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Residential Segregation and Latino, Black and White Mortality in New York City

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ABSTRACT *Although racial segregation is associated with health status, few studies have examined this relationship among Latinos. We examined the effect of race/ethnic group concentration of Latinos, blacks and whites on all-cause mortality rates within a highly segregated metropolitan area, New York City (NYC). We linked NYC mortality records from 1999 and 2000 with the 2000 U.S. Census data by zip code area. Age-adjusted mortality rates by race/ethnic concentration were calculated. Linear regression was used to determine the association between population characteristics and mortality. Blacks living in predominantly black areas had lower all-cause mortality rates than blacks living in other areas regardless of gender (1616/100,000 vs. 2014/100,000 for men; 1032/100,000 vs. 1362/100,000 for women). Amongst whites, those living in predominantly white areas had the lowest mortality rates. Latinos living in predominantly Latino areas had lower mortality rates than those in predominantly black areas (1187/100,000 vs.1950/100,000 for men; 760/100,000 vs. 779/100,000 for women). After adjustment for socioeconomic conditions, whites, older blacks, and young Latino men experienced decreasing mortality rates when living in areas with increasing similar race/ethnic concentrations. Increasing residential concentration of blacks is independently associated with lower mortality in older blacks; similarly, increasing residential concentration of Latinos and whites is associated with lower mortality in young Latino men and whites, respectively.*

KEYWORDS *Hispanic, Latino, Morality, New York City, Race, Segregation.*

INTRODUCTION

Residential segregation, or the spatial and social distribution of two or more population groups within a metropolitan area, is a multidimensional construct[1] that has been posited as a fundamental cause of the racial disparities found in health outcomes.[2] Many studies have shown that black mortality rates are higher in

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metropolitan areas with high levels of segregation as compared to areas with lower levels of segregation.[3–11] The adverse effects on health are felt to occur through poorer residential area quality and its effects on health behaviors and health care, independent of individual and/or area level socioeconomic status (SES).[2]

The studies cited above used various measures to define segregation, ranging from population composition[6,7,11,12] to more formally defined measures.[3–5,8–10] Though the use of population composition as a proxy for segregation is neither technically nor conceptually the same as the formal constructs, the studies that used population composition as a measure of segregation[6,7,11] have also found that black mortality rates are higher in areas with a high proportion of blacks. The segregation literature,[3–10] for the most part, has used large geographical areas as the unit of analysis or has compared smaller areas across a broad geography but generally not focused on the local impacts of segregation that result in areas with both low and high residential race/ethnic minority concentrations within a metropolitan area. One exception is a study by Fang and colleagues,[12] which examined the impact of local race concentration on mortality using 1990 census and mortality data from New York City (NYC). This study found that within a residentially segregated city, whites and blacks living in zip code areas where they were the predominant race had lower mortality rates than persons of other races within their community and persons of their same race who resided in other areas. These findings are consistent with what has come to be termed an "ethnic density" effect and may be explained by health enhancing consequences of residing in residential areas where there exists opportunity for greater social support and protection from direct prejudice.

Fang et al.[12] did not examine this relationship in Latinos, the fastest growing ethnic group in the country[13] and in New York City.[14] Two studies have shown that Latino concentration contributes to a mortality advantage in Mexican-Americans,[6,15] but neither looked at the local impact of ethnic density on Latino mortality. The overall impact of Latino concentration on Latino mortality has been predicted to be smaller[2] because the levels of segregation of Latinos are moderate compared to those between blacks and whites.[16] New York City is the most segregated city for Latinos in the United States,[17] making it an ideal location to study whether the health enhancing consequences of residing amongst others of similar race/ethnicity extend to Latinos. We examine the impact of local race/ethnic density on all-cause mortality in blacks, Latinos and whites within a highly segregated city, New York City.

MATERIALS AND METHODS

Data Sources and Study Variables

Data for New York City mortality records for 1999–2000 and the Year 2000 U.S. Census were used for this study. Two years of mortality data were obtained from New York City Department of Health, to which all vital events in New York City were reported. Deaths were recorded by borough, age, gender, race, ancestry, and United States Postal Service zip code and ascertained through death certificates. Race and ancestry included non-Hispanic white, non-Hispanic black, and total Hispanics. Family members provided information of race and ancestry to funeral home directors. Outcome was tabulated as all deaths coded according to the 10th revision of International Classification of Diseases. This analysis was limited to deaths of non-

Hispanic blacks, non-Hispanic whites and Hispanics, 25 years and older. Hereafter, non-Hispanic black and white will be referred to as black and white.

