Resources, Race, and Health: Spatial Patterning of General and Race-Specific Mortality in the United States

P. Johnelle Smith[1] and Corey S. Sparks[2]

Introduction

Spatial patterns emerge when examining mortality risks in the United States. Spatial clusters are particularly pronounced for racial/ethnic groups. However current literature addressing this distribution of mortality risks has not fully explained the mechanisms influencing this spatial distribution. This could partly be the result of methodological and theoretical questions about the appropriate level for assessing mortality risks (Diez Roux 2001), as well as how other contextual level measures may lead to different mortality risks for concentrations of racial/ethnic groups while considering how resource are spatially located.

The more general purpose of this paper is to address the impact of county-level characteristics on mortality risks. Specifically this paper will examine the interaction between race and resources, including the availability of health services, economic characteristics of counties, and population composition, as they relate to overall mortality rates for the entire U.S. population as well as for Black- and Hispanic-specific mortality rates. Spatial analysis of mortality rates will be used to examine the interaction between racial concentration levels for counties and resource availability. We hypothesize that counties with a high concentration of Black residents and poor resources will experience higher overall mortality rates. However we think Black-specific mortality rates are likely to be lower in areas with high concentrations of Black residents and fewer resources when tests for spatial dependence are included. Hispanic mortality is likely to operate in a different manner. We hypothesize that counties with high concentrations of Hispanic residents and poor resources will experience overall mortality rates similar to whites. Yet when considering Hispanic-specific mortality rates, we expect to find a mortality advantage when tests for spatial dependence consider Hispanic concentration and resource availability. Our goal for this paper is to understand how the spatial concentration of minority populations and resources helps in explaining variations in U.S. mortality rates.

Literature Review

Research in the public health literature has had an emerging focus on examining the impact of environment, both physical and social, on a variety of health outcomes (Jones and Duncan 1995; Kaplan 1996; Macintyre, Maciver and Sooman 1993; Robert 1999). Numerous studies have examined the impact of structural level factors on individual health outcome using multilevel modeling techniques and have found that measures at the higher level unit have given insight into the interplay between health and place. However this method has not allowed for the spatial distribution of populations and resources to be examined as they relate to overall and race-specific mortality risks for the U.S. population. A recent study by McLaughlin and colleagues (forthcoming) finds that the spatial patterning of mortality is highly correlated with economic characteristics and physician distribution in counties. Similar relationships are likely to found for race-specific mortality rates when spatial clustering of minority groups and resources are considered.

Several arguments have been given to explain why minority mortality risks are likely to differ from the mortality risks of whites. Reasons suggested for higher mortality among Blacks include genetic variation, cultural and lifestyle diversity, social and economic disadvantage, and a legacy of discrimination (Hummer 1996; Otten et al. 1990). Residential segregation has also

[1] Department of Demography and Organization Studies, The University of Texas at San Antonio, Institute for Demographic and Socioeconomic Research Institute
[2] Department of Anthropology, The Pennsylvania State University, Population Research Institute

been an important factor in shaping the health risks of Blacks in the United States (LaVeist 1993). Blacks have traditionally lived in areas with high income inequality and poverty concentration (Colclough 1988; McLaughlin and Stokes 2002; Zekeri 1997). Each of these factors has been hypothesized to lead to higher mortality risks for Blacks. The mortality experience for Hispanics has been quite different in the United States compared to other minority groups, particularly Blacks, even though Hispanics tend to experience economic disadvantages similar to Blacks (Jargowsky 1997: Lewis 1966). Despite similar economic situations between Blacks and Hispanics, Hispanics tend to have high rates of labor force participations, intact families, residential stability, and community institution and kin support (Eschbach et al. 2004). However it is still unclear how the concentration of Hispanics in particular locations and the influence of resources in these places may lead to differential mortality risks.

Data and Methods

Data for this analysis are taken from three sources, Compressed Mortality Files from the National Center for Health Statistics, 2000 U.S. Census of Population and Housing, Summary File 3, and 2004 Area Resource Files (ARF). Five year age-race-sex standardized mortality rates for the years 1996-2000 as well as Black- and Hispanic-specific mortality rates for this same time frame will serve as the dependent variables in this analysis. Independent variables for this analysis will be taken from the Census and ARF and will contain county-level indicators of economic, social, and health care availability.

We employ two methods in this paper. First for descriptive purposes we use local spatial autocorrelation analysis (LISA, Anselin 1995) to identify clusters of mortality and Black/Hispanic population proportions. Secondly, spatial regression is used to analyze how the county-level indicators influence overall mortality, taking into account the suspected spatial autocorrelation in them. We estimate three models for Black and Hispanic mortality. First we estimate a normal OLS regression model of overall mortality on race-specific variables representing the county level interaction between percentage of racial group and total number of hospitals (race*hospital) in the county not taking into account spatial dependence. We examine model diagnostics of autocorrelation attributable to spatial dependence in the data and use the Lagrange multiplier statistic (Anselin 1988) to detect spatial dependence due to both nonrandom spatial error and spatial lags. Based on this criterion we will select the most appropriate model when examining our other dependent variables, Black- and Hispanic-specific mortality rates while also including the effects of county level economic and population composition independent variables. In preliminary analyses we estimate both the spatial error model and the spatial lag model, since both display large and significant Lagrange multiplier statistics.

