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Spatial Variation in the Hispanic Paradox: Mortality Rates in New and Established Hispanic US Destinations

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ABSTRACT

A long line of research has shown that despite their lower socioeconomic standing, Hispanics have lower mortality rates relative to Whites. In a separate literature, scholars have shown that Hispanics are increasingly relocating and shifting their destination choices within the US. Using 1999–2010 county-level national vital statistics data, this paper combines these two research domains by comparing Hispanic and White all-cause mortality rates and their differentials in new and established Hispanic destinations. The results reveal that the Hispanic mortality advantage in established destinations is much smaller relative to the rest of the nation owing to significantly higher Hispanic mortality rates. Utilising spatial regression techniques, the study also compares the ecological correlates of White and Hispanic mortality rates and their gaps across Hispanic destinations. The results show that the structural factors associated with mortality gaps vary by destination type except for the percent of Hispanics that are recent immigrants, which is associated with a greater Hispanic mortality advantage in all areas. In addition to providing support for a healthy migrant effect, the results also reveal the importance of internal Hispanic migration, which is associated with larger gaps in established areas. Lastly, factors associated with White mortality, particularly local socioeconomic conditions, are associated with larger mortality gaps, specifically in new destinations. The study highlights the increasing need to consider geographic heterogeneity in White and Hispanic health and mortality outcomes given the expanding dispersion of Hispanics into areas that until recently attracted few Latinos.

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INTRODUCTION

Research has consistently shown that low socioeconomic status is strongly associated with poor health and mortality outcomes in the US (Kawachi and Berkman, 2000). Studies have also found a consistent relationship between socioeconomic status and race, where non-Hispanic Whites (hereafter called Whites) are generally more economically advantaged than their Black and Hispanic counterparts. Given these associations, it is not surprising to find that Whites have better health outcomes than Blacks for both genders across all age groups (Williams and Collins, 2001). However, a long line of research has found the opposite when comparing Whites with Hispanics: Whites in the US experience higher mortality rates than do Hispanics (Palloni and Arias, 2004; Turra and Goldman, 2007). This finding, known as the Hispanic or Latino health paradox, has perplexed researchers since it was first discovered nearly 30 years ago (Markides and Coreil, 1986).

In order to shed light on the potential factors driving these counterintuitive results, researchers have examined the Hispanic paradox across a number of dimensions including gender (Palloni and Arias, 2004), data source (Arias *et al*., 2010), biological risk factor (Crimmins *et al*., 2007), immigration status (Eschbach *et al*., 2004), self-reported health (Browning *et al*., 2003), and potential cause, such as neighbourhood characteristics (Eschbach *et al*., 2004), return migration (Abraido-Lanza *et al*., 1999), and selective migration (Rubalcava *et al*., 2008). However, there are no studies to the author's knowledge that has examined geographic variation in the Hispanic paradox, which we might expect considering that mortality rates and their structural determinants are not randomly distributed across space (Sparks and Sparks, 2010; Yang *et al*., 2015). If the Hispanic paradox varies spatially, a demographic comparison of areas where the White-Hispanic mortality gap is smaller, larger, or non-existent may help validate or uncover new explanations.

Spatial variation in the Hispanic paradox has become increasingly likely given the growing variability in the destination choices of the Hispanic population. Historically, Hispanics in the US have resided in large metropolitan areas in the Southwest and Northeast (Leach and Bean, 2008). In recent years, owing to factors such as economic restructuring and hostile political environments, Hispanics have increasingly dispersed, resettling in small towns and rural areas in the South and Midwest (Durand *et al*., 2000; Kandel and Parrado, 2005; Lichter and Johnson, 2006). Given their rapidly growing Hispanic populations and socioeconomic differences with traditional gateways, new destinations merit more attention from the health and mortality literature. However, studies examining the Hispanic health paradox have largely been conducted at the national level or in regions with large, established Hispanic populations (Markides and Eschbach, 2011). Surprisingly, little attention has been paid to the health and mortality outcomes in new destinations.

In this paper, I address this research gap by comparing age-adjusted all-cause mortality rates for Hispanics and Whites in traditional versus new Hispanic destinations using county-level national vital statistics data. I then use spatial regression techniques to determine whether the effects of ecological characteristics on Hispanic and White mortality rates and their gaps also vary by destination type. This paper combines two prominent literatures in Hispanic research – destination choices and health advantages – to shed new light on the Hispanic paradox by focusing attention on the mortality outcomes in areas of the country that have largely been unexamined despite their growing Hispanic populations.

THE HISPANIC MORTALITY ADVANTAGE OVER SPACE

Most studies examining the mortality and health advantages of the Hispanic population rely on individual-level data drawn from either vital registrations or surveys (Markides and Eschbach, 2011). Many of these data sources provide nationally representative samples that do not allow researchers to generalise results at lower geographic levels. Therefore, most of these studies do not attempt to account for spatial variation, with the exception of controls for urbanicity, metropolitan status, or regional affiliation (Markides and Eschbach, 2011).

Researchers have not been completely oblivious to the possible presence of spatial variation in the Hispanic mortality advantage. In fact, in a critical review of the literature, Palloni and Morenoff (2001) discuss the important role that geography plays in influencing Hispanic mortality levels and trends. In their review, they note that earlier

> results vary, not just depending on the definition of the target population, but also as a function of the geographic location of such groups. This is not surprising. If, as we argue later, there are powerful selection effects accounting for some of the unexpected findings, it stands to reason that the outcomes of interest will vary sharply by region of residence. As a consequence, one should expect and not be surprised by the fact that contrasts between target and standard population include important geographic heterogeneity (Palloni and Morenoff, 2001:158).

Subsequent research has not completely ignored the authors' arguments; however, the integration of geography in the examination of the Hispanic paradox has been narrow.

The few studies that have examined Hispanic health and mortality at sub-national levels do so for regions with large Hispanic populations. The most utilised regional dataset is from the Hispanic Established Population for the Epidemiological Study of the Elderly, a survey of a representative sample of Mexican-Americans in five Southwestern states (Arizona, California, Colorado, New Mexico, and Texas). Researchers relying on this data have examined a range of Mexican-American health outcomes, including mortality and morbidity levels of diabetic people, depression, health conditions of the oldest old, and mortality from cardiovascular diseases (Kuo *et al.*, 2003; Ostir *et al.*, 2003). In general, these studies have found that Mexican-Americans exhibit better health depending on medication use, neighbourhood characteristics, and metabolic syndrome.