Zip code tabulation areas (ZCTAs) were used as proxies for residential neighborhoods. ZCTAs were developed by the U.S. Census Bureau for tabulating data from the Year 2000 Census and are a "generalized area representation of U.S. Postal Service Zip Code service areas."[18] Census data at the ZCTA level included race-specific information for the following socioeconomic characteristics: educational attainment (persons 25 years or older with 12th grade or equivalency completed/total persons 25 years or older), poverty (persons living below poverty/persons living below and above poverty), and employment status (civilians 16 years or older unemployed/civilians 16 years or older unemployed and employed). These variables were included as potential confounders. In addition, because 55.7% of Latinos, 23.6% of whites and 27.4% of blacks in New York City were foreign-born (2000 Population Survey) and because foreign-born status has been associated with lower mortality rates, information on foreign-born (percentage of foreign-born) was included. When referring to ZCTA's, we use the term, zip code areas.

Census data were downloaded through the Census Internet web site (www.census.gov) and Infoshare (www.infoshare.org), a public access domain that provides census data for New York City. Zip code area data for non-Hispanic whites and Hispanics were obtained from Infoshare while the data for non-Hispanic blacks was obtained from the Summary File 1 of the 2000 U.S. Census from Lehman College Bronx Data Center.

Zip code areas where the white, black or Latino population exceeded greater than 70% of the total population were defined as predominantly white, black or Latino. For example, zip code areas with a non-Hispanic white population of 70% and above were defined as predominantly white areas. Sensitivity analyses showed that the results did not greatly differ when using various cut-offs ranging from 50 to 70%. The analysis was performed at 70% to remain closely consistent with previously published studies.[12] Zip code areas exclusive of Latino, black and white predominance contained two zip code areas that were greater than 50% Asian, but otherwise these zip code areas had no specific dominant race/ethnic group; these zip code areas were aggregated and defined as "other areas."

There were a total of 171 zip code areas. After linking mortality and census data, there were 169 zip code areas; two zip code areas were eliminated because the mortality data were suspect. Nine zip code areas with a population of less than 5,000 people[12] were excluded to increase the stability of the mortality rate estimates. This exclusion criteria yielded a final sample of 160 zip code areas (population sizes ranging from 5,000 to 106,415), including a total of 102,948 deaths over 2 years (60,188 non-Hispanic whites, 28,011 non-Hispanic blacks and 14,749 Hispanics). With the exception of the older white population, annual median deaths per zip code area ranged from 3 (range 0–44) to 14 (0–83) depending on the age-gender-race/ethnicity group. The older white population had higher median deaths: 41 (range 0–362) for males and 57 (range 0–471) for females. Most zip code areas had few deaths.

Statistical Analysis

Mortality rates and socio-demographic characteristics were compared amongst the different race/ethnic predominant areas for whites, blacks and Latinos separately.

Age-adjusted mortality rates for those age 25 and above, as well as stratified by age groups (25–44 years, 45–64 years and ≥65 years), were calculated using the U.S. 2000 Standard Population.[19,20]

Separate race–gender-specific multiple linear regression models were fitted with all-cause mortality rates as the dependent variables stratified into two broad age groups (age 25–64 years and 65 years and above) to remain consistent with previous studies[12] and because the causes of death for premature mortality is different from those who die older than age 65 and between men and women. In some zip code areas, the number of minorities was small. Thus, in order to obtain reliable mortality estimates for minorities in these areas, we combined adjacent tracts with similar populations of minorities. Zip code areas where there was no population within a race-specific 10-year age group were eliminated during stratified analyses. Mortality data of young non-Hispanic white populations were skewed, and logarithmic transformations of dependent variables were used. Independent variables expressed as percentages were treated as continuous variables in the models. Analyses were adjusted for education, employment, poverty and foreign-born status defined at the level of the zip code.

