of the health of local populations.

Methods

The 2000 Census was the first to ask respondents their previous residence down to the ZIP Code level, potentially allowing exploration of short-distance moves or moves between locally defined geographic areas.² Although this ZIP Code information is not included in census data usually available for research, we obtained authorization to analyze it at the Michigan Census Research Data Center (MCRDC). Reporting of our findings is limited to those the Census permits after disclosure review.

² Current residence has and continues to be coded to even lower levels of aggregation such as census tract or block group. Regarding previous residence, however, in earlier Censuses, the census designated place (CDP), was the smallest level of aggregation. From a research perspective, CDP aggregations are arbitrary. For example, in New York City, Greenwich Village is

Overview and Characteristics of the Study Populations

Our analytic sample comprises the entire non-Hispanic black and non-Hispanic white populations, aged 16 to 64, in 20 geographic aggregates of economically similar ZIP Codes (urban areas) or counties (rural areas). While we focus on these focal areas as points of migration departure or arrival, we study all moves for these areas from or to anywhere in the United States.

Our focal areas are those selected by Geronimus et al. (1996, 1999, 2011) to explore diversity in the consequences of areal poverty for urban and rural black and white mortality.³ Geronimus et al originally selected areas of concentrated poverty of sufficient size for the reliable calculation of mortality schedules, then supplementing them with geographically proximate nonpoor areas. Using census data, we could replicate these areas exactly. By studying focal areas whose mortality profiles were previously described, our findings can inform understanding of mortality differences as well as in census health measures.

These areas represent regional and racial diversity throughout the United States and provide useful comparisons across race, geographic location (ie, northern vs. southern) and urbanicity. Table 1 lists acronyms, economic characteristics and standardized mortality ratios (SMRs)-- directly standardized with reference to the age distribution of the White population nationwide in 2000 according to gender-- for the focal populations in the year 2000 (Geronimus et al. 2011). While the focal black populations generally are less economically advantaged and have higher SMRs than the focal white populations, within the black or white populations, residents of non-poor areas generally have lower SMRs than residents of high-poverty areas and

a CDP, but Harlem is not. City or township of prior residence was the next smallest level and was too large for studying migration between types of neighborhoods within cities.

those in high-poverty urban areas generally have the highest SMRs, including compared to same-race populations from rural areas with similar or higher poverty levels and lower educational levels.

Geronimus et al. studied only these areas and, for ease of classification, dichotomized them as “poor” or “nonpoor.” We retain this classification when studying the focal areas alone, however, because we are studying moves into or out of these focal areas to or from anywhere in the US, we are able to classify places across the US as: low poverty: (<10% of adults in poverty); moderate poverty (10-20%); high poverty (20-30%); and very high poverty (over 30%), in addition to disaggregating them in terms of urbanicity and region.

Study Data

Study data are drawn from the Sample Edited Detail File (SEDF) of the 2000 Decennial Census. The SEDF represents roughly 16% of the population and provides average sample sizes for the monoracial⁴ black or white working-age men and women in our populations of just under 5,500 men and just over 6,100 women. The SEDF includes all the long-form records and in greater detail than the public use files. For example, the public use files have confidentiality edits such as top-coding on income or collapsing of detailed categories into broader categories.

In Item 15, the 2000 Census long form asked detailed questions about residential mobility within the United States:

³ Sample size considerations limited their choices to major Northern cities with large black populations or to rural areas around the Mississippi Delta. Major Southern cities had large diverse, black populations, but not concentrated poverty areas of sufficient size. Other Southern rural areas had black populations that, while often poor, were dispersed rather than concentrated.

⁴ Nationally, approximately 2% of respondents reported being multiracial. Given the geographic, age, and socioeconomic patterning of our sample, 2% is likely to be a generous upper bound on the percent in our focal areas who reported being multiracial. The preponderance of those reporting being multiracial were children younger than 15 years old and Asian Pacific Islanders; while monoracial respondents were disproportionately adult residents of the Deep South, Appalachia, and the mid-West (Farley 2002).

- (15a). Did this person live in this house or apartment 5 years ago (on April 1, 1995)?
- 1) Yes, this house -- *Skip to 16*
 - 2) No, outside the United States — *Print name of foreign country, below; then skip to 16.*
 - 3) No, different house in the United States.

(15 b). Where did this person live 5 years ago?

Name of City, Town or Post Office

Did this person live inside the limits of the city or town?

Name of county; Name of state; ZIP Code

Response rates in focal areas were high (92% to 97%). A trivial fraction of *movers into* our study areas migrated from another country (ranging from 0.3% to 0.9%).

We limited our analysis to those who were identified as living in the same dwelling unit five years previous, or, if not, who reported a valid 1995 ZIP Code. We divided our sample into three mobility categories: (1) *stayers*, (2) *movers into* our local areas between 1995 and 2000, and (3) *movers out* of our local areas between 1995 and 2000. ***Stayers*** are either residents who did not report a move between 1995 and 2000, or residents who reported a move but whose reported 1995 ZIP Code or county fell within the 2000 focal area. ***Movers in*** are those whose 1995 ZIP Code/county fell outside the 2000 focal area. ***Movers out*** are those whose 1995 ZIP Code/county fell within the focal area, but who are no longer living in the area in 2000.

The 2000 Census long form asked respondents two sets of health-related questions probing functional limitations induced by chronic health conditions.⁵ We count a respondent as limited if they answered yes to any of these questions⁶:

⁵ Because the health measures were reported in 2000, we do not know whether movers between 1995 and 2000 were in poor health at the time they moved. This would be highly problematic if our primary research interest was in the causal impact of health on migration. However, our interest lies in whether migration patterns influence cross-sectional snapshots of the health profiles of study areas. We can address research questions 3 and 4 about the potential association between residential mobility and health limitations knowing only the health of migrants and non-migrants in 2000, because we are interested in comparing the health profile of areas in 2000 to what they would have been had no migration occurred.

⁶ We conducted all analyses first by combining answers to all of these questions, counting a person as health limited if they report any impairment or disability. We then experimented with alternative coding schemes involving subsets of these questions. We were particularly interested in schemes excluding the work disability question, out of concern that responses might differ systematically with local labor market variations. Disability levels are somewhat higher when we include the work disability question, but patterns of results are robust to our choice of disability measures.

(16) Because of a physical, mental, or emotional condition *lasting 6 months or more*, does this person have any difficulty in doing any of the following activities:

- a) Learning, remembering or concentrating?
- b) Dressing, bathing or getting around inside the home?
- c) Going outside the home alone to shop or visit a doctor's office?
- d) Working at a job or business?

(17) Does this person have any of the following *long-lasting* conditions:

- a) Blindness, deafness or severe vision or hearing impairment?
- b) A condition that substantially limits one or more basic physical activities such as walking, climbing stairs, reaching, or lifting?

Measurement Issues

ZIP code Data

As the first researchers to use ZIP Code data to identify residential mobility patterns, we tried to assess their validity (Geronimus, Bound and Ro 2010). We found that when respondents report previous ZIP Codes of residence, they generally report these items accurately: only 2% of reported ZIP Codes were invalid, while an additional 2% were inconsistent with other data in the file (e.g., county of residence). Although the census imputed values when 1995 county or state data were missing, no imputations were made for ZIP Codes.