Other studies examining narrower geographic regions suggest spatial heterogeneity in the Hispanic paradox. For example, while Lee (2009) finds no effect of residential segregation on Hispanic mental health in Chicago, Lee and Ferraro (2007) using data from New York and Chicago and Osypuk *et al*. (2009) using data from Los Angeles, New York, and St. Paul find evidence that Hispanics residing in ethnic enclaves have lower mortality levels. Furthermore, while Hunt *et al*. (2002) find no Hispanic mortality advantages amongst diabetic people in San Antonio and Tian *et al*. (2010) find no mortality advantages for Hispanic women in Texas, studies from California find strong evidence of a Hispanic paradox (Pearl *et al*., 2001; Palaniappan *et al*., 2004). These results provide some evidence of spatial variation in Hispanic health advantages even amongst narrowly defined geographic areas. Expanding the analyses to include other areas of the country will likely reveal further geographic variations in White-Hispanic health and mortality differentials.

EMERGENCE OF NEW HISPANIC DESTINATION CHOICES

In the past 30 years, the US has witnessed a remarkable growth in the Hispanic population, which increased by 37.4 million or 256% from 1980 to 2010. This increase is largely due to the contemporaneous rise in immigration rates from Latin American countries. Historically, Hispanic immigrants have settled in only a handful of gateway states and cities. Collectively, in 1990, California, Texas, New York, Florida, Illinois, and New Jersey contained 78% of the US Hispanic population (Vasquez *et al*., 2008).

Since the 1990s, US Hispanics have increasingly dispersed, moving to new destinations in the South and Midwest that are typically small, rural or suburban, and less dense (Lichter and Johnson, 2006; Liaw and Frey, 2007). Between 1990 and 2000, the Midwest registered the highest rate of Hispanic growth (81%), followed by the South (Vasquez *et al*., 2008). During the same period, the Northeast's share of the overall national Hispanic population went down from 16.8% to 14.9%, whereas in the West, it declined from 45.2% to 43.5% (Guzman and McConnell, 2002). Although the majority of the Hispanic population in the US still resides in traditional destinations, Hispanic migration and settlement patterns are rapidly evolving.

Previous studies have defined new destinations at many different levels of geography (Kandel and Cromartie, 2004; Singer, 2004; Lichter and Johnson, 2009). In this paper, I define Hispanic destinations at the county level using data from the 1990 and 2000 census of population. Following previous literature (Kandel and Cromartie, 2004; Johnson and Lichter, 2008), I classify counties into three categories: (1) high Hispanic growth counties (nonmetropolitan counties with an increase of 150% or more and 1,000 individuals or more in the Hispanic population and metropolitan counties with an increase of 150% or more and 5,000 individuals or more), (2) established Hispanic counties (counties with Hispanic populations of 10% or more in both 1990 and 2000), and (3) other counties that do not meet the preceding criteria. Of the 3,108 counties considered in this paper, which excludes counties in Hawaii and Alaska and those undergoing boundary changes from 1990 to 2000, 186 are defined as high growth, 329 as established, and 2,593 as other.

Figure 1 maps counties by their Hispanic destination type. Established Hispanic counties are predominantly located in the Southwest. High-growth Hispanic counties are largely located in the Midwest and South. Table 1 presents demographic profiles of high-growth, established, and other counties for the year 2000. Compared with established counties, new destinations are more socioeconomically advantaged, more manufacturing based, have larger White and Black populations, and have greater percentages of foreign-born and less-assimilated Hispanics. Recent studies have also found that new

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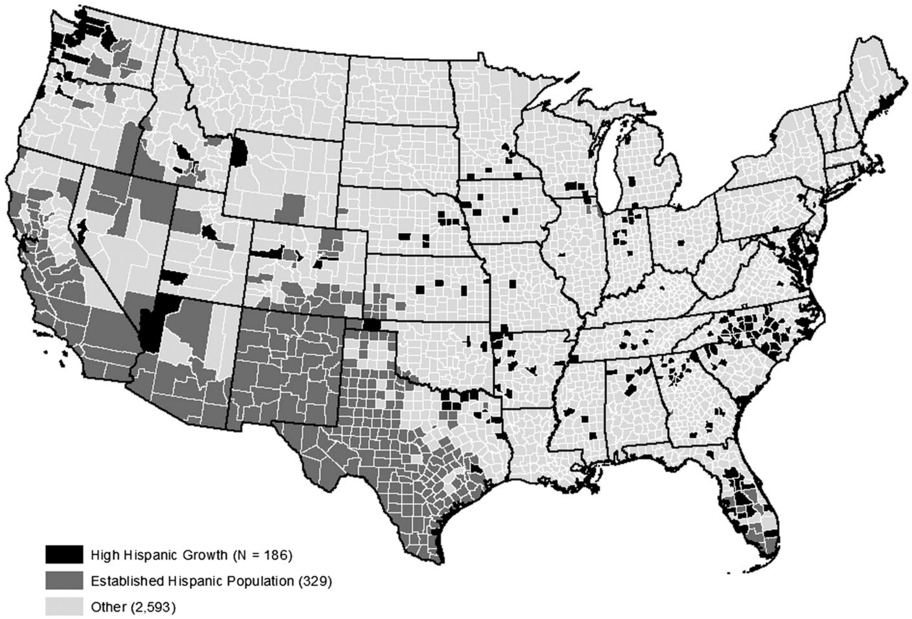

Figure 1. Hispanic population growth in US counties, 1990–2000.

destination areas have high levels of population and economic growth (Massey, 2008); are home to low-wage, low-skill employment opportunities predominantly in manufacturing and agriculture (Kandel and Parrado, 2005; Crowley *et al*., 2006); are more segregated than areas with established Hispanic populations (Lichter *et al*., 2010; Park and Iceland, 2011); and have high levels of fertility (Johnson and Lichter, 2008). Differences in these demographic characteristics, many of which have been linked to White and Hispanic health and mortality outcomes, likely lead to variations in mortality gaps across destination type (Sparks and Sparks 2010). However, while previous studies have established the socioeconomic differences between new and traditional destinations, there has been no comparison of their health and mortality outcomes. The analysis presented here fills this gap in the literature by comparing White and Hispanic mortality rates across destination type.

Ecological Determinants of Mortality Rates and Gaps

There are several reasons why we would find differences in White-Hispanic mortality rates and gaps between high-growth, established, and other counties. This section describes the factors that are commonly linked to aggregate measures of health and mortality, hypothesises the reasons why their influence may differ by destination type, and outlines how these differences may lead to spatial variation in White-Hispanic mortality gaps.

