The Hispanic Health Paradox: Does the Barrio Advantage Exist Outside of Urban Enclaves?

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Abstract

Although Hispanics have rates of poverty similar to African Americans, their health is more comparable to that of wealthier non-Hispanic whites. This Hispanic Health Paradox has been well documented in highly urbanized cities like Chicago and Los Angeles where researchers have additionally found that Hispanics living in highly segregated co-ethnic enclaves exhibit even better health than their counterparts in more integrated areas. Previous studies have attributed this *barrio* effect to higher levels of social cohesion and more social ties. This study examined the Hispanic Health Paradox and, more specifically, the *barrio* advantage as it pertains to rural areas in the Southwest where neighborhood dynamics, such as levels of social cohesion and number of social ties, operate distinctly from inner-city communities. After looking at the health of elderly Mexican-Americans in both large cities and small rural villages in Colorado, Arizona, Texas, California and New Mexico, I found that there is no *barrio* advantage in rural communities even though levels of social cohesion are higher there than in urban neighborhoods. These results show that when speaking about the *barrio* advantage, it is important to acknowledge that it is simply an urban phenomenon and that social cohesion does not explain its effect. As the population of Hispanics burgeons, and is becoming increasingly segregated, in rural areas of the Southeast and Midwest, the future of the Hispanic Health Paradox is at stake.

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Introduction

Health disparities among different socio-economic classes are a well-studied reality. Social conditions such as access to resources and socio-economic status, are considered the "fundamental cause of disease" (Link & Phelan, 1995). This association between social position and wealth has continuously been proven to hold true across different geographies and with different diseases (Adler & Newman, 2002; Braveman, Egerter, & Williams, 2011; Chang & Lauderdale, 2009; West, Blacksher, Burke, & M, 2017). Among these examples, however, there is an exception: Hispanics have three times the poverty rate of non-Hispanic Whites, yet they fare equally, or better, than non-Hispanic Whites in different health outcomes, including infant-mortality, cardiovascular disease, and all-cause mortality (Markides & Coreil, 1986; DeNavas-Walt & Bernadette, 2015). This anomaly is often referred to as the Hispanic Health Paradox.

This paradox is well documented, and researchers have found that within its scope lies another curious abnormality: Hispanics living in neighborhoods with a high percentage of Hispanics have been shown to have better health outcomes despite the high levels of poverty observed in those neighborhoods (Cagney, Browning, & Wallace, 2007; Eschbach, Ostir, Patel, Markides, & Goodwin, 2004). This suggests that residing among co-ethnics promotes a health advantage for Hispanics. This positive "barrio advantage" is perplexing since most segregated communities of other ethnicities, such as African Americans, are not equally protective of health and can, in fact, be predictive of worse health (Cutler & Glaeser, 1997; Ellen, 2000; Subramanian, Acevedo-Garcia, & Osypuk, 2005). Little research has been devoted to further understanding the sources of the "barrio effect" and why a health advantage would exist in these segregated neighborhoods. In addition, since the bulk of the studies on this epidemiological paradox are from densely populated urban areas, there is scant evidence that the barrio advantage exists outside of the urban core (Cagney et al., 2007; Lee & Ferraro, 2007). The explanations for the barrio effect are mostly related to strong social networks and neighborhood cohesion, both factors that operate differently in rural areas where access to resources, spatial density and demographic make-up can be vastly different than metropolises (Almeida, Kawachi, Molnar, & Subramanian, 2009; Eschbach et al., 2004).

This research project will contribute to an understanding of the mechanisms of the "barrio effect" by examining whether it is observed in rural areas, not simply in inner-city enclaves, while also analyzing differences in neighborhood level characteristics like social cohesion and social networks, both of which are suggested explanations for the barrio effect (Cagney & Browning, 2004; Markides & Coreil, 1986; Ostir, Eschbach, Markides, & Goodwin, 2003; Palloni & Arias, 2004). The questions I aim to answer include: are *all* neighborhoods with high percentages of Mexican Americans similarly conducive to better health, or is the barrio effect mostly or simply an urban phenomenon? If it is simply an urban phenomenon, then what is it about urban enclaves that makes people healthier? Also, are social cohesion and social network mechanisms operating in this barrio effect? Through this analysis I hope to discover if the barrio effect is observed across all community types and also engage in a conversation about what is so powerful about living among co-ethnics that might outweigh the poor health commonly observed in impoverished communities. This research will attempt to answer these questions by looking at Mexican-American enclaves in the rural and urban Southwest using multivariate regression techniques on data from the Hispanic Established Population for the Epidemiological Study of the Elderly (H-EPESE). The findings will reveal if patterns of disease prevalence might differ between urban and rural communities of increasing proportion Mexican-American.

Background Information and Literature Review

The explanations for the Hispanic Health Paradox, and more specifically the paradox in the context of neighborhood composition, are multifaceted and not yet clear. First of all, migration is a key part of the phenomenon and different studies show different (dis)advantages depending on generational status. One study that looked at residential segregation in Chicago found that co-ethnic neighborhoods led to better health among second and third generation Mexican Americans than among first generation Mexican Americans (Lee & Ferraro, 2007). Meanwhile, a study in Los Angeles found that second generation Latinos living in census tracts with above average levels of Latinos, were more likely to engage in health-risk behaviors than their counterparts in census tracts with below average levels of Latino co-ethnics (Frank, Cerdá, & Rendón, 2007). Another study on the prevalence of asthma in Chicago found a barrio advantage among the foreign-born Latino population and prevalence of asthma (Cagney et al., 2007). However, what does seem to be clear, is that this barrio advantage has only been observed in Mexican-American Hispanics and to some extent Central and South American immigrants (Escarce, Morales, & Rumbaut, 2006; Lee & Ferraro, 2007; Palloni & Arias, 2004). Puerto Ricans, the second largest Hispanic group in the US (Humes, Jones & Ramirez, 2011; Motel & Patten, 2012) have been found to actually have more health problems when living in segregated communities (Lee & Ferraro, 2007). However, Puerto Ricans are U.S. citizens and experience vastly different migration experiences than Mexicans. Due to their unique migration experience, Puerto Ricans are thought to have weaker social networks, which are essential to the Mexican migration process (Lee & Ferraro, 2007); in addition, Mexican-Americans have not endured the long history of residential segregation that Puerto Ricans have in New York City and Chicago

(Almeida, Kawachi, Molnar, & Subramanian, 2009; Lee & Ferraro, 2007; Massey, 1981; Winters, De Janvry, & Sadoulet, 1998).

The fact that Puerto Ricans have higher mortality rates than Mexican-Americans, and the fact that Mexican-Americans have to engage in often dangerous and life-threatening immigration processes, has led to the development of the "healthy migrant hypothesis" as an explanation of this epidemiological paradox (Franzini, Ribble, & Keddie, 2001; Palloni & Arias, 2004). The healthy migrant hypothesis stems from the idea that only the healthiest and strongest people migrate, thereby creating a false sense of positive health in that immigrant community compared to the populations they live amongst (Franzini et al., 2001). There is some evidence to support this hypothesis. The foreign-born population in the US exhibits better health than the US-born population, and recent migrants fare better than migrants who have been in the US for more than 10 years (Stephen, Foote, Hendershot, & Schoenborn, 1994). There is also evidence of self-selection among migrants where pre-migration positive health measures and behaviors have been found to be correlated with emigration specifically in the case of self-rated health, hypertension, height and smoking (Riosmena, Kuhn, & Jochem, 2017; Riosmena, Wong, & Palloni, 2013). In addition, the better health outcomes of US-born Latinos compared to US-born Whites could be a result of healthy migrants passing on their genetic and lifestyle advantages (Abraido-Lanza et al., 1999; Franzini et al., 2001). However, foreign born Latinos do have significantly lower rates of mortality than foreign-born Whites (Abraido-Lanza et al., 1999). Nonetheless, this thesis will not focus on mortality but instead on morbidity and disability. Researchers have found lower rates of morbidity among elderly Mexican-Americans, while it is unclear what effect being Mexican-American has on becoming disabled later in life (Hayward, Hummer, Chiu, González-González, & Wong, 2014; Nam, Al Snih, & Markides, 2015; Zhang, Hayward, & Lu, 2012).

Questions about data reliability have resulted in the emergence of another hypothesis in the research on the Hispanic Health Paradox: the salmon bias hypothesis. This hypothesis is based on the notion that Hispanics tend to return to their country of birth when they retire, become older and/or seriously ill (Franzini et al., 2001). Thus, mortality statistics can be based off of a seemingly "immortal" group of Hispanics who may no longer be living, but have died in a country other than the US. It is true that return Mexican migration is a very common occurrence. Some estimates have found the rate to be as high as 56.2 percent for foreign born Mexicans (Jasso & Rosenzweig, 1982). Moreover, a study conducted in a Mexican sending community where 75% of families include a migrant who has gone north, found that 75% of those migrants engaged in return migration (Reichert & Massey, 1979). Yet, Abraido-Lanza et al. (1999) tested this hypothesis by looking at mortality rates for Hispanics that are either more restricted in participating in return migration (Cubans) or whose deaths are recorded under US mortality statistics (Puerto Ricans). Their assumption was that if the salmon bias were true, then mortality rates would only be lower among groups for which the salmon effect is plausible, thus, not for Cubans and Puerto Ricans. However, they found that Cubans and Puerto Ricans exhibited lower mortality rates than non-Hispanic Whites. In addition, they presumed that US-born Latinos, including Mexican-Americans, would not go back to a country that they were not born in, and found that they too had lower mortality rates than Non-Hispanic Whites. Another study, that focused solely on Mexican-Americans, used compatible data from the US and Mexico and found that the salmon bias existed, but only in the case of disability and not in other health aspects (Bostean, 2013). These and other studies that have aimed to verify the plausibility of the salmon bias have shown that it is important to take into account, but its effect is minimal and it is more a claim of statistical distortion than a consequential explanation of the epidemiological paradox (Riosmena et al., 2013; Turra & Elo, 2008).