Table 2 shows response and imputation or missing rates for each of the migration questions by area type. The vast majority of those who move dwelling units reported both their previous state and county of residence. However, 20-30% of movers did not report ZIP Code data for previous residence. Moreover, when we estimated logit regressions on the sample of individuals who would have been asked to report their ZIP Codes of previous residence based on their answers to earlier questions, we found men, the unemployed, and the disabled were each about 20% less likely to report their previous ZIP Code than were their counterparts. We also found that those who made moderate or long-distance moves were about 60% less likely to

report previous ZIP Codes than were short- distance movers. However, long-distance moves were substantially less common than short-distance moves; and when they did occur, we could identify them using state or county of previous residence when ZIP Code was missing.⁷ Despite non-randomness, sensitivity analyses described in the results suggest that our conclusions are robust to excluding those with missing ZIP code information.

Health Indicator

The health-induced functional limitation data are the only health indicators available in the census. Although they are neither sufficient for medical diagnosis of specific conditions,⁸ nor fully representative of all aspects of health that might be associated with either place or residential migration, there is reason to believe that the census measures are sufficient for the analytic objectives of this study (Brimblecombe et al. 1999, 2000; Hayward and Heron 1999; Geronimus et al 2001 Norman et al, 2005).⁹ Self-reported measures of health are highly correlated with clinical measures of morbidity and predictive of subsequent death, health care utilization, and labor market behavior (Idler and Benyamini 1997; Manning, Newhouse and Ware 1982). Researchers have also found that conceptually distinct self-reported health and

⁷ In the 2000 population we could have included those who were living in the local area as of 2000, had moved since 1995 but had missing zip codes. Rather than doing this, we chose to exclude movers with missing or invalid zip codes to make our measurement of the health profile of the population in 2000 more comparable to our measurement of the population in 1995. Essentially, our procedure involves comparing the health profile of those who move in to those who move out. If the health profiles of these two populations are quite different or if the size of these two populations are quite different, then our estimates will show migration affecting the health profile.

⁸For those interested in the severity of functional limitations or disabilities, *per se*, legitimate concerns have been raised about the validity of the census impairment and disability items, which are based on a mail-back questionnaire, are sometimes filled out by proxy respondents, and contain only general questions rather than specific measures of ADLs or IADLs collected in some surveys. Andresen et al. (2000) found that responses to the more global census questions did not correspond precisely to responses to narrow questions about specific ADLs or IADLs. This finding is neither surprising nor particularly pertinent to our analysis. For us, the important question is whether differences across areas in responses to census questions accurately reflect differences across areas in the age-specific health status of the respective populations.

⁹ Hayward and Heron (1999) and Geronimus et al. (2001) have used census disability measures successfully for similar analytic purposes. British studies of the role of selective migration in understanding the sources of the geographic distribution of the healthy population across local areas (Brimblecombe et al. 1999, 2000; Norman et al, 2005) used a combination of vital statistics data and self-reported functional limitation measures similar to those available in the census. Findings using the different measures were similar, supporting the notion that, in the context of studies such as our own, self-reported functional limitation data allow for valid inferences with respect to health selective migration.

chronic condition measures -- including global health measures such as these census measures, or Activities of Daily Living (ADLs), and Instrumental Activities of Daily Living (IADLs) -- are highly correlated with one another (Johnson and Wolinsky 1993). Regarding population contrasts, we note that general patterns of health-induced limitations by age and race in the 2000 Census are consistent with what is known about age and racial patterns of disability from other sources.¹⁰

Statistical Analysis

We took a two-step approach to address research question 1 about the extent, nature and types of moves made within, into, and out of the focal areas to or from anywhere in the nation. First, we tracked the percentage of each focal population who moved dwelling units between 1995 and 2000. Second, we classified movers as those who moved within the focal area, those who moved out of the area after 1995, and those who moved into the area by 2000. We tracked whether movers stayed within a specific focal area, moved between similar local areas anywhere in the United States (e.g., from one poor urban area to another), or moved across area types in the United States (e.g., from poor to nonpoor areas; from poor urban to poor rural areas).

To address research questions 2 and 3 on the potential association between residential mobility and health limitations, we first compared the health-induced limitation rates of those who moved into or out of our focal areas to those who remained in them. Additionally, we estimated the probability that those living in each of our focal areas in 1995 moved out by 2000 as a function of their health-induced functional limitation status in a series of logistic regression

¹⁰ Limitation rates rise with age. Older Americans are more likely to suffer multiple limitations than younger ones. African Americans have higher impairment and disability rates than whites, with racial disparities most pronounced in young through middle adulthood. Limitations in young through middle adulthood are disproportionately work-related limitations, with those in

models that ultimately also controlled for age and education. In a similar fashion, we estimated the probability of moving into one of our focal areas between 1995 and 2000. These estimates allowed us to determine whether health-induced limitation and residential mobility are associated, and the extent to which age and education affect this association.

The net effect that migration might have on resident populations will depend on both the characteristics of movers and the frequencies of moves. To measure the extent to which differential residential mobility affected the geographic distribution of the healthy and unhealthy populations, we calculated the geographic distribution of health status of focal area residents by (1) residence as of 1995 and (2) current residence in 2000. A comparison between (1) and (2) provides a direct measure of the effect of residential mobility on the geographic distribution of the healthy population over the five-year time horizon.

Results

Migration

Figure 1 displays that between one-quarter and almost one-half of the 2000 residents of each focal area had moved dwelling units since 1995. The vast majority of the movers relocated short distances. For example, of the Harlem residents who moved between 1995 and 2000, 47% stayed within the same Harlem focal area, 64% moved into Harlem from another part of the same county (Manhattan), and 85% of those who moved into Harlem came from another part of New York state (Figure 1). Similarly, 76% of those moving out of Harlem stayed within New York state – 38% stayed in Harlem, 47% stayed in Manhattan, and 65% stayed in the same metropolitan statistical area (MSA) .

mobility and personal care increasing in magnitude in old age. Each of these patterns is consistent with expectations based on

Moves between Urban and Rural or between Northern and Southern Areas

Tables 3 (*movers in*) and 4 (*movers out*) provide information on the nature of moves. We find little evidence of migration between northern urban and southern rural local areas. The vast majority of *movers into* or *out of* the black northern urban poor areas move within the same MSA; most others move from or to another northern MSA or, in some cases, to a southern MSA. For example, 87% of *movers in* to Eastside Detroit and 88% of movers out of the area moved within the same MSA. While we find some evidence of movement between rural and urban areas within the same region (north or south), the number who move across regions to or from a high-poverty rural area is often too small to disclose (e.g., Harlem movers to a rural area). Similarly, the vast majority of white residents of high-poverty urban areas move within the same MSA and virtually all stay in a northern MSA. For example, 78% of Cleveland *movers out* went to the same MSA and only 4% went to a southern MSA.

Among *movers into* or *out of* high-poverty southern rural areas, the largest share moved to or from a southern MSA. For example, in East North Carolina, 42% of *movers in* came from and 70% of movers out went to a southern MSA. The stream between southern rural and urban areas is substantial in both directions (to and from) and for whites and blacks. Small percentages of black populations move between southern rural areas and virtually none moves between a southern rural and a northern rural area. White residents of high-poverty rural areas move into or out of other rural areas at a greater rate than blacks, but they primarily move between southern rural areas.

The vast majority of *movers into* and *out of* non-poor urban areas, black or white, moved within the same MSA. While small percentages moved between a northern and southern MSA,

what is known about age and racial patterns of health-induced limitations from other sources.

virtually none (undisclosed - <5%) moved between an urban focal area and a rural area (north or south).