Socioeconomic conditions have been found to be fundamental determinants of aggregate mortality rates and health outcomes (Link and Phelan, 1995). The relationship stems from the presence of health-protective social processes that involve collective aspects of neighbourhood life such as social cohesion and collective efficacy in high socioeconomic areas (Browning and Cagney, 2002; Sampson *et al*., 2002). Furthermore, communities with lower socioeconomic disadvantage have greater health-related resources, such as hospital beds and the quality and quantity of health care (Browning and Cagney, 2002; Singh, 2003; Yang *et al*., 2015). However, the positive association between socioeconomic conditions and health reduces or disappears when comparing Hispanics with Whites. Hispanic enclaves, which are generally poor, present examples of community contexts where concentrated disadvantage is frequently not accompanied by other social pathologies because of the offsetting buffering effects of high levels of group cohesion (Ostir *et al*., 2003). The characteristics of Hispanic enclaves, and thus the strength and reach of their buffering effects, likely vary across destination type given

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Table 1. Mean characteristics of high-growth, established Hispanic, and other counties, 2000.

	High-growth	Established	Other	Est.-HG†
Hispanic mortality rate (1999–2004)	439.56	791.17	605.01	351.61***
White mortality rate (1999–2004)	876.47	855.61	880.19	−20.86
White-Hispanic mortality gap (1999–2004)	436.91	64.44	275.17	−372.47***
% Hispanic	8	35	3	27***
% Non-Hispanic Black	12	5	9	−7***
% Non-Hispanic White	77	56	84	−21***
% Employed in manufacturing	28	16	24	−12***
% of residents living in urban tract	59	57	49	−2
Hospital beds per 1,000 population	3.23	3.23	3.72	0
% without health insurance	15	21	13	6***
Social affluence index	0.54	0.08	0.27	−0.45***
% 25+ with bachelors degree	20	17	18	−3**
Log household median income	10.56	10.42	10.51	−0.14***
% employed in professional position	7	6	6	−1**
Concentrated disadvantage index	−0.18	0.60	−0.10	0.77***
% Female-headed households with children	9	9	9	0
% With public assistance	3	4	3	1***
% Poverty	12	18	13	6***
% Unemployed	5	7	6	2***
Social capital index	−0.51	−0.67	−0.10	−0.16
% of Hispanics who are foreign-born and lived in the US for less than 10 years	38	12	18	−26***
% of Hispanics who are foreign-born and lived in the US for 10+ years	17	15	12	−2*
% of Hispanics of Mexican origin	71	68	57	−3
% of Hispanics living in a different US county 5 years ago	27	15	30	−12***
Hispanic assimilation index	−1.07	−0.02	0.13	1.04***
% of Hispanics with owner-occupied homes	39	60	50	21***
% of Hispanics that speak only English at home	20	24	42	4***
Number of counties	186	327	1,539	

The social capital index is a composite of the number of associations per 10,000 population, the number of non-profit organisations per 10,000 population, 2000 census mail response rate, and the voting rate for the 2004 presidential election.
†Difference between high-growth (HG) and established (Est.) values with a two-tail *t*-test of differences.
***$p < 0.001$;
**$p < 0.01$;
*$p < 0.05$.

the differences in size, nativity, and socioeconomic characteristics of the resident Hispanic population.

Researchers have also consistently found associations between local employment structure and health outcomes (Diez-Roux *et al.*, 1997; Armstrong *et al.*, 1998; Singh, 2003). Certain employment structures are connected to socioeconomic deprivation and therefore to lower health outcomes through many of the same pathways connecting concentrated disadvantage and health well-being. In particular, a larger proportion of the workforce employed in manufacturing, construction, and other non-professional occupations is associated with poorer health outcomes through such mechanisms as exposure to greater occupational health hazards and low access to community economic resources (Armstrong *et al.*, 1998). Many scholars cite the growth of manufacturing plants in the Midwest and South as a major pull factor for Hispanic immigration into non-traditional gateways (Kandel and Parrado, 2005; Vasquez *et al.*, 2008). Therefore, Hispanics residing in new destinations should have poorer health outcomes relative to Hispanics residing in other areas not only because they are more likely to be working in low-wage positions that have high occupational health hazards, but they also have less access to health-related resources in their communities.

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Previous studies have also found a strong relationship between local healthcare resources and mortality (Yang *et al.*, 2015). Many Hispanic newcomers require Spanish-speaking doctors, demand greater childbirth-related care owing to higher levels of fertility, often lack health insurance, and forgo or lack access to routine health care (Crowley and Lichter, 2009). Therefore, a rapid influx of Hispanics, particularly into new destinations, will put pressure on local health-related resources, such as emergency rooms, community clinics, and medical staff, which affects both Hispanics and native Whites.

Geographic differences in phenomena directly linked to the observed health advantage of Hispanics may lead to geographic variations in mortality gaps. For example, researchers have found that health advantages apply only to Hispanics of certain origins, specifically Hispanics of Mexican descent (Riosmena *et al.*, 2014). In contrast, Puerto Ricans, who largely reside in the Northeast, and Cubans, who are concentrated in Florida, have been shown to have minimal health advantages over native Whites. Studies have found differences even amongst Mexicans, with those who are foreign born and residing outside of California and Texas exhibiting better health outcomes (Palloni and Arias, 2004).

Studies have also found that high-density Hispanic communities have greater Hispanic health advantages relative to other areas (Eschbach *et al.*, 2004; Ostir *et al.*, 2003; Osypuk *et al.*, 2009). Researchers hypothesise that these communities preserve cultural factors, such as beliefs concerning diet, exercise, and familism, that contribute to better health outcomes (Eschbach *et al.*, 2004). However, scholars also hypothesise that these health-protective factors soften with greater assimilation to the dominant culture (Markides and Eschbach, 2011). This erosion will depend on time spent in the US (within one generation) and generational status, both of which vary by region (Abraido-Lanza *et al.*, 2005; Lara *et al.*, 2005).

Although a positive association between mortality and duration of residence may reveal the detrimental effects of assimilation, it may also indicate migrant health selection. According to this hypothesis, the Hispanic migrant population is healthier than the population at origin and native Hispanics and Whites (Sorlie *et al.*, 1993). Therefore, areas with a larger proportion of recent Hispanic immigrants, which varies significantly within and between destination types, will display lower Hispanic mortality rates. The specific phenomenon – assimilation or health selection – explaining the observed health advantages of recent immigrants remains a point of contention in the literature.