If neither the salmon bias nor the healthy migrant hypothesis can explain the whole story of the Hispanic Health Paradox, then other factors must be at play; it is among these factors where neighborhoods become important. Differences in psychosocial factors are a more plausible explanation for the Hispanic Health Paradox and these differences can be more pronounced in co-ethnic neighborhoods. There is evidence that Hispanics, especially the foreign born, have stronger and larger social networks and that neighborhoods with higher percentages of Hispanics exhibit higher social cohesion or collective efficacy, both neighborhood level indicators of positive health (Cagney & Browning, 2004; Cagney et al., 2007; Deindl, Brandt, & Hank, 2016; Massey & Espinosa, 1997). In addition, lower levels of acculturation have been associated with certain healthy behaviors for Hispanics, and lower levels of acculturation can often be contingent on higher neighborhood percentage co-ethnicity (Franzini et al., 2001).

Acculturation measures the level of assimilation to, and exposure of, US society that an immigrant has had (Anderson, Wood, & Sherbourne, 1997; Hazuda, Haffner, Stern, & Eifler, 1988; Riosmena & Jochem, 2012). The language a person uses more frequently and their level of English are common in most acculturation scales, yet feelings towards traditional gender roles and preserving Mexican culture, as well as having friends and coworkers who were Non-Hispanic Whites are also elements of these scales (Eschbach, Ostir, Patel, Markides, & Goodwin, 2004; Hazuda et al., 1988). Hispanics have mixed risk factor profiles in that they have higher rates of diabetes and are less likely to engage in recreational exercise, but are less likely to smoke and more likely to receive pre-natal care (Franzini et al., 2001). Lower prevalence of some of these risk factors can be correlated with lower levels of acculturation and positive health outcomes like having a higher fiber diet, less low-birthweight pregnancies, higher childhood immunization levels, and lower rates of cigarette smoking in women (Anderson et al., 1997; Balcazar, Castro, & Krull, 1995; Collins & Shay, 1994). However, there is pushback in using acculturation in health research. Critics claim that acculturation is a form of cultural stereotyping and is based on "linear assimilation models" that do not take into account reciprocal interactions between immigrants and their environment and the cultural diversity of Latinos, while also ignoring the role that poverty and social determinants have on health (Abraído-Lanza, Armbrister, Flórez, & Aguirre, 2006; Creighton, Goldman, Pebley, & Chung, 2012; Zambrana & Carter-Pokras, 2010). Nonetheless there is strong evidence that maintaining cultural traditions, especially related to diet, seem to promote some of the health behaviors that protect Hispanics from developing chronic diseases especially in later life stages. With lower levels of acculturation being observed in neighborhoods with higher proportions of co-ethnics in Hispanic communities and in immigrant communities all over the world, it is possible that a key to the barrio advantage is its ability to stave off acculturation (Berry, Phinney, Sam, & Vedder, 2006; Logan, Zhang, & Alba, 2002).

Although segregated and deprived neighborhoods can delay acculturation, they are often viewed negatively. Shaw and McKay's (1942) social disorganization theory suggests that the disorder typically found in places of concentrated poverty leads to an erosion of "positive social resources and processes" resulting in higher rates of crime, delinquency, mistrust and fear among residents (Almeida et al., 2009; Ross & Jang, 2000; Sampson and Groves, 1989) However, it has been shown that not all segregation deprives residents of material and social resources, and, in fact, some argue that social ties and organization are characteristic of disadvantaged areas precisely because of their need for additional support (Forrest & Kearns, 2001; Lee & Ferraro, 2007; Ostir, Eschbach, Markides, & Goodwin, 2003). This “social needs perspective” of higher levels of collective efficacy and social cohesion in disadvantaged neighborhoods can offer a clue as to why Mexican-Americans seem to have a stronger health advantage in co-ethnic enclaves.

Collective efficacy is defined as “social cohesion among neighbors combined with their willingness to intervene on behalf of the common good” (Sampson, Raudenbush, & Earls, 1997). Thus, it encompasses several measures of the social context. A study on asthma in Chicago neighborhoods with a high percentage of foreign born residents measured collective efficacy by combining measures on social cohesion and informal social control (Cagney, Browning & Wallace, 2007). Social cohesion was determined by asking the respondents questions on how well people in the neighborhood got along, if neighbors could be trusted, and how willing they were to lend each other a hand. Informal social control, which refers generally to the “capacity of a group to regulate its members according to desired principles—to realize collective, as opposed to forced, goals” (Sampson et al., 1997), was measured by asking respondents questions about how much they could depend on their neighbors to watch out for their kids, intervene if a fight broke out, or bring them groceries if they got sick. The answers indicate how effective residents are at maintaining order in their neighborhoods without external influences such as the police. A study mentioned earlier that looked at neighborhood effects of Latino youth in Los Angeles found that despite the fact that high rates of Latino concentration in a neighborhood predicted higher rates of delinquency in second and third generation youth, higher levels of collective efficacy significantly lowered the odds of delinquency for all ethnic groups (White, Black, Hispanic, Asian) but even more so for third generation Latinos (Frank et al., 2007).

Social interaction and social support, or networks, are other mechanisms that operate at the neighborhood level. In the study by Cagney et al. (2007), social interaction was measured by asking respondents questions with more concrete and quantitative responses such as how often neighbors got together, how often neighbors visited each other in the street and in each other's homes, how often neighbors asked each other for advice, and how often neighbors did favors for each other. In this study, social interaction had more of a protective effect than collective efficacy did for foreign-born Latinos, yet higher levels of neighborhood collective efficacy predicted lower rates of asthma in the overall population (Cagney et al., 2007).

All of these findings serve to demonstrate that the extent and influence of social networks are essential in research about immigrant life and neighborhoods. Ethnic enclaves can provide resources to residents by increasing interaction between the co-ethnics of the enclave (Lee & Ferraro, 2007). Resources can be shared between families such as occupation, health or housing referrals, as well as within families by pooling financial resources. It has been shown that in larger ethnic populations, resources are more readily available, which can partially explain why Mexican Americans (pop. ~ 32 million) rather than Puerto Ricans (pop. 5 million) could have better health outcomes in co-ethnic barrios (Humes, Jones and Ramirez, 2011; Franzini & Spears, 2003). Social networks and support in the Latino context can refer to family support and has evidence of positively affecting Latino health outcomes (Keefe, Padilla, & Carlos, 1979; Mulvaney-Day, Alegría, & Sribney, 2007). Social support has been found to significantly improve Mexican American mortality risk in men but not in women (Hill, Uchino, Eckhardt, & Angel, 2016). Social support has also been shown to predict lower levels of stress in Latinos, a principal cause of disease, as well as acculturation stressors like discrimination and legal status (Finch & Vega, 2003). Favorable birth outcomes in Mexican-born women in the US have also been attributed to social networks and support that create a type of informal prenatal care system (McGlade, Saha, & Dahlstrom, 2004). A study of different neighborhoods in Texas City, Texas found that those who lived in high Hispanic composition neighborhoods showed fewer depressive symptoms and social support was shown to mediate this relationship (Shell, Peek, & Eschbach, 2013).

Nonetheless, there is doubt that levels of social cohesion are actually greater and stronger in Mexican American neighborhoods, and that they even influence self-rated physical health (Almeida et al., 2009; Mulvaney-Day et al., 2007). There is also a lack of knowledge about the health effects of social cohesion and social ties in rural neighborhoods, which raises doubts about the prevalence of the barrio advantage in rural communities. The majority of the studies on the neighborhood effects on health and this epidemiological paradox have been conducted in large, metropolitan cities, leaving rural areas less well-studied. In Chicago there is a large Hispanic population and the “Project on Human Development in Chicago Neighborhoods Community Survey” (PHDCN-CS) is a dataset used by several researchers studying neighborhood effects on health in that city (Cagney, Browning & Wallace, 2007; Lee & Ferraro, 2007). Los Angeles has a very large population of mostly Mexican American Hispanics and a data set used for health and neighborhood information in the county is called the “Los Angeles Family and Neighborhood Survey” (LAFANS) (Frank et al., 2007). Studies have also been done at a national level as well as in (mostly) urban areas using census data and national registries (Eschbach, Mahnken, & Goodwin, 2005; Huie, Hummer, & Rogers, 2002). Therefore, there is a lack of evidence that the barrio effect benefits Hispanic health in rural areas, or in areas where there are not large populations of Hispanics but where Hispanic enclaves could exist.

The Southwestern United States also has a very large Hispanic, (primarily Mexican American) population and the Hispanic Established Population for the Epidemiological Study of the Elderly (H-EPESE) is a data set that holds information on a sample of Mexican Americans over 65 living in Texas, California, Arizona, Colorado, and New Mexico (Eschbach et al., 2004; Ostir et al., 2003). This is the data set that will be used for this research project, for while it encompasses data on several metropolitan areas, including some of the biggest in the US like Los Angeles, Dallas and Houston, it also holds important data on rural Hispanic communities.

The few studies that have looked at neighborhoods and health in rural areas have found different results. Although there is not a consistent rural-urban health gradient for all health outcomes, rural areas tend to be more disadvantaged than suburban and urban areas (Eberhardt & Pamuk, 2004). In addition, there is some evidence that Shaw and McKay's (1942) theory of social disorganization exists in rural areas and operates similarly where rates of residential instability, ethnic heterogeneity and family disruption predict higher rates of crime (Osgood & Chambers, 2000). This finding can support the assumption that neighborhood levels of social cohesion, ties and collective efficacy are, in fact, important indicators of health and well-being in rural areas like they are in urban ones. However, the role that those indicators play is still unclear. One study in Native American rural communities found that collective efficacy is not as important of a predictor of crime in rural areas as it is in urban ones (the concept of collective efficacy comes from the study of criminology) (Abril, 2013; Sampson et al., 1997). Other studies have found that residents of rural border towns called *colonias*, that often lack basic amenities like plumbing and electricity and have low levels of social cohesion, are more likely to have poorer physical health, more alcohol dependence and engage in binge drinking, yet have similar rates of mental health compared to the general US population (Mier et al., 2008; Spence & Wallisch, 2007). Meanwhile, levels of collective efficacy in other communities on the US-Mexico border have resulted in mixed effects: for women and older men it predicts less binge drinking while for younger men, it predicts higher rates of binge drinking (Spence & Wallisch, 2007; Vaeth, Caetano, & Mills, 2015). Abril (2013) recommends measuring collective efficacy differently than it is traditionally assessed in urban areas by accounting for differences in rural culture (e.g. accounting for more homogenous racial demographics, more agriculturally dependent lifestyles, and, diverging ways of reporting crime) In doing so, this will help researchers and policy makers discover the unique ways that collective efficacy presents itself in rural communities.