TABLE 1. Sociodemographic characteristics of population by area of racial segregation

		New York City[a]	White area[b]	Black area[c]	Latino area[d]	Other area[e]
Population		7,933,242	1,459,893	852,229	382,009	5,239,111
			(0.18)	(0.11)	(0.05)	(0.660)
Whites	*N* (%)	2,778,058	1,140,937	26,233	31,769	1,579,119
		(0.35)[g]	(0.41)[h]	(0.009)[h]	(0.011)[h]	(0.56)[h]
Age	25–44	887,821	399,085	6,230	10,626	471,880
		(0.32)[i]	(0.35)[i]	(0.24)[i]	(0.33)[i]	(0.31)[i]
	45–64	387,426	169,310	2,931	4,034	211,151
		(0.14)	(0.15)	(0.11)	(0.13)	(0.13)
	>65	521,928	190,667	5,169	6,489	319,603
		(0.19)	(0.17)	(0.20)	(0.20)	(0.20)
Blacks	*N* (%)	1,943,280	35,084	702,552	51,125	1,154,519
		(0.24)	(0.018)	(0.36)	(0.026)	(0.59)
Age	25–44	602,040	12,908	210,012	15,496	363,624
		(0.31)	(0.367)	(0.30)	(0.30)	(0.31)
	45–64	404,081	8,455	151,377	9,513	234,736
		(0.21)	(0.24)	(0.22)	(0.186)	(0.20)
	>65	184,871	3,603	71,270	5,683	104,315
		(0.095)	(0.01)	(0.10)	(0.11)	(0.09)
Latinos	*N* (%)	2,135,469	124,388	81,067	284,143	1,645,871
		(0.27)	(0.058)	(0.038)	(0.133)	(0.77)
Age	25–44	699,589	47,310	25,525	88,109	538,645
		(0.33)	(0.38)	(0.31)	(0.31)	(0.33)
	45–64	234,038	15,708	9,011	32,079	177,240
		(0.11)	(0.126)	(0.11)	(0.11)	(0.11)
	>65	135,730	9,541	5,339	19,504	101,346
		(0.06)	(0.077)	(0.66)	(0.07)	(0.06)
Median household						
Income ($)		43,081	59,992	36,078	22,841	40,501
White		44,448	62,240	27,800	27,129	43,099
Black		38,206	43,681	36,916	23,021	37,917
Latino		37,615	52,217	22,188	21,380	35,286

TABLE 1. ***Continued***

	New York City[a]	White area[b]	Black area[c]	Latino area[d]	Other area[e]
Below poverty (%)					
White	16.14	7.48	23.69	35.73	16.06
Black	23.69	21.40	21.50	35.94	23.78
Latino	24.54	14.76	29.14	38.97	25.74
Unemployed (%)					
White	9.02	4.18	15.17	19.51	8.69
Black	14.2	12.65	13.44	18.79	14.44
Latino	12.82	8.02	16.13	18.82	13.31
High school graduate (%)					
White	84.73	88.86	79.28	84.15	81.75
Black	70.43	76.12	71.29	59.60	70.45
Latino	53.42	72.63	54.24	42.37	53.25
Percent foreign born	32.97	23.88	31.69	38.83	35.62

[a]New York City.

[b, c, d]All zip code areas with whites (blacks, Latinos) ≥70% of the population.

[e]All zipcode areas in NYC excluding those in columns b, c, d.

[g]Percent total population whites amongst total NYC population.

[h]Percent of whites in white, black, Latino, or other areas amongst all New Yorkers who are white.

[i]Percent of whites age 25–44 amongst total population whites who live in New York, white, black, Latino, or other areas.

RESULTS

Sociodemographic Characteristics of Population

Table 1 summarizes the sociodemographic characteristics of the different population groups in New York City. Zip code areas predominantly Latino had the lowest median household income, and those areas predominantly white had the highest; predominantly black areas fell in between with a median household income lower than the city as a whole.