Areal Economic Mobility

Regarding moves between areas with different poverty levels, we see patterns that vary considerably for black and white populations. Among black residents of high-poverty urban areas who moved, about half or more moved between high-poverty urban areas and up to 95% moved to or from moderate or high-poverty areas. The percent moving to or from low-poverty areas never exceeded 19% (movers out of Harlem), and was 10% or less in many cases (movers into Harlem, Eastside Detroit, Southside Chicago and Watts). In stark contrast, the vast majority of whites who moved to or from urban high-poverty areas moved to or from low-poverty areas. Roughly 85% of those who moved out of white urban high-poverty areas moved to a low-poverty area, while 70-80% of *movers into* the high-poverty white urban areas came from low-poverty areas.

The economic patterns of residential mobility for the rural areas were similar, in that most of the *movers in and out of* the high-poverty black areas made moves to and from similar poor areas while the white rural areas saw more areal social mobility in their migration patterns. The majority of black movers out from rural high-poverty areas went to moderate or other high-poverty areas and no more than 20% moved to a low-poverty area. For example, 75% of East North Carolina movers out went to moderate or high-poverty areas and only 19% went to a low-poverty area. In contrast, a substantial proportion of whites in rural high poverty areas (37-74%) moved to low-poverty areas, and a very small percentage moved to high-poverty areas, except for those moving out of the Appalachian Kentucky area, among whom about 22% moved to

another high-poverty area (still a smaller percentage than found for blacks moving from high-poverty rural areas).

Only 10% of black rural *movers in* to high-poverty rural areas came from low-poverty areas, while up to 80% of white rural *movers in* to high-poverty rural areas came from low-poverty areas. Most black rural *movers in* to high-poverty rural areas came from other high-poverty areas, while the percentage of white *movers in* from high-poverty areas is so small that we cannot disclose it.

Among movers to or from the non-poor urban areas, black-white variation in origin and destination is also apparent. Unlike black movers from high-poverty areas, who tended to make socioeconomically lateral moves, the majority of black *movers out* of non-poor areas in 1995 (60-82%), moved to higher poverty areas by 2000, with a smaller percent moving to another low-poverty area. In striking contrast, the vast majority of white *movers out* from non-poor areas (83-92%) move to other low-poverty areas, with only 8-17% moving to less well-off areas.

With the exception of *movers in* to the Northwest Detroit area, black *movers in* to the non-poor urban areas come primarily from moderate or high-poverty areas. In the case of Northwest Detroit, 70% come from low-poverty areas and about 30% from high-poverty areas. Unlike most black movers to urban non-poor areas, the vast majority of white movers into urban non-poor areas come from other low-poverty areas (78-90%). Thus, unlike their black counterparts, the vast majority of white movers to or from non-poor urban areas move to or from other low-poverty areas.

What do the findings addressing research question 1 say about the potential for health-selective migration as a contributor to the area-specific mortality differentials found in previous research? We found a considerable amount of residential mobility, especially among blacks in

northern urban areas, yet, this appeared to be migration from one area of concentrated poverty to another. This fact would seem to argue against the plausibility of health-selective migration being an important determinant of observed geographic differences in health among poor blacks. We found at least as much upward mobility among blacks living in poor rural communities as in poor urban areas. For selective migration to explain the large mortality differential found between focal areas in the urban north and rural south, the northern upward outmigration would have to be substantially more health-selected than the rural southern upward outmigration. The similar mobility patterns we observed between the black urban high-poverty and black rural high-poverty areas suggest that documented urban-rural differences in mortality are unlikely to be importantly influenced by health-selective migration – either urban-rural or north-south. Still, both socioeconomic and geographic mobility occurred often enough that we cannot use migration streams alone to dismiss the possibility that health-selective migration might be having an impact on some geographic health profiles.

Migration and Health

Table 5 presents sex-specific age-standardized health-induced disability prevalence for each local area stratified by residential mobility status – *stayers*, *movers out*, and *movers in* – between 1995 and 2000. With two exceptions – Watts *movers in* and Bronx *movers out* -- black men who moved in or out of any focal area had the same or lower disability prevalence than those who stayed. Differences between black male *movers* and *stayers* were generally larger in the high-poverty focal areas than in the non-poor ones, with the largest disability rate difference found in Eastside Detroit – 8 percentage points higher for *stayers* versus *movers out*. Differences between black male *movers out* and *stayers* were statistically significant in four areas, Harlem,

East Detroit, Northwest Detroit, Southwest Chicago, and marginally significant ($p < .10$) in Black Belt Alabama. Disability differences between black male *stayers* and *movers in* were marginally significant in East North Carolina, Black Belt Alabama, and Delta Louisiana.

Black women *movers in* or *movers out* of poor areas also usually had the same or lower disability rates than *stayers*. Unlike for men, black women *movers in* nonpoor areas tended to have lower disability rates than *stayers* when they were in the *movers out* category, but higher disability rates when they were *movers in*, although the differences were small for both move types.

White men *movers in* or *out* generally had lower disability rates than *stayers* in all areas, though the differences were usually insignificant except for Detroit, where white male *movers* had a 9 percentage point lower disability rate than white male *stayers*. White women showed a less consistent pattern. In most cases we see no statistically significant differences between *movers* and *stayers*, and where we do, *movers* have lower disability rates than *stayers*.

Residential Mobility, Age and Education

Table 6 presents sex-specific age-standardized high school graduation rates¹¹ for each focal area stratified by residential mobility status between 1995 and 2000.¹² For every focal area, the same or a higher percentage of black male *movers* (in or out) were high school graduates than were *stayers*. This differential was generally large and statistically significant in the high-poverty areas, but not in the non-poor areas. In several cases in high-poverty areas, graduation rates were about 10 percentage points higher among *movers* than among *stayers*, and

¹¹ We focus on education rather than income, because education is a less volatile measure of socioeconomic position and, unlike income, likely to be a permanent feature of an adult, and less subject to the threat of reverse causality.

¹² Here and in most of the rest of the paper we age standardize because there are clear health and education differences across age groups, reflecting a combination of age and cohort effects on these outcomes. We do not also standardize on education because educational differences across areas could reflect differential migration.

movers out of poor rural areas had graduation rates that were 11 to 20 percentage points higher than those of *stayers*.

The patterns for black women in poor local areas were similar to black men's, though more muted. In non-poor urban areas, black women *stayers* were generally as likely to be high school graduates as *movers in*, while black women *movers out* were often more likely to be high school graduates than *stayers*, with the difference statistically significant in two areas (Northwest Detroit, Southwest Chicago).

White men in urban or rural high-poverty areas who were *movers* had substantially greater high school graduation rates than did *stayers*. In non-poor urban areas, differences between *movers* and *stayers* were small and the direction was inconsistent. Patterns for white women were generally similar in all areas, but education differences between *stayers* and *movers* were smaller than for white men and less likely to be statistically significant.

Logistic Regression Results

In Table 7, we report the results of our race- and sex-specific regressions of the odds of *moving out* of and the odds of *moving in* to high-poverty urban, high-poverty rural, and non-poor urban between 1995 and 2000. Explanatory variables include dummies for age (referent=16-24 years), high school graduate, college graduate (referent = less than high school education), focal area of residence (in 1995 for odds of *moving out*; in 2000 for odds of *moving in*), and disability status.

As a general rule, we find that the odds of moving between 1995 and 2000 were higher in the younger and the more-educated groups than in the counterparts. Net of age, those who did not complete high school usually had the lowest odds of moving, and those who only completed high school had lower odds of moving than those with a college education, with the odds of

moving for college graduates significantly larger in many cases. Exceptions to this were seen among black women who, for example, exhibited little difference by education in their odds of *moving into* a non-poor urban area.