While neighborhood effects in rural Hispanic communities is understudied, it is a potentially important factor in the Hispanic Health Paradox. The number of rural counties with more than 50% Hispanic population is rising in traditionally high percentage Hispanic states in the Southwest (Colorado, California, New Mexico, Texas and Arizona) and even more so in new rural destinations in the Southeast and Midwest (Effland & Kassel, 1996; Lichter, Parisi, Taquino, & Grice, 2010). In fact, Latino population growth in the 1990's was higher in non-metropolitan areas (67%) than in metropolitan areas (57%) (Brown & Swanson, 2003). In addition, Hispanics in these new destinations are even more segregated than they are in their traditional longstanding communities in the Southwest (Lichter et al., 2010). Understanding the barrio advantage in rural Hispanic communities is, thus, essential to understanding the future of health and Hispanics.

Data and Methods

The data for this project comes from the Hispanic Established Population for the Epidemiological Study of the Elderly (H-EPESE), a longitudinal study of Mexican Americans conducted in 5 Southwestern states over a period of almost 20 years. The study was done in eight waves, beginning with a wave of interviews in 1993/1994. The last wave was completed in 2012/2013 and data is currently being collected for a 9th wave. The subjects for the survey were selected using a multistage area probability cluster sample. The first stage consisted of ranking the counties in Colorado, Texas, New Mexico, Arizona and California with the highest number of elderly (65 years or older) Mexican American residents, then selecting those that added up to 90% of the Elderly Mexican American population in the US. If a county fell below that cutoff but it's population was more than 60% elderly Mexican Americans, it was added to the selection. Census tracts within those counties were selected using the same method, yet only the census tracts above the cutoff were used, and of those census tracts, 300 were selected with probabilities proportional to the number of elderly Mexican Americans. Census blocks and their respective households were then randomly selected from those tracts. (Markides, 1994). For this thesis project, only data from the fifth wave was used since it introduced a second cohort of respondents with higher levels of education than the previous cohort. This new sample expanded the range of density of Mexican-Americans per tract because it was assumed that those with higher levels of education were likely to have moved away from more densely populated Mexican American areas. Wave 5 was also the only wave that included information about social cohesion and social ties (Markides, Ray, Angle & Espino, 2005)

The methods for this thesis project followed those used by Eschbach et al. (2004). However, for this project only one wave of the H-EPESE was used, compared to four used in Eschbach et al.'s paper (2004). Instead of mortality, only morbidity and disability were considered in relation to other predictor variables such as social cohesion and social ties, as well as differences between urban and rural neighborhoods.

Morbidity was determined using a self-reported physician's diagnosis of six medical conditions: stroke, heart attack, hip fracture, cancer, hypertension and diabetes. Disability was analyzed using the respondent's limitations in completing any of seven different activities (bathing, using the toilet, transferring from bed to chair, walking across a small room, personal grooming, dressing, and eating) based on the Katz Activities of Daily Living (ADL) scale (Branch, Katz, Kniepmann, & Papsidero, 1984). Information about age, gender, marital status, highest level of education completed, household income, immigrant status, and language of interview (acculturation) will be taken from the survey and adjusted in the multivariate models (Eschbach et al., 2004).

The principal investigators of the H-EPESE provided census tract information for each respondent. While the interviews for wave 5 were conducted in 2004-2005, the census tracts are geocoded to 2010 tracts. The different community types, Urban Tract or Rural Tract, were determined using Rural Urban Commuting Area codes (RUCA) (Table 1). Census tracts that fall under RUCA codes 1-3 were considered urban; RUCA codes 4-10 were categorized as rural. RUCA codes are based on the Office of Management and Budget's definition of Metropolitan and Metropolitan areas and data collected from the American Community Survey (ACS). They use similar criteria to measure urbanization, population density and daily commuting flows at the county level. However, RUCA codes are based on census tracts instead of counties. They were developed by the University of Washington Rural Health Research Center and the USDA Economic Research Service (ERS). RUCA codes have been used in other studies related to urban and rural health disparities and they have been shown to provide accurate estimates of rural geographies (Hart, Larson, & Lishner, 2005; USDA, 2016; Weeks et al., 2004).

Data from the 2010 US Census Bureau's American Community Survey (ACS) was used to determine the percentage of people in the tract living below the poverty line, and percentage of Mexican Americans per tract.

Table 1. RUCA code classification descriptions. Taken from USDA (2016).

Primary RUCA codes, 2010

Code	Classification description
1	Metropolitan area core: primary flow within an urbanized area (UA)
2	Metropolitan area high commuting: primary flow 30% or more to a UA
3	Metropolitan area low commuting: primary flow 10% to 30% to a UA
4	Micropolitan area core: primary flow within an urban cluster of 10,000 to 49,999 (large UC)
5	Micropolitan high commuting: primary flow 30% or more to a large UC
6	Micropolitan low commuting: primary flow 10% to 30% to a large UC
7	Small town core: primary flow within an urban cluster of 2,500 to 9,999 (small UC)
8	Small town high commuting: primary flow 30% or more to a small UC
9	Small town low commuting: primary flow 10% to 30% to a small UC
10	Rural areas: primary flow to a tract outside a UA or UC
99	Not coded: Census tract has zero population and no rural-urban identifier information

Questions about a respondent's neighborhood were used to create predictor variables of social ties (social networks) and social cohesion. Perceived number of social ties was measured as the sum of the participants' report of the number of family and friends living in their neighborhood. Possible values for the Social Ties Score ranged from 0-6, 0 meaning no social ties and 6 meaning most of the respondent's family and friends live in their neighborhood.

Five questions were used to determine the level of social cohesion in the participants' neighborhood. Each question was measured on a five-point Likert scale that asked respondents to rate their interpretation of the following statements: (1) this is a close-knit neighborhood; (2) people around here are willing to help their neighbors; (3) people in this neighborhood generally don't get along with each other; (4) people in this neighborhood do not share the same values; (5) people in this neighborhood can be trusted. Questions 3 and 4 were reverse coded for ease of interpretation and the range of values was 0–5 where higher scores indicated higher social cohesion. The scores were then summed resulting in a Social Cohesion Score with possible values ranging from 0-25.

The first step in analyzing the data was calculating the percentages of respondents who reported a diagnosis of each of the six medical conditions of interest or a disability. These percentages were stratified by neighborhood percentage of Mexican Americans, RUCA code and then stratified by neighborhood percentage Mexican American within each RUCA classification of either urban or rural. The predictor variable percentage responses were added to these demographic statistic tables. Significance values in these tables were calculated using chi-squared tests and Kruskal-Wallis tests when comparing between means as was the case with tract poverty rates and social cohesion and social ties scores. The next step included running the logistic regression models relating increasing neighborhood percentage Mexican American (scaled 0 to 1) to the prevalence of each condition, with adjustments (Eschbach et al., 2004). A logistic regression model was chosen because the response variable for each disease was binary: 1 indicated the presence of the disease, 0 indicated an absence, NA values were not included. The first model adjusted for age and gender only. The second model included all predictor variables except for the RUCA classification and social ties and cohesion. RUCA classification was added to the 3rd model and an interaction term between RUCA code and Percent Mexican American was added to the fourth model. The fifth model adjusted for the social cohesion and social ties scores as well as the interaction term if it was significant in model 4. Odds ratios were estimated for exposure to the different RUCA code types, census tract percentages of Mexican Americans and all predictor variables. Odd ratios represent the odds of having one of the medical conditions, or disability, given that the respondent was “exposed” to the specific variable (e.g., being married, being foreign born) compared to the odds of not being exposed to that predictor (Szumilas, 2010). All analyses were performed using R (version 3.3.2, R Core Team, 2016).

Results

Demographic Characteristic Tables:

Tables 2, 3 and 4 show demographic statistics about the wave 5 sample. Table 2 is stratified by tract percentage Mexican American. There were significant differences between the neighborhoods in gender (p = 0.01), marital (p = 0.01) and immigration status (p = 0.00), choice of English-language interview (p = 0.00), education (p = 0.00), percent below the poverty line (p = 0.00) and income (p = 0.00). Respondents living in tracts with higher proportions of Mexican-American were more likely to be immigrants, were slightly more likely to be married, were less likely to have been interviewed in English, had lower incomes, fewer years of schooling and were significantly more likely to live in a poorer tract. Heart attack, diabetes and hip fracture were health outcomes with significant differences among neighborhood proportion Mexican-American. Prevalence of heart attack (p = 0.00) and hip fracture (p = 0.01) decreased significantly as percent Mexican American increased while prevalence of diabetes (p = 0.05) showed no clear trend, although the tracts with percent Mexican American between 30-49% and 50-69% had the highest rates (Table 2).

Table 2. Demographic characteristics of H-EPESE Wave 5 respondents by tract percentage Mexican-American. Significance values are from fisher exact and chi-squared tests.