Preliminary Results

Figures 1 and 2 show the results of the LISA analysis. In areas with a high proportion of Black population, we see an accompanying high level of total mortality, most localized in the south-eastern portion of the country. In addition we also see significant clusters of low mortality, high proportion Black population through Ohio, Indiana and Oklahoma. The western portion of the country displays a completely different pattern of low mortality, low proportion Black, most attributable to the "white flight" migration pattern observed over the past few decades. Figure 2 shows a much different pattern for the relationship between Hispanic populations and overall mortality. In the southeastern US, we see a low-high pattern of mortality and Hispanic population, and in the southwestern portion of the country a significant cluster of high mortality, low proportion Hispanic. The only real definable cluster of high mortality, high proportion Hispanic occurs in northern Texas and southern Oklahoma. These patterns are suggestive of recent work on the positive influence of Hispanic social networks on lowering Hispanic mortality.

Results of the spatial regression analysis indicate that the spatial error model best fits (minimum AIC criteria) the spatial association of mortality and our race*hospital interaction variable. This suggests that the spatial clustering of total mortality in these areas is most likely attributable to shared observed/unobserved heterogeneity among these areas. After controlling

for the shared spatial error in the model, the effect of the race*hospital term indicates that areas with high proportions of Hispanics or Blacks (see separate models) and a large number of hospitals tends to increase mortality on average. As a side note, the results of the OLS regression model tend to agree with the LISA analysis, where we see a strong positive effect of the race*hospital variable on total mortality for Blacks, but a negative association for Hispanics, once again suggesting the effect of Hispanic social networks. Further race-specific analyses will focus on the effects of local social and environmental determinants on Black and Hispanic mortality in the U.S.

Table 1. Results of spatial regression analysis for the three models discussed in the text.

Race	**Black**			**Hispanic**		
Model	**OLS**	**Spatial Error**	**Spatial Lag**	**OLS**	**Spatial Error**	**Spatial Lag**
Parameter						
Intercept	881.241***	848.326***	272.061***	803.812***	851.613***	231.435***
$\beta_{(Race*Hospital)}$	48.032***	14.321***	17.831***	-14.316***	17.433***	3.137
ρ			0.694***			0.729***
λ		0.779***			0.797***	
Lagrange Statistic (error)	2689.618***			3353.273***		
Lagrange Statistic (lag)	2130.392***			2612.449***		
Model AIC	38687.4	**37478.2**	37582.9	38899.5	**37477.8**	37626.2
Model R^2	0.070	0.413	0.385	0.0038	0.416	0.378

***= p<.0001, Bold AIC values represent best fitting model.

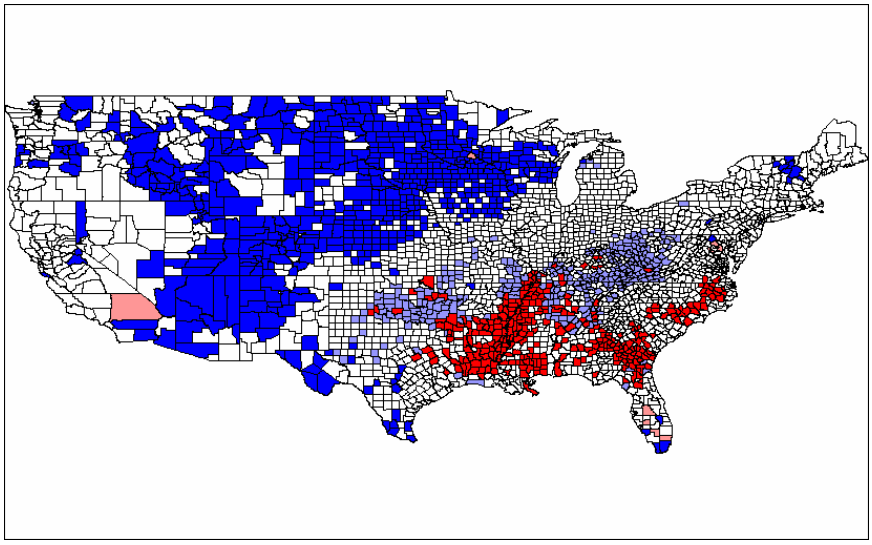

Figure 1. Total Mortality and Percent Black LISA map. Red=high mortality, high percentage Black population, pink=high mortality, low percentage Black population, dark blue= low mortality, low percentage Black population, light blue=low mortality, high percentage Black population.

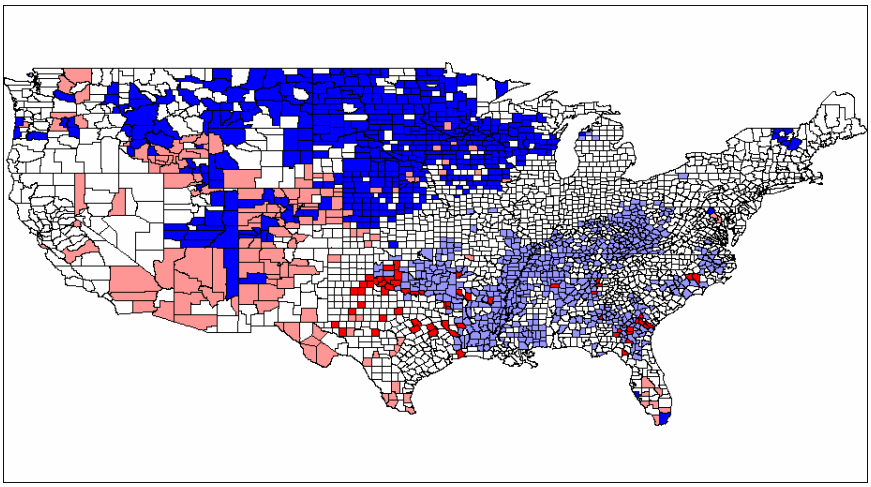

Figure 1. Total Mortality and Percentage Hispanic Population LISA Map (color codes as in Figure 1).

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