Recent literature has also suggested another potential source of healthy migrant selection: the internal migration of more socioeconomically advantaged Hispanics (Lichter and Johnson, 2009; Kritz *et al.*, 2013). Internal out-migrants tend to have higher educational levels than their non-mobile counterparts and move for both economic and social support reasons (Kritz *et al.*, 2011). Therefore, these migrants are highly selected by their skill set and motivations for moving, allowing them to relocate to areas with greater economic opportunities, community support, and health-related resources. Lichter and Johnson (2009) find that nearly half of the inmigrants – mostly foreign-born – in new destinations originated from traditional gateways. In this case, if healthy international *and* internal migrant effects exist, new destinations have the benefit of receiving highly selected foreign-born Hispanics from traditional gateways. However, this effect depends on the length of time residents spend in those traditional destinations. Immigrants may have assimilated in a traditional destination context and then relocated to a new destination context. If Hispanic assimilation leads to poor outcomes, new destinations absorb a population with poorer health. Additionally, migration itself and its displacement from former community ties might deteriorate health through physical and psychological stress (Larson *et al.*, 2004).

DATA AND METHODS

In the first set of analyses, I examine geographic variation in Hispanic and White all-cause mortality rates, and the gaps between these two groups by Hispanic destination type between 1999 and 2010. US mortality data come from restricted compressed mortality files from the Centers for Disease Control and Prevention through the National Center for Health Statistics' vital statistics system. I standardised mortality rates, which are defined as the total number of deaths per 100,000 population, using the 2000 US age population structure, and averaged them across

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multiple years in order to adjust for annual fluctuations. The White-Hispanic mortality gap is defined as the age-adjusted White mortality rate minus the age-adjusted Hispanic mortality rate. A larger positive value, whereby the Hispanic mortality rate is lower than the White mortality rate, indicates a larger Hispanic mortality advantage.

Scholars have hypothesised that artefacts in vital statistics data, specifically the misclassification of Hispanic origin on death certificates and the misreporting of age, may lead to the appearance of a Hispanic mortality advantage (Palloni and Arias, 2004).[1] In the case of ethnic misidentification, bias is introduced owing to the incongruence of Hispanic origin identification in the numerator (deaths), which is identified by someone other than the decedent, and the denominator (total population), which is mainly self-identified, of mortality rates. In the case of age misreporting, bias is introduced owing to the overstatement of age typically in the older ages. I minimise these data problems using the adjustments described by Arias (2010).

The second set of analyses examines differences in the county-level ecological correlates of Hispanic and White mortality rates and their gaps by Hispanic destination. I use the 5-year (1999–2004) county-level all-cause mortality rates for Whites and Hispanics, and the White-Hispanic mortality gap as the dependent variables in the analysis. The independent variables, which are described in the following section, are the socioeconomic and demographic characteristics previously linked to Hispanic and White mortality. Data for these variables come from the 2000 decennial census unless otherwise specified. For this analysis, I limit the analytic sample to the 2,052 US counties with at least 100 Hispanic residents in 2000, and for which there was ethnically disaggregated data on foreign-born entry into the US.[2]

Measures

Studies typically operationalise socioeconomic conditions as local employment structure and levels of concentrated disadvantage and social affluence (Wen *et al*., 2003). In this study, social affluence is composed of the following variables: log of household median income, percentage of the population age 25 years or older with a bachelor's degree or higher, and the percentage of the population employed in professional, administrative, and managerial positions. Concentrated disadvantage includes the following variables: the percent of female-headed households with children, the percent of persons receiving public assistance, the percent of individuals earning an income below the poverty line, and the unemployment rate. Variables are combined into single indices using factor analysis after a varimax rotation. My measure of employment opportunity structure is the percent of the county's civilian work force employed in manufacturing.

I include the following three Hispanic-specific characteristics, which have been previously linked to Hispanic mortality: Hispanic assimilation, which is measured as an index that combines the percent of the Hispanic population that speaks only English at home and the percent of the Hispanic population that owns a home, the percent of Hispanics that are foreign born by duration of residence in the US (e.g. less than 10 years and 10 years or more), and the percent of Hispanics of Mexican origin. I also include the percent of Hispanics that lived in another US county 5 years ago to capture internal migration.

I measure local healthcare infrastructure using the following variables: the percent of the population aged less than 65 years without health insurance and total number of hospital beds per 1,000 population. Data for these variables are obtained from the 2007 Area Resources File (ARF, 2007). Lastly, I control for percent non-Hispanic Black, social capital, and urbanicity, variables strongly linked to White and overall mortality rates in the US (Browning and Cagney, 2002; McLaughlin *et al*., 2007; Yang *et al*., 2011). Urbanicity is defined as the percent of county residents living in an urban census tract. Following Yang *et al*. (2015), I operationalise social capital using the index constructed by Rupasingha *et al*. (2006), which combines the following four variables: the number of associations per 10,000 population, the number of non-profit organisations per 10,000 population, 2000 census mail response rate, and the voting rate for the 2004 presidential election.[3]

Method

Previous studies have found that mortality rates are not distributed randomly across counties but typically cluster (Yang *et al*., 2015). Spatial autocorrelation violates the independence assumption

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for regular regression procedures. I formally test for spatial autocorrelation in the residuals by using Moran's *I*, a statistic that tests against a null hypothesis of spatial randomness (Cliff and Ord, 1981). Moran's *I* takes on values of 0.34 (p value ≤ 0.001), 0.07 (p value ≤ 0.001), and 0.07 (p value ≤ 0.001) for White, Hispanic, and the gap between White and Hispanic mortality rates, respectively. The positive and significant *I* values indicate that counties in close spatial proximity share similar patterns of White-Hispanic mortality rates and differentials relative to more distant counties.

In order to account for the spatial autocorrelation observed in the residuals, I run simultaneous autoregressive error models. Formally, the regression equation takes on the following form:

$$Y = \beta X + \lambda W \mu + \varepsilon, \tag{1}$$

where λ is the spatial autoregressive coefficient, μ is the spatially dependent error term, and W is an n × n matrix of spatial weights representing a measure of connection between each county i and j, which in this case is based on first-order queen adjacency. The model represents the usual ordinary least-squares regression model but complemented by a term ($\lambda W \mu$) that represents the spatial structure in the spatially dependent error term.