Tract Percentage Mexican-American	0-29	30-49	50-69	70-89	90-100	*P*
Characteristic						
Age, %						
75-84	58.7	73	73.3	73.2	72.3	
85+	41.3	27	26.7	26.8	27.4	0.1234
Female, %	66.7	54.8	59	65.1	58.5	**0.01007**
Married, %	40	47.5	40.5	39.6	49.4	**0.005946**
Immigrant, %	45.3	32	39.2	43.5	57	**2.60E-09**
English language interview, %	29.3	33.2	28.2	17	8.1	**2.20E-16**
Years of schooling, %						
0-6	61.3	68.8	65.1	69.5	84.2	
7-11	25.3	25.3	20.8	17.6	10.1	
≥ 12	13.3	7.9	14.1	13	5.7	**9.99E-10**
Annual household income, %						
<$10,000	37.3	32.8	33.1	41.8	51.6	
≥ $10,000	44	52.3	50.5	44	40.5	
Income not reported	18.7	14.9	16.4	14.2	7.9	**9.84E-07**
Mean tract poverty rate	12.5	19.8	25.6	31.7	37.8	**<2.2e-16**
Social cohesion mean score	11.7	11.3	11.7	11.9	12.1	0.09557
Social ties mean score	2.4	2.6	2.6	2.5	2.6	0.5686
Percentage reporting medical condition						
Stroke	13.7	7.6	9.3	8.2	7.7	0.4709
Cancer	10.7	10.8	7.2	6.7	5.8	0.1023
Hypertension	61.3	63.4	62.6	61.9	59.2	0.8175
Heart Attack	15.1	10.9	11.4	8	5	**0.001823**
Diabetes	31.1	40	36.9	31.5	31.1	**0.04917**
Hip Fracture	12.2	6.3	5.9	3.9	3.7	**0.01469**
Percentage reporting disability	40	28.6	36.8	38.5	37	0.07852
Percentage reporting any condition or disability	84.7	80.1	83.3	83.8	79.8	0.3482
n (unweighted)	75	241	390	957	405	

When divided into Urban and Rural tracts there were fewer significant differences (Table 3). Immigration status was also a significant predictor in this stratification (p = 0.00), with higher rates in urban tracts, and social cohesion became significant with a higher mean in rural tracts (p = 0.00). The only significant difference in health outcome was with hypertension (p = 0.05) and overall contraction of disease or disability (p = 0.03), where rates were higher in urban tracts. Income was marginally significant with those living in rural tracts having higher incomes. Percentages of the tract below the poverty line was also marginally significant with urban tracts being slightly richer than rural ones.

Table 3. Demographic characteristics of H-EPESE Wave 5 respondents by tract RUCA classification (urban or rural). Significance values are from fisher exact and chi-squared tests.

RUCA Classification	Urban	Rural	*P*
Characteristic			
Age, %			
75-84	73	70.2	
85+	26.9	29.8	0.4976
Female, %	62	59	0.3105
Married, %	42.6	42.4	0.9827
Immigrant, %	46.6	32	**6.83E-07**
English language interview, %	19.3	21.6	0.3592
Years of schooling, %			
0-6	70.8	71.6	
7-11	17.6	19.4	
≥ 12	11.6	9	0.302
Annual household income, %			
<$10,000	41.6	37.1	
≥ $10,000	44.3	51.1	
Income not reported	14	11.8	0.06213
Mean tract poverty rate	29.92821	28.19326	0.06814
Social cohesion mean score	11.6	12.8	**7.43E-09**
Social ties mean score	2.6	2.6	0.4152
Percentage reporting medical condition			
Stroke	8.1	9.9	0.3063
Cancer	7.4	6.2	0.4743
Hypertension	62.7	56.8	**0.04612**
Heart Attack	8.8	7.7	0.5541
Diabetes	33.5	32.9	0.8516
Hip Fracture	5	3.7	0.3354
Percentage reporting disability	36.4	38.9	0.4249
Percentage reporting any condition or disability	83.4	78.4	**0.03481**
n (unweighted)	1712	356	

Table 4 shows differences between each strata of percent Mexican-American within urban and rural tracts respectively. Urban tracts were more similar to Table 1, and differences in gender (p = 0.02), marital (p = 0.03) and immigrant status (p = 0.00), English language interview (p= 0.00), years of schooling (p = 0.00), income (p= 0.00), tract poverty (p = 0.00) were all significant. Rate of English language interview, more years of schooling and higher incomes all declined as the percent of Mexican-Americans increased. Poverty rates increased as percent Mexican-American increases in urban tracts. Social ties are highest in the second tier of percent Mexican, but show no clear trend. Differences in heart attack (p = 0.01), diabetes (p = 0.01) and hip fracture (p = 0.03) prevalence were again significant and decreased as percent Mexican-

American increased. In rural tracts, proportion of immigrants, percent who are interviewed in Spanish as well as tract poverty rates all increased as percent Mexican-American increased. Years of schooling were lower in tracts with a higher proportion of Mexican-Americans and rural tracts in the 4th level of percent Mexican-American exhibited the highest levels of social cohesion. However, rural tracts did not exhibit a barrio effect with respect to health outcomes with no significant differences between percent Mexican-American observed for any of the health outcomes.

Table 4. Demographic characteristics of H-EPESE Wave 5 respondents by tract RUCA classification (urban or rural) and tract percentage Mexican-American. Significance values are from fisher exact and chi-squared tests.

RUCA Classification	**Urban Tracts**						**Rural Tracts**					
Tract Percentage Mexican-American	0-29	30-49	50-69	70-89	90-100	*P*	0-29	30-49	50-69	70-89	90-100	*P*
Characteristic												
Age, %												
75-84	63.2	73.3	73.7	73.2	73.8		44.4	72.3	70.5	73.8	68.9	
85+	36.8	26.7	26.3	26.8	26.1	0.5614	55.5	27.7	29.5	26.2	31.1	0.1765
Female, %	68.4	56.8	59.5	65.6	57	**0.0198**	61.1	49.2	54.5	61.9	63.1	0.3906
Married, %	42.1	46.3	41.3	39.8	50	**0.0311**	33.3	50.8	34.1	38.1	47.6	0.2148
Immigrant, %	54.3	40.3	41.3	45.1	58.6	**2.82E-05**	16.7	9.2	22.7	32.5	52.4	**7.23E-08**
English language interview, %	28.1	29.5	27.5	18.1	6	**2.97E-13**	33.3	43.1	34.1	10.3	14.6	**3.38E-07**
Years of schooling, %												
0-6	59.6	72.7	63.3	69	85.4		66.7	50.8	79.5	73	80.6	
7-11	26.3	19.9	21.4	17.8	9.6		22.2	40	15.9	15.9	11.7	
≥ 12	14	7.4	15.3	13.2	5	**3.09E-08**	11.1	9.2	4.5	11.1	7.8	**0.001039**
Annual household income, %												
<$10,000	38.6	33	33.2	43.1	53		33.3	32.3	31.8	33.3	47.6	
≥ $10,000	43.9	49.4	50.3	42.8	38.7		44.4	60	52.3	51.6	45.6	
Income not reported	17.5	17.6	16.5	14.1	8.3	**1.77E-05**	22.2	7.7	15.9	15.1	6.8	0.1239
Mean tract poverty rate	13	19.5	26.2	32	37.8	**< 2.2e-16**	10.9	20.7	20.8	29.4	37.6	**< 2.2e-16**
Social cohesion mean score	11.3	11.3	11.6	11.6	12	0.2004	12.6	11.4	12.5	13.8	12.5	**0.001145**
Social ties mean score	2.3	2.7	2.6	2.5	2.5	0.05726	2.7	2.4	2.5	2.6	2.8	0.3232
Percentage reporting medical condition												
Stroke	10.7	7.5	8.4	7.9	8.3	0.9219	23.5	7.9	15.9	10.4	5.8	0.1033
Cancer	10.5	10.9	7.6	6.9	6.3	0.3003	11.1	10.8	4.5	5.6	3.9	0.3317
Hypertension	68.4	63	63.4	62.2	61.8	0.8992	38.9	64.6	55.8	60.2	51.5	0.2183
Heart Attack	16.1	9.7	12	8.3	5	**0.008113**	11.8	14.3	6.8	6.5	4.9	0.2195
Diabetes	33.3	43.2	37.6	30.8	30.8	**0.008686**	23.5	31.3	31.8	36	32	0.8515
Hip Fracture	12.5	6.3	6.3	4.2	3.7	**0.03091**	11.1	6.2	2.3	1.6	3.9	0.2235
Percentage reporting disability	42.1	22.2	37.1	38.4	37.1	**0.001362**	33.3	46.2	34.1	38.9	36.9	0.6851
Percentage reporting any condition or disability	89.3	77.6	84.4	84.3	81.9	0.1564	68.8	86.9	74.4	80.8	73.8	0.2315
n (unweighted)	57	176	346	831	302		18	65	44	126	103	

Logistic Regression Models:

Cancer

Table 5 shows the results of the logistic regression models and the resulting odds ratios of neighborhood percentage Mexican American on cancer. In model 1, the only significant predictor variable was percent Mexican American with an advantage of 0.36 (CI: 0.16, 0.82, p = 0.0137). After adjusting for all other demographic characteristics analyzed, the protective effect of percent Mexican American weakened to 0.42 and became only marginally significant (CI: 0.16, 1.13, p = 0.0814). Model 3 adjusted for differences in urban and rural tract, which were not significant, nor did that term significantly affect the advantage of percent Mexican American. There was no significant interaction between Urban/Rural tract and percent Mexican American (Model 4, Table 5). Adjusting for social cohesion and social ties in model 5 rendered all coefficients not significant.

Table 5. Odds ratios and 95% confidence intervals (CIs) for prevalence of cancer as a function of RUCA classification and increasing tract percentage Mexican American and covariates. Ratios, CI's and significance values are from logistic regression models.