We often saw lower odds of moving among those with health-induced disability, however the differences were smaller than seen for age or education, and were attenuated by controls for age and education. In fact, in high-poverty rural populations and in white non-poor areas, the odds of moving out were insensitive to disability status net of age and education. Overall, selection on education is larger and stronger than on health-induced disability, per se, fully accounting for the age-adjusted relationship between migration and disability status in these cases.

Women showed no difference, net of age and education, in their odds of *moving into* focal areas by disability status, with the exception of urban poor black women, for whom the odds were 14% lower among the disabled (compared to 32% and 101% higher for high school and college graduates, respectively). *Moving into* urban non-poor areas was insensitive to education or disability, net of age. Among white women in urban high-poverty areas, the odds of *moving in* were 19% higher for the disabled (but 97% and 200% higher for high school and college graduates, respectively).

For men, many groups showed no difference by disability status in the odds of being *movers in*, net of age and education, with slightly reduced odds found for disabled black men in rural high-poverty areas, disabled black men in urban non-poor areas, and disabled white men in urban high-poverty areas. Here, too, the odds of *moving in* associated with health-induced disability were generally dwarfed in size by the impact of education.

Using multinomial logit models we found no evidence that disability status affected the nature of either the origin from which or the destination to which an individual moved (not shown).

Impact of Selective Migration on Estimates

The findings to this point, suggest that residential mobility is selected on factors associated with health (age and education) and sometimes on health-induced disability net of age and education, with some signs of variation in the nature and degree of selectivity by gender, area type, and race. Does such selection affect cross-sectional estimates of local area disability prevalence?

In Table 8 we present estimates of health-induced disability prevalence by sex in each focal area in 1995 and 2000 age-standardized to the U.S. black or U.S. white age distributions. The “1995” values represent the fraction suffering health-induced disabilities among those who were living in each focal area as of 1995 – that is, as if no residential mobility had occurred between 1995 and 2000. The “2000” values represent the fraction suffering health-induced disabilities among the actual population living in each focal area in 2000.

Differences in age-standardized estimates of disability prevalence based on the 1995 versus the 2000 population of each focal area are small. For black men or black women, the two estimates are within about 1 percentage point in all areas. This is also the case for white men and white women with the notable exception of Detroit, where estimated disability prevalence is higher for the 2000 than the 1995 population, by 2 points for men and 3 points for women. The only statistically significant differences are seen for black women in Northwest Detroit and for white women and white men in Detroit.

In most areas the lower disability rates for the *movers in* and the *movers out* compared to the *stayers* seem to approximately cancel each other out, leaving estimates based on the 1995 and 2000 populations roughly equivalent. In the three Detroit cases where disability rates differed by year, the rates were always higher when using the 2000 definition of the population. A combination of factors can account for this. First, in the case of the white Detroit populations, the groups *moving out* were substantially larger than those *moving in*. Thus, for example, 37% of the white women residing in Detroit in 1995 had *moved out* by 2000. In contrast, only 13% of white women living in our Detroit area in 2000 had *moved in* between 1995 and 2000. For white men, 33% of 1995 Detroit residents had *moved out* while only 13% of 2000 Detroit residents had *moved in* during the previous five years. Given these disparate flows, even if the *movers in* had lower disability rates than the *movers out*, the flows would not have canceled each other out and the disability rate would still have been higher in the 2000 Detroit population. In addition, for black women in Northwest Detroit and white women in Detroit, the limitation rates for *movers in* were, if anything, marginally higher than the limitation rates for the *stayers*.

One concern about using two snapshots in a five-year period might be that health differences between those who had and had not moved out of areas might diverge, but not in the window studied. This would be more likely if net outmigration favored higher or lower SES groups. To check the plausibility of this possibility, we looked at the educational attainment of our 20 populations defined in terms of their 1995 and 2000 residential locations (not shown). Differences in education between the populations defined in terms of their 1995 and 2000 populations are small. Where meaningful and statistically significant differences do exist, net migration out of poor urban areas was as likely to favor the less well educated as the better educated. In contrast, net migration out of poor rural and non-poor urban populations tended to

favor the better educated. These are not the patterns one would have expected if upward mobility accounted for observed health profiles.

Sensitivity Analyses

To check the sensitivity of the results to the exclusion of those cases missing ZIP Codes of previous residence, we compared our tabulations of the health profiles of the 2000 populations to tabulations that included the movers with missing ZIP codes. In each case, we know the individual was living in the area in 2000, but do not know if they moved in from another area or changed dwelling units within the same area (i.e., whether they were *movers in* or *stayers*).¹³ We made two extreme assumptions in separate sensitivity analyses: first, we assumed all movers with missing ZIP Codes had moved from outside the area (were *movers in*); and second, that all movers with missing ZIP Codes moved within the local area (were *stayers*).¹⁴ Changing our definition had no measureable effect on the characteristics of the movers, regardless of whether we focus on the fraction with a health-induced disability or with a high school diploma.

Similarly, we did a robustness check using available information on previous county and state. So, for example, when individuals did not report a ZIP Code, but did report a state of previous residence, we determined whether or not they moved across or within states. If they reported neither a previous ZIP Code nor state, we made two extreme assumptions, in one case assuming all these individuals moved between states and in the other that none did. Using this method, the bounds we calculate for the fraction of moves that involve moving from out of state

¹⁴ Our strategy is in line with the kinds of strategy suggested by Horowitz and Manski (1995).

were usually quite similar to the fractions reported.¹⁵ Thus, as a general point, our analyses provide reassurance of data validity to other researchers interested in using the ZIP Code of previous residence data available in the census for analytic purposes related to short-distance moves or moves between local areas (whether or not their analytic interests are health related).

Discussion

Using 2000 Census data, we have shed new light on the important question of whether population dynamics of residential areas may be a competing explanation to place or static compositional effects for understanding observed associations between health and place. We were able to analyze migration streams at a more fine-grained level than was previously possible. We found little evidence that observed migration affected the overall distribution of the healthy or unhealthy populations across our focal study areas. While it is often the case that those who moved out of focal areas tended to be younger, more highly educated, and in better health than those who stayed, it is also true that those moving in tended to be younger, more highly educated, and in better health. These two residential mobility streams appear to approximately cancel each other out, leaving cross-sectional estimates of local population health stable.

The notable exception to this regularity was Detroit, where small but statistically significant differences were seen depending on which year's snapshot was considered, among white men and women in the high-poverty areas, and black women in the non-poor area.

¹⁵Thus, for example, we calculated the average maximum possible error for those living in one of our four poor black urban areas to be 10%. Doing a similar analysis for county again showed bounds that were qualitatively similar to the fraction reported in Figure 1. In this case we calculated the average maximum possible error for those living in one of our four poor black areas to be 12%. Extreme bounds for whether individuals moved from within the same local area were, for obvious reasons, less tight, but were still informative. For example, using records with valid zipcode information, we calculated that 53% of those in Harlem who had moved dwelling units between 1995 and 2000 had moved into Harlem from someplace else, with most of these moving from within Manhattan. Including those with missing zipcodes in the analysis and using all reported information, we can bound the fraction of movers who moved in from outside of Harlem to between 49 and 71 percent. While this range is not as tight as we might have liked, it remains clear that most moves are short distance moves.