Whites, blacks and Latinos living in predominantly white areas had the highest income, and those living in predominantly Latino areas had the lowest. Though black and Latino median household incomes in predominantly white areas were higher than those living in predominantly black and Latino areas, the median household incomes for blacks and Latinos were still lower than the median household income for whites by as much as 30%. Fewer whites, blacks and Latinos lived below poverty and were unemployed in predominantly white areas. More people lived below poverty and were unemployed in predominantly Latino areas than in areas that were predominantly black or white.

Mortality Rates

Table 2 presents age-adjusted all-cause mortality rates for black, white and Latino men and women in New York City areas defined by the dominant race. Blacks had the highest death rates, and Latinos had the lowest in New York City, regardless of gender. Whites living in predominantly white areas had statistically significant lower all-cause mortality rates than whites living in predominantly black or Latino areas. Similarly, blacks living in predominantly black areas also had significantly

TABLE 2. Age-adjusted all-cause mortality rates (1/100,000) by race/ethnic concentration in NYC 1999–2000 for ages 25 years and older

	Whites					Blacks					Latinos				
		Areas					Areas					Areas			
	NYC	White[a]	Black[b]	Latino[c]	Other[d]	NYC	White[a]	Black[b]	Latino[c]	Other[d]	NYC	White[a]	Black[b]	Latino[c]	Other[d]
Male	1382	1244[¥]	1811*	1865*	1463*	1762	2014*	1616[¥]	2407*	1819*	1267	1140	1950*	1187[¥]	1266
Female	1012	918[¥]	1380*	1310*	1064*	1182	1362*	1032[¥]	1643*	1251*	777	686	779	760[¥]	788

[a, b, c]All zip codes with whites (blacks, Latinos) ≥70% of the population.
[d]All zipcodes not included in a, b, c.
[¥]Reference category.
*Mortality rate significantly different from reference group[¥] at an alpha level of 0.05. (NYC rates not included in comparison.)

lower mortality rates than blacks living in predominantly white or Latino areas for all-cause deaths. Both blacks and whites living in predominantly black or white areas had lower mortality rates, respectively, than blacks and whites living in areas where the population was not predominantly black, white or Latino. However, only Latino males living in predominantly black areas had significantly higher mortality rates than Latinos living in Latino areas.

Table 3 shows that when stratified by age groups, the higher death rates for blacks living in Latino-dominant areas and "other" areas, which were not predominantly black, white or Latino, held in women and older black men. For whites, higher mortality rates for those living in predominantly black and Latino areas and "other" areas with no predominant race/ethnicity were observed in almost all age groups regardless of gender. Except for Latino women over the age of 65, Latinos experienced lower mortality in predominantly white areas and higher mortality in predominantly black areas as compared to Latinos living in predominantly Latino areas, but the difference was only significant among older Latino men living in predominantly black areas.

Multiple Regression Analysis

Table 4 shows the results of linear regression models with all-cause mortality by gender. In the full model, among whites of all ages regardless of gender, all-cause mortality rates were inversely related to percentage of whites in the zip code area. Similarly, percent foreign-born was significantly associated with decreased mortality rates in all age/gender strata in whites.

Among blacks 65 years and older, all-cause mortality rates were inversely related to percentage of blacks in the zip code area. Specifically, a 1% increase in proportion of blacks in the population decreased mortality rates for men by approximately 13/100,000 and by approximately 11/100,000 for women after adjusting for zip code area education, unemployment and poverty. In blacks, percent foreign-born significantly decreased mortality rates by 4/100,000 only for young men.

Among Latinos, a 1% increase in Latino population was significantly and independently associated with a 3/100,000 decrease in all-cause Latino mortality in younger Latino men after adjusting for zip code area education, unemployment, and poverty. Foreign-born status was significantly and independently associated with reduction in mortality in Latinos, except for older men. Percent of foreign born also weakened the association between percent Latino and mortality rates.

DISCUSSION

Our study found that in New York City racial homogeneity among blacks and whites was associated with substantial differences in mortality. However, while there was a protective effect of homogeneity in Latinos, the effect was limited to younger men only. Persons living in a zip code area where they belong to the majority exhibited lower all-cause mortality rates regardless of their race/ethnicity. Although the effects on mortality did not achieve significance in all age and gender groups, the reduced mortality pattern was similar for Latinos, blacks and whites after adjustments for SES indicators at the zip code level.