In order to examine the differences in β by Hispanic destination type, I run equation 1 using a spatial regime specification. Spatial regime regressions allow the model coefficients to vary between discrete spatial subsets of the data (Anselin, 1990). The underlying assumption is that relationships between covariates and the dependent variable vary by regime. The regimes in this case are counties categorised as high-growth Hispanic, established Hispanic, or other. The spatial regime approach is analogous to a fully interacted model – each of the independent variables is interacted with the indicator variable that designates the different regimes.

The main assumption underlying a spatial regime analysis is that the variance of residuals is equal across the regimes. An examination of the residuals by regime shows that this assumption is not met. In order to control for this heteroskedasticity, I weight each county by the variance of residuals within their respective classification type.

RESULTS

Spatial Variation in the Hispanic Mortality Advantage

In this section, I examine differences in White and Hispanic mortality rates and their gaps by

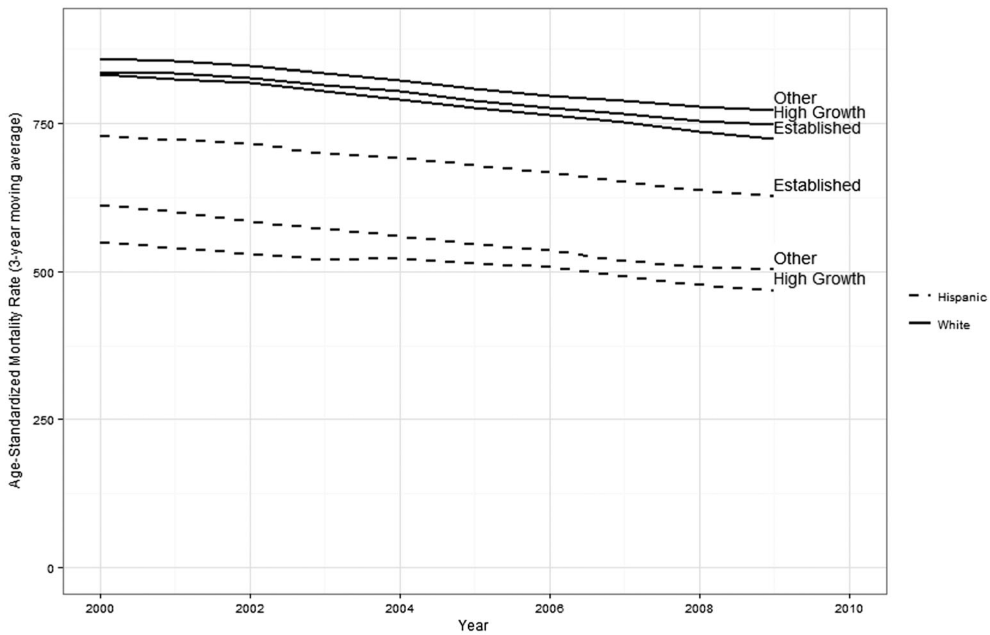

Figure 2. Age-adjusted 3-year moving average all-cause White and Hispanic mortality rates (per 100,000) by high-growth, established, and other, 1999–2010. Rates are calculated by dividing the total number of deaths by the total population in each destination type and multiplying by 100,000.

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Hispanic destination type. Figure 2 graphs the age-adjusted 3-year moving averages of the all-cause White and Hispanic mortality rates for high-growth, established, and other counties from 1999 to 2010. The graph shows that White mortality rates are similar across the three destination types. However, Whites in established Hispanic counties have slightly lower rates (723.65 in 2010) compared with Whites in high-growth (749.17) and other (772.71) counties, and this gap slightly increases over time. We see greater differences in Hispanic mortality rates. While the Hispanic mortality rates in high-growth (467.94 in 2010) and other (502.92) counties are relatively close, the gap between these counties and established counties is quite large and remains so throughout the period. For example, the gaps between established and high-growth counties in 1999 and 2010 are 178.95 and 157.97, respectively.

Figure 3 graphs the White-Hispanic mortality gaps for the three destination types. We find that Hispanics carry a mortality advantage in all areas. However, the advantage is considerably lower in established counties. While the mortality gap hovers around 100 for established counties, the gap is larger by an order of magnitude of two to three in high-growth and other counties in most years. High-growth counties carry the greatest advantage for Hispanics throughout the period. For example, the gaps in high-growth counties in 1999 and 2010 are 288.33 and 281.23, respectively. In contrast, the gaps in those years are 104.75 and 97.74 in established destinations and 245.49 and 269.79 in other counties.

In summary, although Hispanics have considerably lower mortality rates than Whites in all destination types, the advantage in established counties is much smaller. Figure 2 reveals that the smaller advantage in established counties is not driven by lower-than-average White mortality rates, but considerably higher Hispanic mortality rates. High-growth counties have the lowest Hispanic mortality rates and slightly higher White mortality rates. As a result, the large White-Hispanic mortality gap in high-growth counties is a function of Hispanic health advantages *and*, to a lesser degree, White health disadvantages.

Spatial Regime Regression Results

Results from the spatial regime analysis for White mortality rates are reported in Table 2. I find evidence of structural variation for both the model fit and the separate correlates of mortality. The

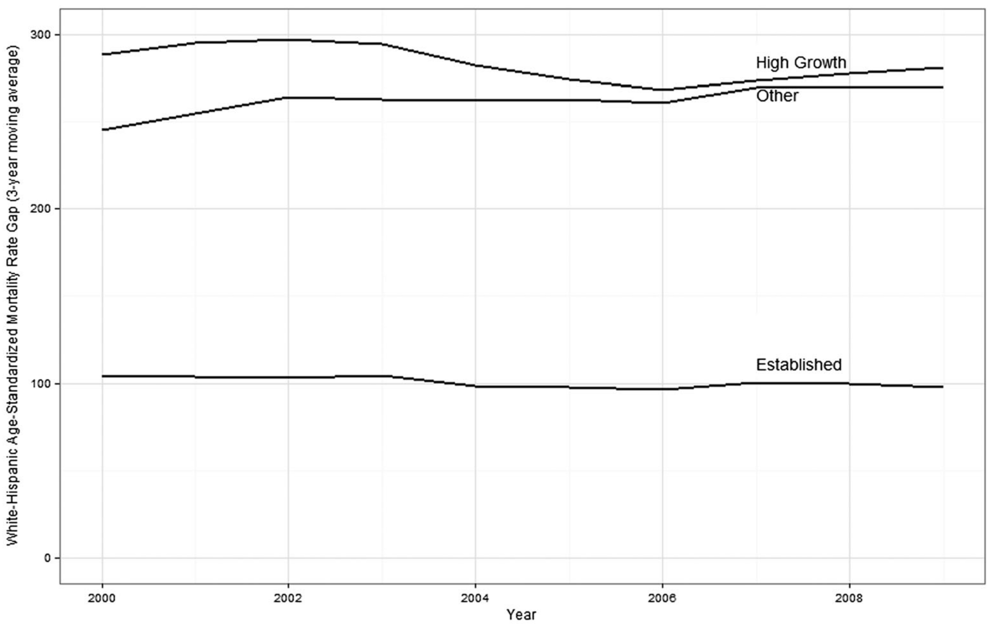

Figure 3. White-Hispanic mortality gap (3-year moving average) by high-growth, established, and other, 1999–2010. Larger values indicate a greater Hispanic mortality advantage.