Although white movers in or out were as or less likely to be disabled than stayers, the streams in the two directions were of vastly different magnitude and did not cancel each other out in terms of their effect on the estimated percent of the population suffering health-induced functional limitations. In addition, for black women in Northwest Detroit, disability rates for *movers in* were marginally higher than for *stayers*, perhaps reflecting the movement of poor blacks from the central cities to inner-ring suburbs – a characteristic of poverty deconcentration efforts (Jargowsky 2003). These exceptions suggest that health and place researchers using cross-sectional estimates should consider whether a recent substantial in- or out-migration has occurred in a specific area that was not countered by a comparably sized migration in the opposite direction. If so, their estimates of the association between health and place may be badly biased.

Investigators have found blacks less likely than whites to translate economic resources into residential movement to better resourced, safer, or higher status communities (Alba et al. 1994; Charles 2003; Crowder 2001; Massey and Denton 1987; Tolnay 2003). Structural barriers are key to this relative lack of upward residential mobility (Charles 2003; Crowder et al. 2012; Massey et al 1994; Tolnay 2003). Our findings are generally consistent with these earlier studies as we saw about 85% of whites who moved out of high-poverty areas move to lower poverty areas, while this was only true for 10-20% of blacks. Also, consistent with our findings of more muted associations between age, education, health and residential mobility for women than men, Halliday and Kimmitt (2008) found a relationship between health and mobility among men, but not women, although spouse's health affected the mobility of married women.

One might wonder whether documented return migration of black populations from the North to the South (Frey 1998, 2001) might influence the size or direction of differences in

excess mortality between Northern urban v. Southern rural high-poverty black areas. However, we found similar results to earlier studies indicating black North to South flows have typically been from urban to urban areas and are, to some extent, concentrated among middle-class blacks (Hunt et al, 2008). As such, return migration does not appear relevant to the question of why high-poverty urban populations experience greater excess mortality than high-poverty rural ones.

While our estimates of the prevalence of health-induced disabilities generally do not suggest that health and place effects are spurious – that they are simply an artifact of selective-health migration -- our findings that much movement into and out of the focal study areas is significantly associated with health suggests that investigators interested in understanding the causal effects of place on health face a complicated challenge. The substantial residential mobility across the study populations between 1995 and 2000 – ranging from over one-quarter to almost one-half of each population -- mitigates against attributing the high rates of mortality found in some areas to the long-term exposure of local residents to specific neighborhood environmental characteristics, especially mortality from diseases with long latency periods. The primary causes of death that persistently account for important variation in nonelderly adult excess mortality across U.S. population types -- such as cardiovascular diseases, cancer, and HIV/AIDS – are such diseases (Geronimus et al 2011). The possibility of a causal relationship between unique aspects of specific places and health might still pertain to health conditions with very short latency periods, to ones – even with long latency periods – if they are easily aggravated by short-term environmentally structured changes (e.g. changes in diet or exercise owing to restricted access to healthy foods or safe and inviting exercise spaces; or aggravated impacts of smoking owing to increased environmental air pollution or lead) , or to differential access to health services by place, if the latter affects the rate that injuries or incident cases of

disease, acute or chronic, progress into disabilities or become case fatalities. Conceptually, these are secondary or tertiary prevention pathways distinct from the pathway in which physical exposures inherent to specific geographic places result in chronic health problems after a long latency period.

To the extent that we found migration did not affect the health profiles of focal areas, one plausible explanation would be that most moves tended to short-distance migration or that, especially for blacks, between similar area types in terms of poverty status, urban or rural, and northern or southern location. It is possible that the environmental characteristics of specific types of local areas (high-poverty urban or high-poverty rural) are similar enough that even moving between specific areas of the same type, individuals are exposed over long periods to the same noxious etiologic agents. Another possibility is that the frequent experiences of loss or disruption that may be implied by the frequency of moves we observed may, in itself, impact health and well-being, and be a common feature of disadvantaged areas (Fullilove 2004; Keene and Geronimus 2010; Keene, Padilla and Geronimus 2010; Wallace and Wallace 1998)

In addition to threatening material and environmental exposures, the psychosocial stressors inherent in lower structural positions or the contingencies of social identity associated with being black, urban, or poor in the U.S. may have adverse health effects that track with structural location, regardless of specific ZIP Code. Cues to cultural oppression and structurally constrained life chances may trigger repeated or chronic episodes of vigilance, rumination, or physiological stress process activation with concomitant wear and tear on important body systems (James 1994; Iznicht and Shmader 2011; Geronimus and Thompson 2004; Geronimus et al 2006; Geronimus 2013).

Limitations

Because we used census data to estimate the impact of health-related migration on associations between health and place, we were limited to the use of functional limitation as the health indicator and to a five-year period for residential mobility. Ideally, we would follow individuals' residential mobility from childhood through adulthood. How might the results differ? One can imagine residential environmental impacts could have immediate, medium-term, or long-term health implications; and that any long-term health implications may result from cumulative environmental impacts over the life course.¹⁶ The 2000 Census data provide us two residential snap shots of each individual, in 1995 and 2000. Some of these individuals were youth or young adults in 1995, others were older. The five-year window allows us to capture immediate environmental impacts, including ones that interact with chronic disease progression to disability or excess mortality such as access to health care. Regarding longer-term health implications, we might very well see larger differences if we were able to observe individuals over a 10-, 20-, or 30-year period. Still, if there is important health-selective migration, then, in general, we would expect to observe some evidence of this within just the five-year window.

We note an instance in which the five year window could be misleading. If some poor young adults are upwardly socially mobile and move out of high-poverty neighborhoods as a result, their health trajectory may differ from their childhood neighbors who were not upwardly

¹⁶ These might include from the delayed expression of epigenetic modifications resulting from previous environmental conditions, including childhood and prenatal contexts. If life-threatening disease onset is a direct product of "fetal programming," as some hypothesize (Gluckman et al 2008), then short of longitudinal data beginning at conception and continuing through midlife, no time horizon would be sufficiently long to capture these effects. However, evidence is weak that any prenatal conditions are more important to adult and later life health than post-uterine environmental conditions (Geronimus 2013).

mobile.¹⁷ Such health differences might not emerge right away. Our consideration of educational characteristics of movers compared to stayers provides some evidence, albeit suggestive, that upward mobility is unlikely to be a serious threat to the validity of the results using the five-year window.

To our knowledge these are the best currently available data for beginning to address the question of the degree to which cross-sectional associations between health and local residential place may be biased by failure to take into account the dynamic nature of local populations. Additional data are needed – to be collected or made available – that will allow researchers to dig deeper into the associations between health, place, and residential mobility. The ideal dataset would have enormous sample sizes that are place-based or can be geocoded, would follow people longitudinally through their lives, and would include reliable health measures. Administrative data would be one route. For example, social security records linked to death certificates have the potential to tell us where people were working at any point in their working lives, a proxy for place-based exposures as well as a way to track presumed residential mobility. One could imagine various other administrative data sets such as welfare records, Medicaid records, or Medicare records that would offer needed information as well. Any one of these data sets would miss groups of people -- those who have never worked, those who are not recipients of safety net programs – and matching administrative records to death certificates is imperfect. Yet, if researchers could overcome the confidentiality barriers to accessing these data, and perhaps triangulate from different data sources, major strides might be made.