The "density hypothesis" refers to the idea that the health of a group's members is fostered or protected by higher group concentration.[21] Our findings suggest that there may be a common social mechanism of action through which "ethnic density," or the relative size of ethnic groups in areas that are occupied by members

TABLE 3. Age-specific mortality rates (1/100,000) of all-cause disease by race/ethnic concentration in NYC 1999–2000

	Whites				Blacks				Latinos			
	Areas				Areas				Areas			
	White[a]	Black[b]	Latino[c]	Other[d]	White[a]	Black[b]	Latino[c]	Other[d]	White[a]	Black[b]	Latino[c]	Other[d]
Male												
25–44	109.51[¥]	391.65*	481.58*	210.15*	331.13	329.97[¥]	486.90	362.30	150.9	280.90	211.04[¥]	198.61
45–64	631.45[¥]	1463.61*	1078.70*	854.75*	1584.94	1206.12[¥]	1947.73	1443.91*	633.60	974.23	810.93[¥]	874.27
65+	4714.77[¥]	5988.99*	7011.54*	5575.79*	6005.79	4866.13[¥]	7112.18*	5476.77*	3635.81	5594.00*	3651.65[¥]	3740.46
Female												
25–44	46.54[¥]	212.14*	293.13*	96.50*	208.43	175.48[¥]	299.54*	217.65*	63.05	122.72	98.61[¥]	94.02
45–64	374.49[¥]	607.61	623.71	498.12*	815.03	657.35[¥]	1264.91*	828.21*	277.59	474.47	390.90[¥]	378.94
65+	4216.69[¥]	6237.46*	5939.76*	4929.42*	5020.26*	3598.87[¥]	5693.72*	4353.39*	2760.05	2593.62	2712.27[¥]	2747.17

[a, b, c]All zip codes with whites (blacks, Latinos) ≥70% of the population.

[d]All zipcodes not included in a, b, c.

[¥]Reference category.

*Mortality rate significantly different from reference group[¥] at an alpha level of 0.05.

TABLE 4. Regression coefficients for the effect of percentage of white (black, Latino) on all-cause mortality rates among white (black, Latino) men and women, controlling for zip code area SES variables[a]

	Whites				Blacks				Latinos			
	Model 1		Model 2		Model 1		Model 2		Model1		Model 2	
Model[b]	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Age 25–64												
Percent race[c] β (s.e.)	−3.35 (0.000)	−3.55 (0.000)	−5.16 (0.000)	−5.17 (0.000)	−1.14 (0.201)	−0.889 (0.143)	−1.47 (0.101)	−0.885 (0.154)	−3.24 (0.0003)	−0.792 (0.086)	−3.04 (0.0014)	−0.494 (0.2537)
Percent foreign-born			−4.661 (0.003)	−3.99 (0.001)			−3.86 (0.04)	−0.049 (0.97)			−3.64 (0.0019)	−2.17 (<0.0001)
r^2	0.7102	0.625	0.7302	0.659	0.3417	0.3502	0.3635	0.3502	0.4915	0.3429	0.5248	0.3782
Age 65+												
Percent race[c] β (s.e.)	−28.12 (<0.0001)	−24.91 (<0.0001)	−36.25 (<0.0001)	−31.71 (<0.0001)	−13.27 (0.026)	−9.96 (0.0295)	−13.02 (0.0319)	−11.21 (0.0151)	−8.69 (0.2863)	−2.58 (0.596)	−7.8 (0.3396)	−1.22 (0.7958)
Percent foreign-born			−29.59 (0.0002)	−25.51 (0.0038)			3.19 (0.7996)	−16.20 (0.091)			−11.703 (0.258)	−20.73 (0.001)
r^2	0.4600	0.2014	0.5210	0.2473	0.1465	0.1513	0.1470	0.1711	0.1828	0.089	0.1903	0.1602

[a]Zip code area percentage high school grad by race; Zip code area percentage unemployment by race; Zip code area percentage below poverty by race and age 25–64 or age >65.

[b]Model 1: white (black, Latino) female mortality = β0 + (β1*percent white (black, Latino)) + (β2*percent high school education) + (β3*percent unemployment) + (β4*percent poverty);
Model 2: white (black, Latino) female mortality = β0 + (β1*percent white (black, Latino)) + (β2*percent high school education) + (β3*percent unemployment) + (β4*percent poverty) + (β5*percent foreign-born).