Variable	Model 1 Odds Ratios (95% CI)	*P*	Model 2 Odds Ratios (95% CI)	*P*	Model 3 Odds Ratios (95% CI)	*P*	Model 4 Odds Ratios (95% CI)	*P*	Model 5 Odds Ratios (95% CI)	*P*
Neighborhood Percent Mexican American (0-1)	0.36 (0.16, 0.82)	**0.0137**	0.42 (0.16, 1.13)	0.0814	0.41 (0.16, 1.11)	0.0764	0.28 (0.04, 2.06)	0.19968	0.38 (0.11, 1.37)	0.1322
Age (vs. 74-84)										
85+	1.07 (0.74, 1.54)	0.7035	1.13 (0.77, 1.64)	0.523	1.14 (0.77, 1.65)	0.5057	1.14 (0.77, 1.65)	0.5097	1.34 (0.82, 2.14)	0.2275
Female	0.80 (0.57, 1.13)	0.1996	0.82 (0.57, 1.19)	0.2947	0.82 (0.56, 1.18)	0.2822	0.82 (0.57, 1.19)	0.28693	0.96 (0.60, 1.56)	0.8837
Married			0.93 (0.62, 1.37)	0.7017	0.93 90.62, 1.37)	0.7009	0.92 (0.62, 1.37)	0.69524	0.82 (0.50, 1.35)	0.4442
Years of Schooling(vs 0-6 y)										
7-11			1.04 (0.64, 1.63)	0.8794	1.03 (0.64, 1.62)	0.9097	1.03 (0.64, 1.61)	0.91579	0.87 (0.48, 1.51)	0.6234
≥12			1.19 (0.69 1.98)	0.5202	1.16 (0.67, 1.94)	0.584	1.16 (0.67, 1.94)	0.57613	0.95 (0.47, 1.81)	0.8841
Annual Household Income(vs. < 10,000)										
≥ 10,000			1.34 (0.90 2.00)	0.1527	1.35 (0.91, 2.01)	0.1422	1.35 (0.91, 2.02)	0.13852	1.27 (0.78, 2.08)	0.3374
Income not reported			0.66 (0.34, 1.21)	0.2022	0.66 (0.34, 1.21)	0.2008	0.66 (0.34, 1.21)	0.20431	0.36 (0.11, 0.94)	0.0624
Native (vs. immigrant)			1.12 (0.77, 1.64)	0.5669	1.15 (0.79, 1.70)	0.4666	1.14 (0.78, 1.69)	0.48887	1.38 (0.85, 2.26)	0.1988
English-language Interview			1.33 (0.86, 2.03)	0.1838	1.33 (0.86, 2.02)	0.1865	1.33 (0.86, 2.02)	0.18893	1.09 (0.63, 1.85)	0.7483
Neighborhood Percentage Poor (0-1)			1.00 (0.98, 1.02)	0.9472	1.00 (0.98, 1.02)	0.9948	1.00 (0.98, 1.02)	0.98977	0.99 (0.97, 1.01)	0.4793
Urban (vs. rural)					1.34 (0.85, 2.20)	0.2346	0.97 (0.24, 4.52)	0.96492		
Percent Mexican-American Interaction with Urban (vs. rural)							1.61 (0.19, 12.84)	0.65187		
Social Cohesion Score (0-25)									0.97 (0.91, 1.03)	0.3244
Social Ties Score (0-6)									0.94 (0.77, 1.13)	0.5037

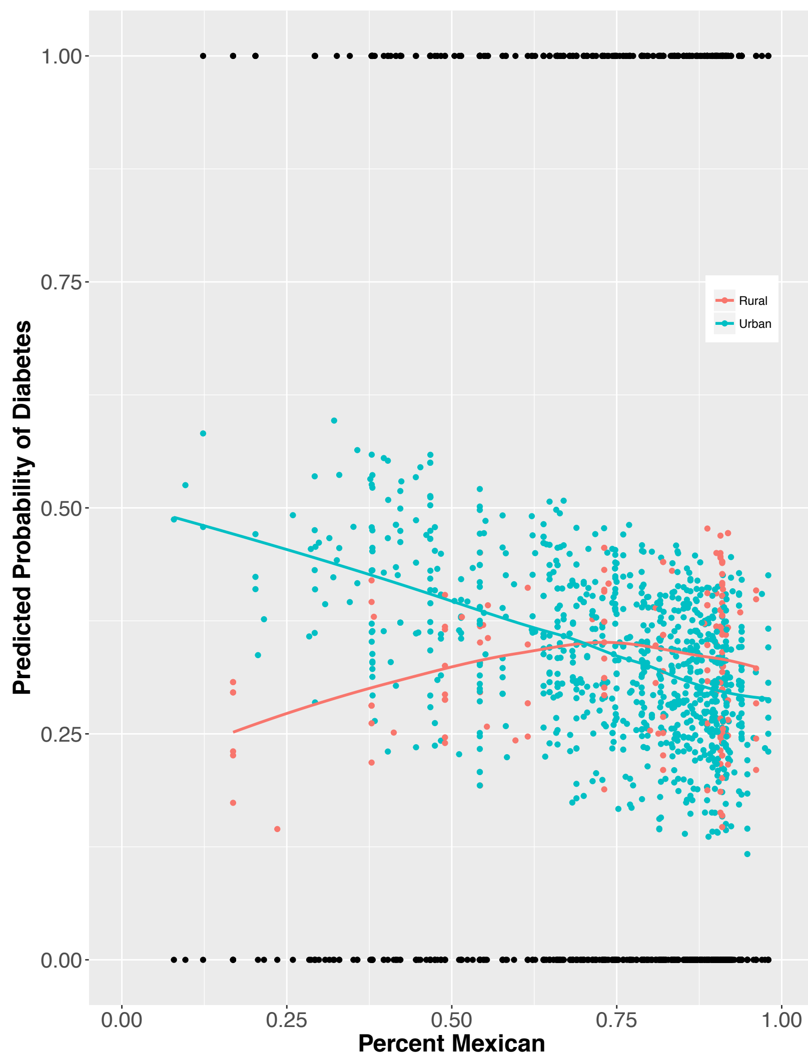
Diabetes

Table 6 shows the results of the logistic regression models and the resulting odds ratios of neighborhood percentage Mexican American on diabetes. In model 1, all three predictors were significant, or marginally significant in the case of gender. Higher percentage Mexican American (OR: 0.51, CI: 0.31,0.82, p = 0.00583) and older age had protective effects (OR: 0.52, CI: 0.41,0.64, p = 5.386E-09) while being female was predictive of diabetes (OR: 1.19, CI: 0.99,1.45, p = 0.07124). In model 2, the predictive effect of female became slightly stronger, as did the protective effect of percent Mexican-American. After adjusting for differences in urban and rural tracts, which were not significant (OR: 1.04, CI: 0.82, 1.34, p = 0.73275), percent Mexican American, age and gender all maintained their same odds ratios. Model 4 incorporates the interaction term which, for diabetes, was significant (OR:0.25, CI: 0.072, 0.83, p = 0.245). Introducing this terms also made neighborhood percent Mexican American lose its significant protective effect (OR:1.42, CI: 0.47, 4.50, p = 0.5406), while urban vs. rural, in this model, was significant with respondents in urban tracts having almost 3 times the odds of having diabetes (OR:2.87, CI: 1.16, 7.36, p = 0.0251). The interaction term shows that in urban places, respondents living in neighborhoods with a higher percentage Mexican have significantly reduced odds of diabetes, but there is no significant effect of percent Mexican-American in rural areas. Figure 1 shows that an increase in percent Mexican-American counteracts the increased odds of diabetes in urban areas while it increases the odds very slightly in rural areas. Model 5 also posits that higher levels of social cohesion are actually predictive of diabetes (OR:1.04, CI: 0.94, 1.16, p = 0.02766).

Table 6. Odds ratios and 95% confidence intervals (CIs) for prevalence of diabetes as a function of RUCA classification and increasing tract percentage Mexican American and covariates. Ratios, CI's and significance values are from logistic regression models.

Variable	Model 1 Odds Ratios (95% CI)	*P*	Model 2 Odds Ratios (95% CI)	*P*	Model 3 Odds Ratios (95% CI)	*P*	Model 4 Odds Ratios (95% CI)	*P*	Model 5 Odds Ratios (95% CI)	*P*
Neighborhood Percent Mexican American (0-1)	0.51 (0.31, 0.82)	**0.00583**	0.47 (0.27, 0.83)	**0.00871**	0.47 (0.27, 0.83)	**0.00875**	1.42 (0.47, 4.50)	0.5406	1.32 (0.35, 5.28)	0.68809
Age (vs. 74-84)										
85+	0.52 (0.41, 0.64)	**5.38E-09**	0.53 (0.42, 0.67)	**3.03E-08**	0.53 (0.42, 0.66)	**3.16E-08**	0.53 (0.42, 0.66)	**3.35E-08**	0.55 (0.41, 0.74)	**7.88E-05**
Female	1.19 (0.99, 1.45)	**0.07124**	1.26 (1.02, 1.55)	**0.03222**	1.26 (1.02, 1.55)	**0.03287**	1.25 (1.01, 1.54)	**0.0385**	1.51 (1.16, 1.97)	**0.00201**
Married			1.03 (0.83, 1.28)	0.77121	1.03 (0.83, 1.28)	0.77603	1.03 (0.83, 1.28)	0.7735	1.08 (0.82, 1.41)	0.59579
Years of Schooling (vs 0-6 y)										
7-11			0.82 (0.63, 1.07)	0.15224	0.82 (0.63, 1.07)	0.15004	0.83 (0.63, 1.08)	0.1656	0.75 (0.54, 1.04)	0.08355
≥12			0.89 (0.65, 1.21)	0.44443	0.88 (0.64, 1.20)	0.43373	0.87 (0.64, 1.19)	0.3921	0.84 (0.57, 1.22)	0.36013
Annual Household Income (vs. < 10,000)										
≥10,000			1.21 (0.97, 1.51)	0.09322	1.21 (0.97, 1.51)	0.09085	1.20 (0.96, 1.50)	0.1016	1.22 (0.93, 1.61)	0.15116
Income not reported			0.95 (0.70, 1.29)	0.74992	0.95 (0.70, 1.29)	0.74703	0.94 (0.69, 1.28)	0.6958	1.03 (0.68, 1.56)	0.88417
Native (vs. immigrant)			1.11 (0.91, 1.36)	0.31575	1.12 (0.91, 1.37)	0.29964	1.14 (0.93, 1.40)	0.2241	1.04 (0.78, 1.35)	0.78108
English-language Interview			0.98 (0.75, 1.26)	0.85246	0.98 (0.75, 1.26)	0.8514	0.98 (0.76, 1.27)	0.8957	1.11 (0.81, 1.51)	0.52733
Neighborhood Percentage Poor (0-1)			1.00 (0.99, 1.01)	0.53646	1.00 (0.99, 1.01)	0.54766	1.00 (0.99, 1.01)	0.5774	1.00 0.99, 1.01)	0.8238
Urban (vs. rural)					1.04 (0.82, 1.34)	0.73275	2.87 (1.16, 7.36)	**0.0251**	2.96 (0.97, 9.49)	0.06136
Percent Mexican-American Interaction with										
Urban (vs. rural)							0.25 (0.072, 0.83)	**0.0245**	0.27 (0.06, 1.15)	0.07946
Social Cohesion Score (0-25)									1.04 (1.00, 1.08)	**0.02766**
Social Ties Score (0-6)									1.04 (0.94, 1.16)	0.43319

Figure 1. The interaction effect of tract percentage Mexican-American and RUCA classification on the predicted probabilities of diabetes using fitted values from model 4, Table 6.