While subject to noted limitations, this study is the first to attempt to address a critical question in the burgeoning health and place literature. We find no evidence that excess mortality

¹⁷ Note that depending on race/ethnicity, gender, and nativity status, the magnitude or direction of this difference would vary

in US high-poverty urban relative to high-poverty rural areas results from selective migration. Selective migration does not appear to bias cross-sectional estimates in most instances, but the Detroit results suggest investigators cannot take this as axiomatic. Instead, consideration of whether a specific area studied has been subject to a recent, sizeable net one-way migration -- in or out -- that was racially or socioeconomically structured is indicated for properly interpreting estimates. Our findings provide reassurance that quantitative cross-sectional estimates of the distribution of the healthy and unhealthy population can be used to target medical and social services where they are most needed. Yet, their failure to point in a single etiological direction leave important sociological, epidemiological, and public policy questions unanswered regarding the fundamental and proximate causes of geographic disparities in health. Those designing studies to address such questions are advised to consider the implications of residential mobility dynamics in drawing valid inferences from cross-sectional data.

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DISCLAIMER: Any opinions and conclusions expressed herein are those of the author(s) and do not necessarily represent the views of the U.S. Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed

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Table 1. Economic characteristics and age-standardized death rates¹, local black or white populations, 16-64 years, 2000²

Area Type/Area	Focal Area Acronym	Median Income	% Families < Poverty	Standardized Mortality Ratios	
				Men	Women
U.S.					
Black		44,173	25	1.84	1.90
High Poverty Urban					
Harlem	har	35,896	35	2.25	2.36
East Detroit	edt	36,811	35	2.80	2.80
Southside Chicago	ssc	33,961	46	3.32	3.15
Watts	wts	33,993	38	2.89	2.52
High Poverty Rural					
East North Carolina	enc	34,054	35	1.96	1.87
Black Belt Alabama	bba	27,642	42	2.21	2.16
Delta Louisiana	dla	24,987	46	2.00	2.10
Nonpoor Urban					
Bronx	brx	55,205	15	0.96	1.07
Queens	qny	72,181	07	0.68	0.69
Northwest Detroit	nwd	55,206	16	1.90	1.77
Southwest Chicago	swd	50,268	20	2.13	2.04
Crenshaw/Baldwin Hills	cbh	55,759	20	1.79	1.65
U.S.					
White		70,526	08	1.00	1.00
High Poverty Urban					
Cleveland	cld	43,017	18	1.75	1.43
Detroit	det	43,952	23	2.72	2.36
High Poverty Rural					
Appalachian Kentucky	aky	31,035	34	1.59	1.56
West North Carolina	wnc	48,137	14	1.05	1.02
Northeast Alabama	nal	46,861	14	1.43	1.24
South Central Louisiana	cla	45,238	18	1.32	1.34
Nonpoor Urban					
Western Cleveland	wcl	79,025	05	0.75	0.82
Sterling Heights, MI	shd	101,860	05	0.70	0.77

¹ directly standardized with reference to the age distribution of the White population nationwide in 2000 according to gender.

²The 20 local population groups included Black or White residents of the following neighborhoods, counties, or health center districts. **Black populations, Poor Urban Areas:** *Southside Chicago* – Near Southside, Douglas, Oakland, Fuller Park, Grand Boulevard and Washington Park community areas located south of the Chicago Loop. *Eastside Detroit* – Central, University, Central Business District, Foch, Jefferson Mack, Airport, St. Jean, Chene, and Jeffries subcommunities of Detroit. *Harlem* –

Central Harlem Health Center District. *Watts* – Watts and adjacent areas to the south and west. **Poor Rural Areas:** *East North Carolina* -- Pitt, Northampton, Halifax and Edgecomb counties in the Coast Plains region of North Carolina, *Black Belt Alabama* -- rural counties in and around the Black Belt region including Dallas, Fayette, Greene, Bibb, Sumter, Hale, Lamar, Marengo, Marion, Perry, and Pickens counties. *Delta Louisiana* -- Caldwell, East Carroll, Franklin, Jackson, Madison, Morehouse, Richland, Tensas, Union, West Carroll, Avoyelles, Catahoula, Concordia, Grant, La Salle, Vernon, and Winn parishes in the Mississippi River Delta region. **Non-poor Urban Areas:** *Queens* -- African-Americans living in eastern Queens in sections of the Jamaica East and Flushing Health Center Districts. *Bronx* -- African-Americans living in the north Bronx sections of the Pelham Bay Health Center District. *Southwest Chicago* -- African-Americans living in the Roseland, Pullman and West Pullman community areas. *Northwest Detroit* -- African-Americans living in the Palmer Park, Pembroke, Bagley, Redford, Rosedale Park, Evergreen and Greenfield neighborhoods. *Crenshaw/Baldwin Hills* -- African-Americans living in the Crenshaw, Ladera Heights, Leimert Park, Baldwin Hills and Windsor Hills communities. **White populations, Poor Urban Areas:** *Central Cleveland* -- Brooklyn-Centre, Clark-Fulton, Cudell, Detroit-Shoreway, Edgewater, Ohio City-Near West Side, Old Brooklyn, Stockyards and Tremont statistical planning areas on the near west side of Cleveland. *Detroit* -- Whites living in Delray, Clark Park, Chadsey, Condon, Springwells, Jeffries, State Fair, Burbank, Denby, Finney, Mt. Olivet, Grant, Davison, Pershing and Nolan subcommunities on the northeastern and southern periphery of Detroit **Poor Rural Areas:** *Appalachian Kentucky* -- Lee, Leslie, Owsley, Wolfe, Breathitt, Knott, Letcher, and Perry counties. *West North Carolina* -- Alleghany, Ashe, Avery, Mitchell, Watauga, Wilkes and Yancey counties. *Northeast Alabama* -- Whites living in DeKalb, Jackson and Marshall counties. *South Central Louisiana* -- Whites living in Acadia and Vermillion parishes **Non-Poor Urban Areas:** *Cleveland* -- Bay Village, Fairview Park, Lakewood, North Olmsted, Rocky River and Westlake communities. *Sterling Heights* -- Sterling Heights, a northern suburb of Detroit.

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See Geronimus et al. (2011).

Table 2. Fraction imputed or missing by total sample of valid movers, by local areas

Types	Imputed 15a*	Imputed Previous County		Imputed Previous State		Missing Zips	
		Fraction of Total ¹	Fraction of Movers ²	Fraction of Total ³	Fraction of Movers ⁴	Fraction of Total ⁵	Fraction of Movers ⁶
Urban poor black	0.08	0.02	0.08	0.02	0.06	0.10	0.32
Rural poor black	0.07	0.01	0.04	0.01	0.04	0.06	0.20
Urban non-poor black	0.09	0.02	0.06	0.01	0.05	0.08	0.31
Urban poor white	0.05	0.01	0.03	0.01	0.03	0.08	0.20
Rural poor white	0.04	0.01	0.03	0.01	0.03	0.06	0.18
Urban non-poor white	0.03	0.01	0.03	0.01	0.03	0.06	0.17

*Respondents were asked whether they had moved households within the past five years. Numerator is people who did not respond to 15a. Denominator is total population.

¹ Numerator is respondents answering that they moved dwelling units in 15a who did not respond to the question about county in 15b. Denominator is the total enumerated population.

² Numerator is respondents who answered that they moved dwelling units in 15a who did not respond to the question about county in 15b. Denominator is people who answered that they moved dwelling units in 15a.

³ Numerator is respondents answering that they moved dwelling units in 15a who did not respond to the question about state in 15b. Denominator is the total enumerated population.

⁴ Numerator is respondents who answered that they moved dwelling units in 15a who did not respond to the question about state in 15b. Denominator is people who answered that they moved dwelling units in 15a.