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Table 2. Regression coefficients from the spatial autoregressive regime analysis, White age-adjusted mortality rates, 1999–2004.

	High-growth	Established	Other	Stability of individual coefficients†
Social affluence	−35.98*** (8.73)	−54.13*** (8.65)	−48.07*** (3.35)	2.62
Concentrated disadvantage	46.00*** (12.79)	19.64* (8.46)	14.80*** (3.71)	6.06*
% Employed in manufacturing	161.90* (80.58)	21.73 (121.33)	70.83* (33.87)	1.29
% Foreign-born Hispanic – US residence < 10 years	23.56 (88.35)	122.08 (115.49)	97.15*** (22.62)	0.71
% Foreign-born Hispanic – US residence 10+ years	−46.22 (107.85)	98.82 (120.52)	52.23 (31.25)	1.02
% Hispanic Mexican	25.26 (39.67)	−12.31 (39.49)	−34.88* (13.89)	2.46
% Hispanic internal migrant	−49.00 (63.96)	343.30*** (81.91)	−26.95 (16.49)	19.49***
Hispanic assimilation	19.39 (12.83)	19.76 (11.95)	16.81*** (2.91)	0.10
Hospital beds per 1,000 population	1.30 (2.11)	1.86 (1.24)	2.00*** (0.43)	0.12
% without health insurance	−1.89 (2.45)	−3.24 (2.29)	2.50** (0.97)	7.59*
Social capital	−33.27*** (6.42)	11.35 (7.08)	−27.68*** (2.17)	28.62***
% Non-Hispanic Black	−60.83 (63.57)	184.76 (121.67)	10.84 (22.48)	3.35
% Urban	17.93 (33.12)	125.85*** (24.82)	61.02*** (8.99)	8.34*
Intercept	876.63*** (66.70)	776.22*** (65.07)	803.00*** (20.95)	0.49
Spatial error parameter (λ)	0.10*** (0.004)			
Chow test across regimes	97.59***			
Log likelihood	−11,673.77			
N	186	327	1,539	

Standard errors are in parentheses.
†Spatial chow test, distributed as χ^2 with 2 degrees of freedom, of difference in individual correlates between the three regimes.
***$p < 0.001$;
**$p < 0.01$;
*$p < 0.05$.

spatial chow test, an omnibus test of the stability of the regression coefficients across the regimes (Anselin, 1990), rejects the null hypothesis that the coefficients are the same in all regimes. Results for the individual chow tests shown in the last column also yield evidence of structural instability. I find similar results in all subsequent models.

In other counties, I find statistically significant effects in the expected direction for most factors. For example, higher levels of social capital and social affluence are associated with lower White mortality rates. Concentrated disadvantage and social affluence remain statistically significant and in the expected directions in high-growth and established counties. This finding shows that socioeconomic conditions have effects on White mortality rates regardless of Hispanic destination type; however, the effects appear to be much stronger in high-growth counties. For example, the effect of concentrated disadvantage is more than twice as large in high-growth areas as in established and other counties. Although high-growth and other counties contain equally large White populations, the ecological factors associated with White mortality rates vary between the two areas. For example, health insurance coverage and urbanicity are correlated with White mortality rates in other counties but not in high-growth areas.

Turning to the results for Hispanic mortality rates presented in Table 3, I find differences between destination types. The only significant factor in high-growth counties is the percent of Hispanics that immigrated to the US within the past 10 years, which is negatively associated with mortality. For established counties, I find an effect of percent foreign-born regardless of duration of residence; however, more recent Hispanic immigrants have a much larger effect. I also find that

Table 3. Regression coefficients from the spatial autoregressive regime analysis, Hispanic age-adjusted mortality rates, 1999–2004.

	High-growth	Established	Other	Stability of individual coefficients†
Social affluence	−41.27 (21.99)	−31.52** (11.25)	−30.30 (23.09)	0.19
Concentrated disadvantage	−47.61 (32.55)	−25.71* (11.50)	−1.84 (25.76)	1.41
% Employed in manufacturing	−357.72 (223.55)	279.91 (164.67)	217.48 (231.91)	6.08*
% Foreign-born Hispanic – US residence < 10 years	−433.51* (215.96)	−1045.65*** (150.73)	−319.89 (165.37)	12.44**
% Foreign-born Hispanic – US residence 10+ years	94.68 (277.94)	−369.55* (162.73)	−335.19 (230.43)	2.31
% Hispanic Mexican	93.99 (99.66)	−27.80 (47.51)	−21.56 (86.69)	1.35
% Hispanic internal migrant	−161.67 (163.64)	−240.57* (116.94)	−302.49* (121.65)	0.53
Hispanic assimilation	6.82 (33.00)	20.30 (15.86)	15.05 (21.17)	2.11
Hospital beds per 1,000 population	−9.29 (5.49)	1.45 (1.80)	2.81 (3.29)	4.12
% without health insurance	−8.31 (6.28)	5.76 (3.04)	11.37 (6.47)	6.14*
Social capital	0.63 (16.41)	12.24 (9.83)	37.52* (15.43)	3.46
% Non-Hispanic Black	−1.06 (160.44)	153.50 (162.65)	−440.34** (144.86)	9.40**
% Urban	97.93 (85.39)	58.08 (35.90)	71.67 (66.31)	0.20
Intercept	787.46*** (169.34)	833.21*** (89.18)	604.91*** (141.83)	2.10
Spatial error parameter (λ)	0.03*** (0.01)			
Chow test across regimes	81.46***			
Log likelihood	−15,040.78			
N	186	327	1,539	

Standard errors are in parentheses.
†Spatial chow test, distributed as χ^2 with 2 degrees of freedom, of difference in individual correlates between the three regimes.
***$p < 0.001$;
**$p < 0.01$;
*$p < 0.05$.