Heart attack

Table 7 shows the results of the logistic regression models and the resulting odds ratios of neighborhood percentage Mexican-American on heart attack. In model 1, all three predictors were significant, or marginally significant in the case of age. Higher percentage Mexican-American (OR: 0.26, CI: 0.12, 0.55 p = 0.000381) and female gender had protective effects (OR: 0.69, CI: 0.50,0.94, p = 017725) while older age was marginally predictive of diabetes (OR: 1.32, CI: 0.94,1.84, p = 0.09763). In model 2, the protective effect of female became slightly stronger, while the protective effect of percent Mexican-American became weaker and less significant. In this model higher neighborhood poverty level was slightly protective (OR: 0.98, CI: 0.97, 1.00 p = 0.028216). In model 3, after adjusting for differences in urban and rural tracts, which were not significant (OR:1.24, CI: 0.82, 1.96, p = 0.325427), percent Mexican-American, age, gender and neighborhood poverty level, all maintained their same odds ratios. Model 4 incorporated the interaction term which is not significant for heart attack (OR: 1.46, CI: 0.21, 9.74, p = 0.6943). Introducing this terms also rendered neighborhood percent Mexican American no longer significant. Model 5 indicates that higher levels of perceived social cohesion were protective of heart attacks (OR: 0.93, CI: 0.87, 0.99, p = 0.02037).

Table 7. Odds ratios and 95% confidence intervals (CIs) for prevalence of heart attack as a function of RUCA classification and increasing tract percentage Mexican American and covariates. Ratios, CI's and significance values are from logistic regression models.

Variable	Model 1 Odds Ratios (95% CI)	P	Model 2 Odds Ratios (95% CI)	P	Model 3 Odds Ratios (95% CI)	P	Model 4 Odds Ratios (95% CI)	P	Model 5 Odds Ratios (95% CI)	P
Neighborhood Percent Mexican American (0-1)	0.26 (0.12, 0.55)	**0.000381**	0.46 (0.19, 1.15)	0.09487	0.46 (0.19, 1.14)	0.087942	0.34 (0.06, 2.06)	0.2299	0.98 (0.30, 3.37)	0.97144
Age (vs. 74-84)										
85+	1.32 (0.94, 1.84)	0.09763	1.34 (0.95, 1.89)	0.091332	1.35 (0.95, 1.89)	0.087116	1.35 (0.95, 1.89)	0.0878	1.41 (0.90, 2.17)	0.12847
Female	0.69 (0.50, 0.94)	**0.017725**	0.68 (0.48, 0.96)	**0.025807**	0.67 (0.48, 0.95)	**0.023936**	0.67 (0.48, 0.95)	**0.0244**	0.52 (0.34, 0.80)	**0.00288**
Married			0.90 (0.62, 1.29)	0.559671	0.89 (0.62, 1.29)	0.548	0.89 (0.62, 1.29)	0.546	0.60 (0.37, 0.94)	**0.0277**
Years of Schooling(vs 0-6 y)										
7-11			1.21 (0.78, 1.85)	0.39066	1.20 (0.77, 1.84)	0.410475	1.20 (0.77, 1.84)	0.414	1.20 (0.71, 1.98)	0.49268
≥12			1.56 (0.95, 2.49)	0.06954	1.53 (0.93, 2.45)	0.081593	1.54 (0.94, 2.46)	0.08	1.07 (0.56, 1.96)	0.82829
Annual Household Income(vs. < 10,000)										
≥ 10,000			1.17 (0.81, 1.72)	0.403909	1.18 (0.81, 1.73)	0.387996	1.18 (0.81, 1.73)	0.3813	1.27 (0.80, 2.04)	0.31549
Income not reported			0.95 (0.56, 1.56)	0.846753	0.95 (0.56, 1.56)	0.846735	0.95 (0.56, 1.56)	0.8528	1.09 (0.53, 2.10)	0.80875
Native (vs. immigrant)			0.95 (0.67, 1.35)	0.778998	0.97 (0.68, 1.39)	0.88331	0.97 (0.68, 1.38)	0.8601	1.20 (0.77, 1.90)	0.43006
English-language Interview			1.01 (0.66, 1.51)	0.981064	1.01 (0.66, 1.51)	0.979636	1.00 (0.66, 1.51)	0.985	1.11 (0.67, 1.82)	0.67565
Neighborhood Percentage Poor (0-1)			0.98 (0.97, 1.00)	**0.028216**	0.98 (0.97, 1.00)	**0.026327**	0.98 (0.97, 1.00)	**0.0269**	0.97 (0.95, 0.99)	**0.00772**
Urban (vs. rural)					1.24 (0.82, 1.96)	0.325427	0.97 (0.27, 3.87)	0.9584	1.30 (0.78, 2.30)	0.33872
Percent Mexican-American Interaction with Urban (vs. rural)							1.46 (0.21, 9.74)	0.6943		
Social Cohesion Score (0-25)									0.93 (0.87, 0.99)	**0.02037**
Social Ties Score (0-6)									1.08 (0.91, 1.28)	0.36595

Not shown are the models run for stroke, hypertension, disability, hip fracture, and disease (the response variable created that represents the contraction of any of the 6 diseases or disability). For stroke, in model 2, having gone through 7-11 years of schooling was protective of stroke compared to going through less than 6 years of schooling (OR: 0.57 CI: 0.35, 0.91, p = 0.0213). Being born in the US was also predictive (OR: 1.45, CI: 1.02, 2.07, p = 0.0371). Adjusting for urban v rural tracts and the interaction term did not result in any changes in odds ratios. In the final model for stroke, social ties showed a slight predictive effect (OR: 1.18, CI: 0.99, 1.40, p = 0.063181).

Hypertension did not seem to respond to percent Mexican-American, yet, adjusting for urban vs. rural tracts resulted in a predictive effect for urban tracts (OR: 1.29, CI: 1.02, 1.64, p = 0.03563). The interaction term was not significant for hypertension nor were the neighborhood level factors, social ties and cohesion, yet after incorporating those into the model, the predictive effect of urban tracts intensified slightly (OR: 1.34, CI: 1.01, 1.78, p = 0.04368).

Percent Mexican-American and rurality did not seem to influence the occurrence of disability. The third model showed that higher levels of education and English language interview were protective of disability (OR: 0.68, CI: 0.49, 0.95, p = 0.0240 and OR: 0.76, CI: 0.59, 1.00, p = 0.0470).

For hip fracture, percent Mexican-American had a significant protective effect in model 1 (OR: 0.25, CI: 0.10, 0.66, p = 0.00429), yet that effect became insignificant after adding in the other demographic characteristics. Older age and female gender were both consistently predictive of hip fracture across all models.

For the all-encompassing disease response variable, percent Mexican-American had no influence yet rurality did. Urban tracts had higher odds ratios than rural ones (OR: 1.40, CI: 1.04, 1.86, $p = 0.02615$). Higher income and female gender were consistently predictive of disease (OR: 1.56, CI: 1.18, 2.06, $p = 0.0016$ and OR: 1.55, CI: 1.20, 2.00, $p = 0.00082$).

Discussion

Seeing that most studies on the Hispanic health paradox did not take into account the geography of the neighborhoods they were studying, I tested the assumption that the barrio advantage exists even in rural areas where the neighborhood context differs from urban areas. To test this, health outcomes were predicted after teasing apart the respondents' census tracts into rural and urban categories. I found that rural neighborhoods do not exhibit a barrio advantage similar to one found in urban census tracts. As percentage Mexican-American increased in rural tracts, it did not produce a significant difference in the prevalence of the seven medical conditions that were analyzed. The prevalence of certain diseases did not differ significantly between urban and rural tracts, except for in the case of hypertension and the overall reporting of any medical condition or disability, both of which are higher in urban areas. However, these differences in disease prevalence between rural and urban tracts lose their significance as tract percentage Mexican American increases. Thus, while the Hispanic Health Paradox is not necessarily absent in rural areas, a *barrio* advantage was not observed in those neighborhood types. In addition, the *barrio* effect in urban areas counteracted the higher prevalence of overall disease observed in those communities compared to rural ones.

This finding was not relevant for all diseases but is most clearly demonstrated by the prevalence of diabetes and the interaction between percent Mexican American and urban versus rural classification. Possible explanations for this particular result can be linked to acculturation, since studies have shown that acculturation is associated with obesity risk, poor dietary choices, and increased consumption of alcohol and sugary drinks (Pérez-Escamilla & Putnik, 2007).

However, further research is needed given that the research on acculturation and diabetes is not consistent. In fact, Latinos that are more acculturated into "European-American culture appear to have less prevalence of type 2 diabetes [and] those who are less acculturated have more pronounced patterns of insulin resistance and dysregulation of glucose metabolism" (Fernandez, 2007; Mainous et al., 2006).