⁵ Numerator is respondents answering that they moved dwelling units in 15a who did not respond to the question about ZIPcode in 15b. Denominator is the total enumerated population.

⁶ Numerator is respondents who answered that they moved dwelling units in 15a and who did not respond to the question about state in 15b. Denominator is people who answered that they moved dwelling units in 15

Table 3. 2000 local area population who moved

Black	Urban High-Poverty				Urban Non-Poor					Rural High-Poverty		
	Harlem NYC	Eastside Detroit	Southside Chicago	Watts, Los Angeles	Bronx	Queens	NW Detroit	Southwest Chicago	Crenshaw/BaldwinHills	East North Carolina	Black Belt Alabama	Delta Louisiana
Of all movers:												
% stayed in same local area	47	47	42	47	33	32	37	40	38	76	83	80
Of movers from outside local area:												
% from same MSA	81	87	84	92	93	92	89	90	88			
% from other non-Southern MSA	09	07	08	04	03	04	06	05	07	23	41	33
% from Southern MSA	08	05	06	03	03	03	03	02	04	42	38	35
% from rural non-South	NA	NA	NA	NA	NA	NA	NA	NA	NA	02	NA	03
% from rural South	NA	NA	NA	NA	NA	NA	NA	NA	NA	33	NA	28
% from low poverty area	07	05	07	08	07	20	11	08	13	10	10	09
% from moderate poverty area	22	30	35	37	22	48	29	39	37	32	24	25
% from high poverty area	38	49	24	32	34	20	39	29	27	37	41	27
% from very high poverty area	33	15	32	22	37	12	21	24	23	21	25	38

Notes: When cell size is too small for the Census to permit disclosure, the cell is labeled 'NA.' Low poverty: <10% of adults in poverty; moderate poverty: 10-20% of adults in poverty; high poverty: 20-30%; very high poverty: over 30%.

Table 3 cont'd. 2000 local area population who moved

White	Urban High-Poverty		Urban Non-poor		Rural High Poverty			
	Cleveland	Detroit	West Cleveland	Sterling Heights	Appalachian Kentucky	West NC	Northeast Alabama	SouthCentral Louisiana
Of all movers:								
% stayed in same local area	49	51	47	27	83	64	75	71
Of movers from outside local area:								
% from same MSA	74	75	62	86				
% from other non-Southern MSA	17	13	28	09	27	13	12	04
% from Southern MSA	04	05	05	NA	22	62	63	59
% from rural non-South	03	NA	04	02	09	06	03	02
% from rural South	02	NA	01	NA	41	19	22	35
% from low poverty area	81	70	76	87	40	77	60	38
% from moderate poverty area	11	17	12	08	30	19	35	56
% from high poverty area	06	07	09	03	19	03	03	NA
% from very high poverty area	02+	05	03	02	11	01	02	NA

Notes: When cell size is too small for the Census to permit disclosure, the cell is labeled 'NA.' Low poverty: <10% of adults in poverty; moderate poverty: 10-20% of adults in poverty; high poverty: 20-30%; very high poverty: over 30%.

Table 4. 1995 local area population who moved

Black	Urban High-Poverty				Urban Non-Poor					Rural High-Poverty		
	Harlem NYC	Eastside Detroit	Southside Chicago	Watts, Los Angeles	Bronx	Queens	NW Detroit	Southwest Chicago	Crenshaw/BaldwinHills	East North Carolina	Black Belt Alabama	Delta Louisiana
Of all movers:												
% stayed in same local area	38	37	40	33	29	24	30	25	37	74	73	68
Of movers from outside local area:												
% went to same MSA	65	88	79	86	65	62	81	77	81			
% went to other non-Southern MSA	14	05	11	08	12	11	08	12	11	NA	16	NA
% went to Southern MSA	16	04	08	05	19	22	09	09	07	70	73	69
% went to rural non-South	NA	NA	01	NA	02	02	01	01	NA	NA	NA	NA
% went to rural South	NA	NA	01	NA	02	03	02	01	NA	18	NA	14
% went to low poverty area	19	10	17	10	31	41	32	28	18	19	12	21
% went to moderate poverty area	26	39	39	37	35	38	23	34	40	43	33	27
% went to high poverty area	27	41	21	38	18	13	34	24	26	32	32	28
% went to very high poverty area	27	10	23	15	16	09	11	13	17	06	23	25

Notes: Notes: When cell size is too small for the Census to permit disclosure, the cell is labeled 'NA.' Low poverty: <10% of adults in poverty; moderate poverty: 10-20% of adults in poverty; high poverty: 20-30%; very high poverty: over 30%. South includes the following states: Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas, Oklahoma, and Tennessee

Table 4 cont'd. 1995 local area population who moved

White	Urban High-Poverty		Urban Non-poor		Rural High Poverty			
	Cleveland	Detroit	West Cleveland	Sterling Heights	Appalachian Kentucky	West NC	Northeast Alabama	SouthCentral Louisiana
Of all movers:								
% stayed in same local area	42	22	44	22	67	68	77	71
Of movers from outside local area:								
% went to same MSA	78	81	62	82				
% went to other non-Southern MSA	11	08	23	09	10	11	06	05
% went to Southern MSA	04	04	09	04	38	66	71	67
% went to rural non-South	04	05	04	04	06	04	02	02
% went to rural South	02	02	01	01	46	18	21	26
% went to low poverty area	86	84	84	92	37	74	53	44
% went to moderate poverty area	11	11	08	05	41	19	40	49
% went to high poverty area	02	03	05	01	15	06	02	04
% went to very high poverty area	01	01	03	02	07	01	05	02

Notes: When cell size is too small for the Census to permit disclosure, the cell is labeled 'NA.' Low poverty: <10% of adults in poverty; moderate poverty: 10-20% of adults in poverty; high poverty: 20-30%; very high poverty: over 30%. South includes the following states: Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas, Oklahoma, and Tennessee.

Table 5. Age-standardized disability prevalence by residential mobility status, selected local areas, 2000

Area Type/Area	Stayers	<u>MEN</u>		Stayers	<u>WOMEN</u>	
		Movers Out	Movers In		Movers Out	Movers In
Black						
High Poverty Urban						
Harlem	30	24*	26	32	30	27
East Detroit	34	26***	30	32	32	29
Southside Chicago	27	27	23	29	24*	19***
Watts	31	28	33	31	28†	32
High Poverty Rural						
East North Carolina	30	26	24†	28	24	24
Black Belt Alabama	32	24†	25†	31	35	33
Delta Louisiana	28	26	21†	26	22	22
Non-poor Urban						
Bronx	24	26	22	21	17	23
Queens	21	18	20	19	21	19
Northwest Detroit	26	23*	25	26	20***	29*
Southwest Chicago	26	19***	22	23	22	24
Crenshaw/Baldwin Hills	24	22	21	22	25	24
White						
High Poverty Urban						
Cleveland	25	23	20*	23	23	24
Detroit	30	21***	21*	27	18***	30
High Poverty Rural						
Appalachian Kentucky	38	34	32	30	28	35
West North Carolina	22	16*	17***	19	15*	16*
Northeast Alabama	22	23	20	20	20	20
South Central Louisiana	25	25	21	19	17	17
Non-poor Urban						
Western Cleveland	11	10	12	10	10	12
Sterling Heights, MI	13	10*	12	12	9*	13

Respective movers rate is statistically significantly different from stayers rate p<.10†; p<.05*; p<.01**; p<.001***

Table 6. Percent high school graduates (age-standardized) by residential mobility status, selected local areas, 2000