[c]Percent race = percent black in black models; = percent Latino in Latino models; = percent white in white models.

of more than one group,[22] leads to a mortality benefit at the local level. Ethnic density effects for whites, blacks, and various immigrants have been described in psychiatric literature[21–27] in both the United Kingdom and the United States; their authors[21–24,27] have theorized that members less socially isolated or marginalized are perhaps shielded from prejudice and better positioned to access social support and community resources, thereby reducing psychiatric vulnerability. The same mechanism of action may explain the reduction in mortality risk.[28]

Fang et al.'s[12] earlier paper showed that living in zip code areas that are more economically advantaged failed to confer a mortality advantage among blacks. Similarly, in our study, living in predominantly white zip code areas was associated with higher mortality rates for older Latino men and older blacks of both genders despite living in zip code areas where their socioeconomic status was better than those living in predominantly Latino or black areas. Because median household incomes for Latinos and blacks residing in predominantly white areas were still as much as 30% lower than their white counterparts, there may be limits to the benefits from living in an affluent area and/or even greater psychosocial stress arising from perceived inequities[29] adversely affecting health.

Previous studies that run counter to ours typically show that a greater proportion of blacks in a census tract[6,7] is associated with greater all-cause black mortality. But because high levels of segregation can only occur when the minority population is of significant numbers, most areas with high proportion of blacks within a geographic area are located in segregated cities; these studies effectively may be measuring the association of large area segregation on mortality. Stated another way, these studies may be measuring the effect *between* segregated urban areas (represented by the geographical unit with high proportions of blacks) and less segregated non-urban areas (predominantly represented by the geographical unit with low proportion of blacks). This method discounts the local effect of ethnic density *within* large areas that have similar residential segregation levels; a census tract with a 10% minority population within a highly segregated metropolitan area may operate very differently from a census tract of 10% minority population within a city that is not as segregated. Studies that did not find an ethnic density effect on mental health outcomes similarly were studies that did not specifically adjust for within-local effects.[25,26]

In contrast, we examined within a smaller geographic area. New York City is the sixth most segregated metropolitan area for blacks[30] and the most segregated metropolitan area in the United States for Latinos.[17] Census tracts within regionally segregated areas may operate differently from census tracts located in regions that are not as segregated. Within a segregated local environment, it has been assumed that attendant consequences of economic disinvestments, concentrated poverty and behavioral norms, typically associated with minority populations, would affect health adversely. This study tries to explain the local effects within a region that is highly segregated, resulting in very high concentrations of minority populations.

In our study Latinos have the lowest mortality rate when compared to blacks and whites consistent with the well-described "Hispanic paradox" that describe the phenomenon of lower Latino all-cause and cardiovascular mortality rates compared to non-Hispanic whites despite higher rates of diabetes and obesity, lower socioeconomic status and greater barriers to health care.[31,32] These findings could also be a reflection of their recent immigration, which appear to be a more potent predictor of health and mortality than SES.[27] One of the two previous studies examining Latino mortality and segregation did not include any adjustment

for area level immigration status or individual level immigration.[33] We adjusted for percent foreign-born in our statistical models since foreign-born persons not only may have differential mortality patterns but also may influence and/or provide contextual factors that influence health and mortality.[34–40] In our study, adjusting for foreign-born status attenuated the effect of percent Latino race on mortality but most particularly in Latino women. This may make it very difficult to dissociate the effects of percent Latino population from the effect of foreign-born status without information on birthplace. Percent foreign-born did not fully explain the association between Latino race and mortality rates in Latino men.