Another finding from the analysis was that the there was no significant difference between the number of social ties in urban and rural communities nor across densities of Mexican Americans per tract. However, within urban tracts the neighborhoods in the second tier of Mexican American density (30-49%) proved to have the highest number of social ties. Levels of social cohesion, on the other hand, were highest in rural tracts overall and, within rural tracts, were highest in the fourth tier of Mexican American density (70-89%). Almeida et al. (2009) offer clues as to why this might be. They suggest that the long standing settlement history of Mexican-Americans in the Southwest, the high degree of residential stability of the elderly and the fact that Mexican-Americans are the predominant ethnic group in the area, explain why levels of social cohesion could be higher there than in more urbanized areas. They use Chicago, a city categorized by several different ethnic groups and where Mexican immigrants are relative newcomers, as an example of such an urbanized area. It is also true that the elderly are the least residentially mobile age category in the US and Almeida et al. (2009) found that social cohesion was positively correlated with elderly concentration even in Chicago (Goldscheider, 1966). Nonetheless, the higher levels of social cohesion observed in rural areas were not coupled with a *barrio* advantage. In addition, the effects of social cohesion were variable - predictive of some health outcomes (diabetes) while protective of others (heart attack). These results are somewhat consistent with the few studies that have analyzed the effects on social cohesion and these health conditions. One found that individuals living in neighborhoods with higher levels of social cohesion had 22% reduced odds of heart attack and another found no significant effect of social cohesion on prevalence of diabetes (Kim, Hawes, & Smith, 2014; Lagisetty et al., 2016).

Therefore, if higher levels of social cohesion are not observed in conjunction with improved health outcomes in higher concentration Mexican American neighborhoods in urban tracts, then why do urban tracts have a *barrio* advantage that rural ones do not? I suggest a couple of explanations. First, although acculturation level has no consistent effect on health outcomes, it could have a different effect in rural areas than it does in urban ones. In urban areas with high concentrations of Mexican Americans, greater access to traditional food stores could make it easier for individuals to maintain certain healthy habits from their culture while simultaneously becoming more acculturated, which in this case means improving their English language skills.

The second possible explanation for the lack of a barrio advantage in rural areas can be attributed to the inherit bias of the H-EPESE data set and the salmon bias. The data for the H-EPESE was only collected for non-institutionalized Mexican Americans 65 or older; it is possible that that selection in itself was biased towards the elderly that are healthy enough to have reached the age to be included in the study. Furthermore, the salmon bias certainly could have influenced the analysis, especially if return-migration to Mexico is more likely to occur in urban neighborhoods with higher concentrations of Mexican Americans, and if that return migration is correlated with the onset of disease (Eschbach et al., 2004). This explanation is supported by the fact that rural tracts had significantly less foreign-born respondents than urban ones and US born Mexican Americans are not likely to return to a country that they were not born in (Abraido-Lanza et al., 2001). Additionally, it is possible that the long standing communities of Mexican Americans in the Southwest are present mostly in rural areas, which could explain why levels of social cohesion are significantly stronger there than in urban census tracts.

This study could be improved and expanded in several ways. An important limitation to mention is the use of census tracts to define neighborhoods. Census tracts are used frequently for health data in urban and rural areas, and are also often used for neighborhood studies in urban areas, however, they do not always accurately depict what people actually consider to be their neighborhood (Eberhardt & Pamuk, 2004; Logan, Stults, & Xu, 2016). Nonetheless, at least for urban areas, they do seem to be one of the most accurate units of analysis for neighborhoods that exists (Wooldredge, 2002).

A way that this study could be expanded includes incorporating mortality into the health outcomes would help make the results more easily comparable to a wider range of other studies related to the Hispanic Health Paradox. This could also lead to more concrete findings since there is robust evidence that mortality rates are lower for Mexican-Americans than African-Americans and in some cases non-Hispanic whites, whereas outcomes for Mexican Americans for the six medical conditions used in this study tend to be less consistent and unclear. Another possibility for expanding on this study would be to include health data for Mexican-Americans in other rural areas such as the Southeast where Mexican-Americans do not have a long standing settlement history, yet have recently settled in multitudes. In addition, it would be fruitful to incorporate data that included health outcomes for non-Hispanic whites and African Americans that live in the same communities in order to not only test the *barrio* advantage but also the Hispanic Health Paradox itself between rural and urban areas.

Conclusion

Although the Hispanic Health Paradox has been studied extensively, the majority of the research has been focused either in highly urban areas, or by aggregating results from both large regions of the US and the country as a whole. This research project shed light on the nature of the barrio effect outside of the inner city by teasing apart urban and rural Hispanic communities in the Southwest. The analysis indicated that a barrio effect is not present in rural areas, most likely due to the several ways in which rural areas differ from urban ones with respect to the effects of acculturation, the proportion of foreign born residents, and access to resources. Analysis of neighborhood levels of social cohesion and social ties did not provide conclusive evidence that these are health protective mechanisms in neighborhoods with high percentages of Mexican Americans. Nonetheless, this research was able to show that the barrio advantage is solely an urban phenomenon, a finding that could bring unknown implications to the growing, and increasingly segregated, Hispanic communities in the rural Southeast and Midwest.

References

Abrafdo-Lanza, A. F., Dohrenwend, B. P., Ng-Mak, D. S., Blake, J., Phd, T., Abraido-Lanza, A. F., & Mailman, J. L. (1543). The Latino Mortality Paradox: A Test of the "Salmon Bias" and Healthy Migrant Hypotheses. *American Journal of Public Health*.

Abraído-Lanza, A. F., Armbrister, A. N., Flórez, K. R., & Aguirre, A. N. (2006). Toward a theory-driven model of acculturation in public health research. *American Journal of Public Health*, *96*(8), 1342–6. https://doi.org/10.2105/AJPH.2005.064980

Abril, J. (n.d.). Urban V. Rural: Measuring Collective Efficacy in Two Different Populations.

Adler, N. E., & Newman, K. (2002). Socioeconomic disparities in health: pathways and policies. *Health Affairs (Project Hope)*, *21*(2), 60–76. https://doi.org/10.1377/HLTHAFF.21.2.60

Almeida, J., Kawachi, I., Molnar, B. E., & Subramanian, S. V. (n.d.). A Multilevel Analysis of Social Ties and Social Cohesion among Latinos and Their Neighborhoods: Results from Chicago. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, *86*(5). https://doi.org/10.1007/s11524-009-9375-2

Anderson, L. M., Wood, D. L., & Sherbourne, C. D. (1997). Maternal acculturation and childhood immunization levels among children in Latino families in Los Angeles. *American Journal of Public Health*, *87*(12), 2018–21. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9431295

Balcazar, H., Castro, F. G., & Krull, J. L. (1995). Cancer risk reduction in Mexican American women: the role of acculturation, education, and health risk factors. *Health Education Quarterly*, *22*(1), 61–84. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/7721602

Berry, J. W., Phinney, J. S., Sam, D. L., & Vedder, P. (2006). Immigrant Youth: Acculturation, Identity, and Adaptation. *Applied Psychology*, *55*(3), 303–332. https://doi.org/10.1111/j.1464-0597.2006.00256.x

Bostean, G. (2013). Does Selective Migration Explain the Hispanic Paradox? A Comparative Analysis of Mexicans in the U.S. and Mexico. *Journal of Immigrant and Minority Health*, *15*(3), 624–635. https://doi.org/10.1007/s10903-012-9646-y

Branch, L. G., Katz, S., Kniepmann, K., & Papsidero, J. A. (1984). A prospective study of functional status among community elders. *American Journal of Public Health*, *74*(3), 266–8. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/6696160

Braveman, P., Egerter, S., & Williams, D. R. (2011). The Social Determinants of Health: Coming of Age. *Annual Review of Public Health*, *32*(1), 381–398. https://doi.org/10.1146/annurev-publhealth-031210-101218

Cagney, K. A., & Browning, C. R. (2004). Exploring neighborhood-level variation in asthma and other respiratory diseases: the contribution of neighborhood social context. *Journal of General Internal Medicine*, *19*(3), 229–36. https://doi.org/10.1111/J.1525-1497.2004.30359.X

Cagney, K. A., Browning, C. R., & Wallace, D. M. (2007). The Latino paradox in neighborhood context: the case of asthma and other respiratory conditions. *American Journal of Public Health*, *97*(5), 919–25. https://doi.org/10.2105/AJPH.2005.071472

Chang, V. W., & Lauderdale, D. S. (2009). Fundamental cause theory, technological innovation, and health disparities: the case of cholesterol in the era of statins. *Journal of Health and Social Behavior*, *50*(3), 245–60. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19711804

Collins, J. W., & Shay, D. K. (1994). Prevalence of low birth weight among Hispanic infants with United States-born and foreign-born mothers: the effect of urban poverty. *American Journal of Epidemiology*, *139*(2), 184–92. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8296785

Creighton, M. J., Goldman, N., Pebley, A. R., & Chung, C. Y. (2012). Durational and generational differences in Mexican immigrant obesity: Is acculturation the explanation? *Social Science & Medicine*, *75*(2), 300–310. https://doi.org/10.1016/j.socscimed.2012.03.013

Cutler, D. M., & Glaeser, E. L. (1997). Are Ghettos Good or Bad? *The Quarterly Journal of Economics*, *112*(3), 827–872. https://doi.org/10.1162/003355397555361

Deindl, C., Brandt, M., & Hank, K. (2016). Social Networks, Social Cohesion, and Later-Life Health. *Social Indicators Research*, *126*(3), 1175–1187. https://doi.org/10.1007/s11205-015-0926-5

Eberhardt, M. S., & Pamuk, E. R. (2004). The importance of place of residence: examining health in rural and nonrural areas. *American Journal of Public Health*, *94*(10), 1682–6. https://doi.org/10.2105/AJPH.94.10.1682

Effland, A. B. W., & Kassel, K. (n.d.). Hispanics in Rural America The Influence of Immigration and Language on Economic Well-Being.