Area Type/Area	Stayers	<u>MEN</u>		Stayers	<u>WOMEN</u>	
		Movers Out	Movers In		Movers Out	Movers In
Black						
High Poverty Urban						
Harlem	64	72*	74*	70	75*	74
East Detroit	60	70***	69***	67	73***	74***
Southside Chicago	70	72	80***	74	75	85***
Watts	65	73***	68	68	73*	71
High Poverty Rural						
East North Carolina	61	72***	64	68	76*	76*
Black Belt Alabama	61	73*	68	68	68	75*
Delta Louisiana	54	74***	69***	63	77***	71*
Non-poor Urban						
Bronx	77	83	81	83	86	80
Queens	79	83	79	86	87	87
Northwest Detroit	75	78	78	82	85*	79
Southwest Chicago	72	73	73	79	82*	80
Crenshaw/Baldwin Hills	77	81	81	82	81	80
White						
High Poverty Urban						
Cleveland	67	76***	81***	71	77*	84***
Detroit	63	75	81***	68	79***	82***
High Poverty Rural						
Appalachian Kentucky	56	71***	64*	66	72*	59
West North Carolina	71	83***	85***	77	83*	89***
Northeast Alabama	68	81***	77***	73	81***	79*
South Central Louisiana	67	80***	80***	73	85***	78
Non-poor Urban						
Western Cleveland	88	88	89	89	91*	91
Sterling Heights, MI	87	89	84†	88	90	88

Respective movers rate is statistically significantly different from stayers rate p<.10†; p<.05*; p<.01**; p<.001***

Table 7. Log Odds [standard errors] of moving between 1995 and 2000 by type of area, disability status, and education

	MEN		WOMEN	
	Local Area, Disability, Age	Local Area, Disability, Age and Education	Local Area, Disability, Age	Local Area Disability, Age and Education
MOVING OUT				
Black				
High Poverty Urban				
Disabled	-0.28[0.07]***	-0.22[0.07]***	-0.21[0.05]***	-0.15[0.05]***
HS Grad		0.41[0.07]***		0.23[0.10]***
College Grad		0.76[0.10]***		0.58[0.08]***
High Poverty Rural				
Disabled	-0.27[0.10]***	-0.15[0.10]	-0.27[0.09]***	-0.14[0.09]
HS Grad		1.09[0.11]***		0.73[0.09]***
College Grad		1.97[0.18]***		1.63[0.13]***
Non-poor Urban				
Disabled	-0.22[0.06]***	-0.19[0.06]***	-0.15[0.05]***	-0.12[0.05]*
HS Grad		0.13[0.08] †		0.33[0.07]***
College Grad		0.16[0.11]		0.39[0.08]***
White				
High Poverty Urban				
Disabled	-0.36[0.08]***	-0.24[0.08]***	-0.33[0.08]***	-0.22[0.08]***
HS Grad		0.56[0.08]***		0.51[0.08]***

College Grad		0.91[0.11]***		0.96[0.11]***
High Poverty Rural				
Disabled	-0.25[0.07]***	0.04[0.07]	-0.20[0.07]***	0.01[0.07]
HS Grad		0.73[0.08]***		0.56[0.07]***
College Grad		2.11[0.09]***		1.61[0.08]***
Non-poor Urban				
Disabled	-0.21[0.09]*	-0.13[0.09]	-0.17[0.09]*	-0.08[0.09]
HS Grad		0.68[0.11]***		0.81[0.11]***
College Grad		0.87[0.12]***		0.99[0.12]***

MOVING IN

Black

High Poverty Urban

Disabled	-0.18[0.08]***	-0.08[0.08]	-0.24[0.06]***	-0.14[0.06]*
HS Grad		0.41[0.09]***		0.32[0.07]***
College Grad		1.17[0.12]***		1.01[0.09]***

High Poverty Rural

Disabled	-0.40[0.11]***	-0.32[0.11]***	-0.21[0.10]*	-0.13[0.10]
HS Grad		0.48[0.11]***		0.50[0.11]***
College Grad		1.16[0.19]***		0.99[0.15]***

Non-poor Urban

Disabled	-0.19[0.07]***	-0.18[0.07]*	0.01[0.06]	0.02[0.06]
HS Grad		0.13[0.08] †		-0.02[0.07]
College Grad		0.16[0.11]		0.02[0.09]

White

High Poverty Urban

Disabled	-0.50[0.10]***	-0.23[0.11]*	-0.34[0.10]***	0.20[0.11] †
HS Grad		0.94[0.12]***		0.87[0.12]***
College Grad		2.01[0.14]***		2.03[0.14]***

High Poverty Rural

Disabled	-0.29[0.06]***	-0.08[0.06]	-0.22[0.06]***	0.06[0.06]
HS Grad		0.65[0.66]***		0.51[0.07]***
College Grad		1.60[0.08]***		1.12[0.08]***

Non-poor Urban

Disabled	-0.11[0.09]	-0.05[0.10]	-.25[0.08]***	0.11[0.09]
HS Grad		0.31[0.12]***		0.77[0.13]***
College Grad		0.47[0.13]***		1.09[0.13]***

Note: Note: All models include age-dummies and area-specific effects. So, for example, the models for poor urban blacks include controls for whether the individual lived in Harlem, Detroit, Chicago or Los Angeles. The HS Grad category includes college graduates. Numbers in brackets represent standard errors.

† significant p<.10; * significant p<.05; ** significant p<.01; *** significant p<.001%

Table 8. Estimates of age-standardized percent disability prevalence based on 1995 and 2000 local area populations

	Disability Prevalence			
	MEN		WOMEN	
	1995	2000	1995	2000
BLACK				
High poverty Urban				
Harlem	29.2	30.0	31.3	31.6
Eastside Detroit	31.9	33.0	31.9	31.5
Southside Chicago	27.1	26.3	27.1	26.1
Watts	30.4	31.2	30.0	31.3
High poverty Rural				
East North Carolina	29.0	29.1	27.0	27.3
Black Belt Alabama	31.4	31.9	30.7	30.9
Delta Louisiana	28.4	27.7	25.6	25.8
Non-poor Urban				
Bronx	24.1	23.3	20.4	21.4
Queens	20.6	20.7	19.1	18.5
Northwest Detroit	25.5	25.9	24.5	25.7**
Southwest Chicago	24.4	25.2	22.5	22.9
Crenshaw/Baldwin Hills	23.8	23.3	22.6	22.4
WHITE				
High poverty Urban				
Cleveland	23.9	23.3	23.1	23.3
Detroit	26.9	28.7†	23.5	26.8***
High poverty Rural				
Appalachian Kentucky	37.9	38.1	30.0	30.3
West North Carolina	21.4	21.3	19.0	19.2
Northeast Alabama	21.9	21.7	19.7	19.8
South Central Louisiana	24.4	24.2	18.5	18.4
Non-poor Urban				
Western Cleveland	10.8	10.8	9.5	9.4
Sterling Heights, Michigan	11.9	12.4	10.7	11.4

Note: Bolded italicized contrasts are statistically significantly different from each other. † indicates the difference between 1995 and 2000 is statistically significant at the $p < 0.10$ level, ** indicates the difference between 1995 and 2000 is statistically significant at the $p < 0.01$ level, while *** indicates the difference between 1995 and 2000 is statistically significant at the $p < 0.001$ level. P values are calculated using the method proposed by Bonferroni (Weisstein 2012).

Figure 1. Percent of the 2000 local area populations who moved between 1995 and 2000