Hispanic internal migration is associated with lower mortality levels in established destinations, although the effect is not significantly different from high-growth and other counties. Lastly, I find that while socioeconomic conditions play a prominent role in increasing White mortality rates in all areas, they only have an effect on Hispanic mortality rates in established counties. However, the socioeconomic effects in these counties are beneficial: both social affluence and concentrated disadvantage decrease mortality.

Table 4 shows regression results using the gap between White and Hispanic mortality rates as the dependent variable. A positive regression coefficient means that a one-unit increase in the independent variable results in a β increase in the White-Hispanic mortality gap, which means a greater Hispanic mortality advantage. I obtain four main findings from this analysis. First, I find that the factors significantly associated with mortality gaps vary by destination type. The only factor associated with gaps across all counties is the percent of Hispanics that are recent immigrants. In this case, counties of any destination type with a larger percent of recent Hispanic immigrants have a greater Hispanic mortality advantage,

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Table 4. Regression coefficients from the spatial autoregressive regime analysis, White-Hispanic mortality gap, 1999–2004.

	High-growth	Established	Other	Stability of individual coefficients†
Social affluence	18.06 (24.12)	−26.41* (13.02)	−19.77 (23.10)	2.81
Concentrated disadvantage	111.37** (35.69)	41.96** (13.29)	15.38 (25.77)	5.24*
% Employed in manufacturing	570.48* (245.30)	−213.28 (190.32)	−163.76 (231.98)	7.76*
% Foreign-born Hispanic – US residence < 10 years	526.79* (247.74)	891.91*** (174.41)	412.74* (165.09)	4.28
% Foreign-born Hispanic – US residence 10+ years	−137.19 (304.63)	619.20*** (188.04)	400.37 (229.99)	4.67*
% Hispanic Mexican	−65.89 (109.32)	92.78 (55.11)	−3.21 (86.95)	2.18
% Hispanic internal migrant	194.49 (179.41)	614.05*** (134.89)	291.12* (121.40)	4.71*
Hispanic assimilation	−16.29 (36.18)	−25.61 (18.34)	2.04 (21.14)	0.76
Hospital beds per 1,000 population	11.45 (6.01)	−0.08 (2.07)	−0.90 (3.28)	3.77
% without health insurance	5.02 (6.88)	−10.87** (3.51)	−8.80 (6.48)	4.49
Social capital	−42.99* (17.99)	5.42 (11.35)	−70.91*** (15.41)	18.58***
% Non-Hispanic Black	−58.23 (175.98)	200.42 (188.19)	471.39*** (145.19)	6.24*
% Urban	−92.46 (93.60)	76.25 (41.39)	−5.10 (66.18)	3.30
Intercept	46.50 (185.74)	−88.82 (103.02)	184.86 (141.90)	0.27
Spatial error parameter (λ)	0.03*** (0.01)			
Chow test across regimes	98.97***			
Log likelihood	−15,098.93			
N	186	327	1,539	

Standard errors are in parentheses. The dependent variable is the age-adjusted White mortality rate minus the age-adjusted Hispanic mortality rate.
†Spatial chow test, distributed as χ^2 with 2 degrees of freedom, of difference in individual correlates between the three regimes.
***$p < 0.001$;
**$p < 0.01$;
*$p < 0.05$.

providing evidence for a healthy migrant effect. Second, factors associated with White mortality, particularly measures of socioeconomic disadvantage, are driving gaps in high-growth counties. In these counties, higher levels of concentrated disadvantage and percent employed in manufacturing increase the Hispanic mortality advantage, while greater social capital decreases the gap. Tables 2 and 3 show that these three factors influence White mortality but have no association with Hispanic mortality.

Third, I find no association between Hispanic assimilation and the percent of Hispanics of Mexican origin with Hispanic mortality advantages. Lastly, socioeconomic conditions, the characteristics of the Hispanic resident population, and local healthcare coverage affect gaps in established destinations. In the case of concentrated disadvantage and social affluence, which are associated with gaps in high-growth counties through their influence on White mortality rates, they affect gaps in established counties by influencing both White and Hispanic mortality. For percent Hispanic foreign-born, gaps are positively associated regardless of duration of residence; however, recently arrived immigrants have a much larger effect. Also of note is the positive association between Hispanic internal migration and mortality gaps in established and other counties, which lends support for the presence of a healthy internal migrant effect.

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DISCUSSION AND CONCLUSION

Studies of the Hispanic health paradox have mainly been conducted at the national level or in regions with large Hispanic populations. Previous research on Hispanic health has ignored the growing presence of Hispanics in non-traditional destinations and how this changing geographic distribution affects conclusions about the Hispanic paradox. Comparing all-cause age-adjusted mortality rates from 1999 to 2010, I find that there are differences in White and Hispanic mortality rates and their gaps between high-growth, established Hispanic, and other counties. As a consequence of slightly smaller White mortality rates but much larger Hispanic mortality rates, the Hispanic mortality advantage in established counties is much smaller relative to high-growth and other counties.

The study also examines spatial variation in the effects of ecological factors on mortality rates and gaps. From these regression analyses, I uncover several key findings. I find that not only mortality rates and gaps differ by destination type but also their associated structural determinants. For high-growth counties, concentrated disadvantage, the percent employed in manufacturing, and social capital are primary factors driving larger gaps. While these variables affect White mortality rates, they have no significant effects on Hispanic mortality. This finding underscores the need to examine the characteristics that influence White health outcomes, particularly in high-growth areas, when attempting to understand the possible mechanisms underlying the Hispanic paradox. The percent of recent Hispanic immigrants is also associated with significantly larger gaps in high-growth areas. In fact, the percent of recent Hispanic immigrants is the only significant predictor across all destination types. This result may indicate a compositional effect such that recent immigrants are healthier than their native and earlier arriving counterparts. Alternatively, the result may indicate a contextual effect such that, for example, the presence of recent immigrants provides protection of cultural norms and additional community support. Note that this association is significant after controlling for the independent influence of Hispanic assimilation.

While mortality gaps in high-growth counties are associated with the residential duration of foreign-born Hispanics and the socioeconomic conditions affecting White mortality rates, I find that gaps in established counties are driven by a wider set of phenomena. For example, although socioeconomic conditions also increase Hispanic mortality advantages in established counties, they do so by not only affecting White mortality rates but also influencing Hispanic mortality rates. In the case of Hispanic immigration, not only is recent Hispanic immigration positively associated with mortality gaps in established counties but also earlier immigration. More compellingly, gaps are also positively associated with the percent of Hispanics that have recently relocated from another US county. Similar to the positive effect of international immigration, the effect of internal migration may provide evidence of a compositional effect in the form of healthy internal migrant selection or a contextual effect such that, for example, internal Hispanic migrants bring health-protective resources to their new communities.