The lack of significant effect of Latino concentration on mortality in older Latinos in our study may indicate a threshold effect of segregation on health outcomes.[41] When using a summary index of five segregation indices, New York Latinos are the most segregated in the U.S., but compared to blacks and whites in New York City in 2000, Latinos are far less segregated spatially.[16] In New York, the dissimilarity index, a common segregation measure for which a higher number indicates more segregation, was 0.810 for blacks, but was only 0.667 for Latinos. This degree of segregation for Latinos was approximately the same level as the 18th most segregated city in the United States for blacks.[17,30] Because they are less segregated, Latinos in New York City may not achieve the level of ethnic density required for mortality benefit. Alternatively, it may be that Latinos are less affected by the perceived and real hazards associated with being a minority as indicated by their progressive inroad into suburban America, to levels far greater than blacks, with rising SES.[16,17,30] But more importantly, Latinos are a heterogeneous group, and our classification of Latinos into a single group may miss salient differences that exist amongst them that influence health.

Limitations

Theoretically, administrative boundaries, at all levels, have limited meaning for residents in terms of social interaction, but "smaller aggregate units might have a greater degree of demographic homogeneity that increases the likelihood that the aggregate proxy captures...neighborhood effects of SES."[42] SES measures at the zip code area, census tract and block level all introduce bias, but it is not always the case that zip code area SES estimates are less robust than those of smaller areas.[42] Studies using block group, census tract and zip code areas have shown consistency in the association of SES with mortality outcomes, though this was not the case with cancer incidence in one study.[43] But most importantly, Fang et al.'s[37] follow-up analysis of all-cause and cardiovascular mortality in New York City blacks and whites at the census tract level showed similar results to her findings at the zip code level, which were upheld in our study.

The use of zip code areas as the neighborhood unit is still a significant limitation in other ways. Merging both census-derived and zip code area data has been shown to leave potential for spatial-temporal mismatch.[44] In Massachusetts, there were 474 zip code areas listed in the 1990 census, but 10% of cancer cases occurred in 193 zip code areas not included in the 1990 census[44] that resulted because of 30 zip code areas that were changed after the 1990 census; in our data, however, we found that there were no deaths with a U.S. Postal Service zip code area that did not have a corresponding 2000 census ZCTA. In addition, because Zip code tabulation areas and U.S. postal zip codes can "appear the same, the addresses and areas covered by these areas may not be the same,"[18] greater bias can be a result when using these boundaries than those created by census tracts or block groups.

Another limitation to our study was our inability to control for SES at the individual level, which has been shown to be an important influence on mortality.[48] But studies which have controlled for individual-level SES show that race concentration still remains an independent predictor of mortality after controlling for individual level SES,[7,15] and it has also been suggested that aggregate proxies may more likely control SES confounding in the relationship between SES and race than individual measures alone.[42]

The use of traditional modeling techniques could be a shortcoming of our study. Specifically, because the mortality data were clustered within zip codes, it was possible that there was some intraclass correlation of deaths occurring in the same zip codes.[46–51] However, we noticed that most of the zip codes included in the analyses have few deaths, suggesting that the outcomes may be independent and thus, not necessitating multilevel analyses.

Lastly, though we have data linked to zip code areas reported at the time of death, we do not have information regarding how long people lived at this residence before they died. Disease risk acquisition takes place throughout life, and those locations may be more relevant than location of their death.

CONCLUSION

Forty years after the victories of the civil rights movement, the United States remains a segregated country. Segregation has had profound adverse social, political and economic consequences[52] at the macro level, but at the micro level, there may be some collateral positive consequences as well. Ethnic density may contribute to longevity by providing "the heart (in a) heartless world,"[53] protection from rejection and alienation and support and information in times of need.

Our work suggests that blacks, whites and some Latinos may benefit more from living in areas with a high proportion of people of similar race/ethnicity than living in areas where they are in the minority. Conversely, blacks, whites and some Latinos fare worse when isolated from people of similar race/ethnicity. It is important to note that these differences pale before the enormous gaps in overall mortality between races.[54] Overall black mortality in New York City is much higher than that of whites, and this difference may even be attributable to the persistent large area segregation along both racial and socioeconomic lines.[52]

Still, understanding the small area effect may help reduce racial mortality disparities. We need to identify the mechanisms by which homogeneous micro-communities protect the health of the majority and are detrimental to the health of their minority members, including whites. Harnessing the beneficial factors operating within a homogeneous community and transplanting them to a heterogeneous community may lead both to an overall reduction in minority mortality and a reduction in the racial mortality disparities. Our findings support building bridges between those of similar race/ethnicities regardless of their micro-environment.

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