I also find that social capital decreases gaps in other counties, which are areas that are similar to high-growth counties in that they are predominantly White, through its beneficial effects on White mortality rates. Conversely, in established counties, where Whites make up approximately half of the population, social capital has no effect. In this case, these areas may not have the critical mass of White residents that is required to activate the beneficial effects of social capital. Note that the study's measure of social capital is White specific; Hispanic-specific social capital likely pertains to other forms of social relations and connectivity not captured by voting rates and participation in community associations.

Also of note are the non-significant effects of Hispanic assimilation and the percent of Hispanics of Mexican origin. The null effects could signify the variables' overall lack of explanatory power, which corroborates findings from previous studies (Lara *et al.*, 2005). However, non-significance could also indicate that there may not be enough variation in Hispanic origin and assimilation between counties within destination type to explain mortality gaps; the useful variation may instead occur between destinations. Furthermore, the absence of an effect of Hispanic assimilation may also indicate that it was poorly measured. Studies often use demographic variables or English use as markers for acculturation,

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without considering the broader, multi-dimensional concept of immigrant adaptation. Additionally, duration of residence may be capturing elements of assimilation not measured by language proficiency and homeownership. Therefore, assimilation may have an effect, but it was absorbed by other variables in the model.

Although I believe the results of this study make an important contribution to the current body of work on Hispanic health outcomes and new Hispanic destinations, it is not without its limitations. First, results may change by analysing mortality outcomes at different spatial scales. Specifically, we cannot generalise results at the individual level, a problem known as the ecological fallacy (Freedman, 1999), or at different aggregate levels, a problem identified as the modifiable areal unit problem (Openshaw, 1984). Second, the study is cross-sectional and observational and thus cannot make strong claims of causality. Lastly, the current study does not formally examine the impact of return migration owing to limitations in the available data. If older sick Hispanics return to their country of origin after temporary employment, retirement, or becoming seriously ill (Abraido-Lanza *et al.*, 1999), then less healthy members are culled from the population. Because foreign deaths are not tabulated in US mortality statistics, Hispanic mortality rates will be artificially low. Turra and Elo (2008) empirically examine the influence of this phenomenon, known as the salmon-bias effect, on the Hispanic mortality advantage and find that its effects are too small to account for the advantage. However, they do find negative health selection for migrants returning back to the US, offsetting the small impact of return migrant selection. Given these findings, the salmon-bias effect impacts the current study's results if we expect return and reentry migrant selection to be stronger in certain destination types. Examining the health characteristics of return and reentry migrants by Hispanic destination is an avenue for future study.

The findings of this study raise other questions for future research. The study examines all-cause mortality rates but not other dimensions of health and mortality. Previous studies have found variations in the direction and size of the Hispanic health advantage by specific cause of mortality, health-specific outcome, and individual characteristics (Markides and Eschbach, 2005; Markides and Eschbach, 2011). The current study only scratches the surface of the potential Hispanic health research that can be conducted in new destinations. Further investigations into other health outcomes in high-growth areas are needed as the Hispanic population continues to increase and its migration patterns rapidly evolve.

The study finds that a greater proportion of recent Hispanic immigrants is strongly associated with larger mortality gaps, which provides evidence for a healthy international migrant effect. More compellingly, the study also finds that a greater proportion of Hispanic internal migrants leads to lower Hispanic mortality rates and larger mortality gaps, particularly in established and other areas. Previous studies have found that Hispanic internal migrants are more socioeconomically advantaged relative to non-movers. To the extent that established destinations and other counties receive these more advantaged Hispanics, the internal migrants into these areas may also have better health outcomes. The non-significant association between internal migration and Hispanic mortality in high-growth counties suggests no or weaker selection effects in these areas. A deeper analysis examining the health characteristics of incoming, outgoing, and non-mobile Hispanic populations by destination type is required to verify these speculations.

Lastly, most of the focus in the Hispanic paradox literature has primarily been on understanding how Hispanic health advantages drive the mortality gap. The results from the current study's analysis indicate that more attention should be paid to understanding the sources of White health disadvantages, particularly in new Hispanic destinations, and their impact on the Hispanic paradox. The results point to socioeconomic disadvantage as a primary driver of high White mortality rates; however, other factors may be mediating this pathway. For example, Fenelon (2013) attributes high smoking prevalence in the South as a factor driving the aggregate divergence in White-specific and overall mortality between southern states and the rest of the country. Obesity may be another piece to this puzzle, given that the impact of widespread obesity has been larger in southern states (Wang and Beydoun, 2007). More research examining the mechanisms driving poor White health outcomes and their contributions to the White-Hispanic mortality gap is required.

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In sum, this study reveals the need to consider spatial variation in Hispanic health advantages given the increasing geographic dispersion of the Hispanic population. Relatedly, the study also points to the importance of considering spatial variation in the factors associated with these advantages. Investigating the determinants of the Hispanic paradox in previously unexamined areas and comparing results with those found in traditionally studied regions present an opportunity for the further testing of current hypotheses and the uncovering of new explanatory factors. For example, this study finds evidence of a healthy immigrant selection effect not just in traditional destinations but also in all destination types, thus broadening the explanatory scope of this factor. Moreover, the study reveals the importance of White health disadvantages in high-growth Hispanic areas and the positive health selection of internal Hispanic migrants, explanatory factors that would not have come to light without the benefit of studying non-traditional Hispanic destinations. Studying Hispanic health outcomes in new destinations is critical not only because such regions have become important areas of Hispanic research owing to their burgeoning Hispanic populations but also because the contrast of these destinations to communities with large, established Hispanic populations presents an opportunity for developing better empirical and theoretical understandings of the mechanisms underlying Hispanic health advantages in the US.

NOTES

(1) Another common data artefact, the mismatching of records, occurs when matching vital statistics to survey records, which does not apply in the current analysis.
(2) I also estimated models using 500, 1,000, and 2,500 population minimum. Although the models yield the same substantive results, I report the findings only for the 100 minimum because it yields a significantly larger sample of counties.
(3) An evaluation of variance inflation factor (VIF) values yields no evidence of significant multicollinearity (i.e. VIF $\geq$ 10) amongst the independent variables.

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