Ellen, I. G. (2000). Is Segregation Bad for Your Health? The Case of Low Birth Weight.

Brookings-Wharton Papers on Urban Affairs, *2000*(1), 203–229. https://doi.org/10.1353/urb.2000.0002

Escarce, J. J., Morales, L. S., & Rumbaut, R. G. (2006). The Health Status and Health Behaviors of Hispanics.

Eschbach, K., Mahnken, J. D., & Goodwin, J. S. (2005). Neighborhood composition and incidence of cancer among Hispanics in the United States. *Cancer*, *103*(5), 1036–44. https://doi.org/10.1002/cncr.20885

Eschbach, K., Ostir, G. V, Patel, K. V, Markides, K. S., & Goodwin, J. S. (2004). Neighborhood context and mortality among older Mexican Americans: is there a barrio advantage? *American Journal of Public Health*, *94*(10), 1807–12. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15451754

Fernandez, M. L. (2007). Acculturation and biomarkers for type 2 diabetes in Latinos. *The Journal of Nutrition*, *137*(4), 871–2. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17374646

Finch, B. K., & Vega, W. A. (2003). Acculturation stress, social support, and self-rated health among Latinos in California. *Journal of Immigrant Health*, *5*(3), 109–17. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/14512765

Forrest, R., & Kearns, A. (2001). Social Cohesion, Social Capital and the Neighbourhood. *Urban Studies*, *38*(12), 2125–2143. Retrieved from http://journals.sagepub.com.colorado.idm.oclc.org/doi/pdf/10.1080/00420980120087081

Frank, R., Cerdá, M., & Rendón, M. (2007). Barrios and burbs: residential context and health-risk behaviors among Angeleno adolescents. *Journal of Health and Social Behavior*, *48*(3), 283–300. https://doi.org/10.1177/002214650704800306

Franzini, L., Ribble, J. C., & Keddie, A. M. (2001). Understanding the Hispanic paradox. *Ethnicity & Disease*, *11*(3), 496–518. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11572416

Franzini, L., & Spears, W. (2003). Contributions of social context to inequalities in years of life lost to heart disease in Texas, USA. *Social Science & Medicine (1982)*, *57*(10), 1847–61. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/14499510

Goldscheider, C. (1966). Differential Residential Mobility of the Older Population. *Journal of Gerontology*, *21*(1), 103–108. https://doi.org/10.1093/geronj/21.1.103

Hart, L. G., Larson, E. H., & Lishner, D. M. (2005). Rural definitions for health policy and research. *American Journal of Public Health*, *95*(7), 1149–55. https://doi.org/10.2105/AJPH.2004.042432

Hayward, M. D., Hummer, R. A., Chiu, C.-T., González-González, C., & Wong, R. (2014). Does the Hispanic Paradox in U.S. Adult Mortality Extend to Disability? *Population Research and Policy Review*, *33*(1), 81–96. https://doi.org/10.1007/s11113-013-9312-7

Hazuda, H. P., Haffner, S. M., Stern, M. P., & Eifler, C. W. (1988). Effects of acculturation and socioeconomic status on obesity and diabetes in Mexican Americans. The San Antonio Heart Study. *American Journal of Epidemiology*, *128*(6), 1289–301. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/3195568

Hill, T. D., Uchino, B. N., Eckhardt, J. L., & Angel, J. L. (2016). Perceived Social Support Trajectories and the All-Cause Mortality Risk of Older Mexican American Women and Men. *Research on Aging*, *38*(3), 374–398. https://doi.org/10.1177/0164027515620239

Huie, S. A. B., Hummer, R. A., & Rogers, R. G. (2002). Individual and Contextual Risks of Death among Race and Ethnic Groups in the United States. *Journal of Health and Social*

Behavior, *43*(3), 359. https://doi.org/10.2307/3090209

Jasso, G., & Rosenzweig, M. R. (1982). Estimating the emigration rates of legal immigrants using administrative and survey data: the 1971 cohort of immigrants to the United States. *Demography*, *19*(3), 279–90. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/7117627

Keefe, S. E., & Others, A. (1979). The Mexican-American Extended Family as an Emotional Support System. *Human Organization*, *38*(2), 144–52.

Kim, E. S., Hawes, A. M., & Smith, J. (2014). Perceived neighbourhood social cohesion and myocardial infarction. *Journal of Epidemiology and Community Health*, *68*(11), 1020–1026. https://doi.org/10.1136/jech-2014-204009

Lagisetty, P. A., Wen, M., Choi, H., Heisler, M., Kanaya, A. M., & Kandula, N. R. (2016). Neighborhood Social Cohesion and Prevalence of Hypertension and Diabetes in a South Asian Population. *Journal of Immigrant and Minority Health*, *18*(6), 1309–1316. https://doi.org/10.1007/s10903-015-0308-8

Lee, M.-A., & Ferraro, K. F. (2007). Neighborhood Residential Segregation and Physical Health among Hispanic Americans: Good, Bad, or Benign? *Journal of Health and Social Behavior*, *48*(2), 131–148. https://doi.org/10.1177/002214650704800203

Lichter, D. T., Parisi, D., Taquino, M. C., & Grice, S. M. (2010). Residential segregation in new Hispanic destinations: Cities, suburbs, and rural communities compared. *Social Science Research*, *39*(2), 215–230. https://doi.org/10.1016/j.ssresearch.2009.08.006

Link, B. G., & Phelan, J. (1995). Social Conditions As Fundamental Causes of Disease. *Journal of Health and Social Behavior*, *35*, 80. https://doi.org/10.2307/2626958

Logan, J. R., Stults, B. J., & Xu, Z. (2016). Validating Population Estimates for Harmonized

Census Tract Data, 2000–2010. *Annals of the American Association of Geographers*, *106*(5), 1013–1029. https://doi.org/10.1080/24694452.2016.1187060

Logan, J. R., Zhang, W., & Alba, R. D. (2002). Immigrant Enclaves and Ethnic Communities in New York and Los Angeles. *American Sociological Review*, *67*(2), 299. https://doi.org/10.2307/3088897

Mainous, A. G., Majeed, A., Koopman, R. J., Baker, R., Everett, C. J., Tilley, B. C., & Diaz, V. A. (2006). Acculturation and Diabetes among Hispanics: Evidence from the 1999–2002 National Health and Nutrition Examination Survey. *Public Health Reports*, *121*(1), 60–66. https://doi.org/10.1177/003335490612100112

Markides, K. S., & Coreil, J. (1986). The health of Hispanics in the southwestern United States: an epidemiologic paradox. *Public Health Reports (Washington, D.C. : 1974)*, *101*(3), 253–65. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/3086917

Massey, D. S. (1981). Dimensions of the New Immigration to the United States and the Prospects for Assimilation. *Annual Review of Sociology*, *7*(1), 57–85. https://doi.org/10.1146/annurev.so.07.080181.000421

Massey, D. S., & Espinosa, K. E. (1997). What's driving Mexico-U.S. migration? A theoretical, empirical, and policy analysis. *The American Journal of Sociology*, *102*(4). Retrieved from http://search.proquest.com.colorado.idm.oclc.org/docview/195948276?pq-origsite=summon

McGlade, M. S., Saha, S., & Dahlstrom, M. E. (2004). The Latina paradox: an opportunity for restructuring prenatal care delivery. *American Journal of Public Health*, *94*(12), 2062–5. https://doi.org/10.2105/AJPH.94.12.2062

Mier, N., Ory, M. G., Zhan, D., Conkling, M., Sharkey, J. R., & Burdine, J. N. (2008). Health-related quality of life among Mexican Americans living in colonias at the Texas–Mexico border. *Social Science & Medicine*, *66*(8), 1760–1771. https://doi.org/10.1016/j.socscimed.2007.12.017

Mulvaney-Day, N. E., Alegría, M., & Sribney, W. (2007). Social cohesion, social support, and health among Latinos in the United States. *Social Science & Medicine*, *64*(2), 477–495. https://doi.org/10.1016/j.socscimed.2006.08.030

Nam, S., Al Snih, S., & Markides, K. S. (2015). Sex, Nativity, and Disability in Older Mexican Americans. *Journal of the American Geriatrics Society*, *63*(12), 2596–2600. https://doi.org/10.1111/jgs.13827

OSGOOD, D. W., & CHAMBERS, J. M. (2000). SOCIAL DISORGANIZATION OUTSIDE THE METROPOLIS: AN ANALYSIS OF RURAL YOUTH VIOLENCE*. *Criminology*, *38*(1), 81–116. https://doi.org/10.1111/j.1745-9125.2000.tb00884.x

Ostir, G. V, Eschbach, K., Markides, K. S., & Goodwin, J. S. (2003a). Neighbourhood composition and depressive symptoms among older Mexican Americans. *Journal of Epidemiology and Community Health*, *57*(12), 987–92. https://doi.org/10.1136/JECH.57.12.987

Ostir, G. V, Eschbach, K., Markides, K. S., & Goodwin, J. S. (2003b). Neighbourhood composition and depressive symptoms among older Mexican Americans. *Journal of Epidemiology and Community Health*, *57*(12), 987–92. https://doi.org/10.1136/JECH.57.12.987

Palloni, A., & Arias, E. (2004). Paradox lost: explaining the Hispanic adult mortality advantage. *Demography*, *41*(3), 385–415. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15461007

Pérez-Escamilla, R., & Putnik, P. (2007). The role of acculturation in nutrition, lifestyle, and incidence of type 2 diabetes among Latinos. *The Journal of Nutrition*, *137*(4), 860–70. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17374645

Reichert, J., & Massey, D. S. (1979). Patterns of U.S. Migration from a Mexican Sending Community: A Comparison of Legal and Illegal Migrants. *International Migration Review*, *13*(4), 599. https://doi.org/10.2307/2545178

Riosmena, F., & Jochem, W. C. (2012). "Vulnerability, Resiliency, and Adaptation: The Health of Latin Americans during the Migration Process to the United States" *Realidad, Datos Y Espacio : Revista Internacional de Estadistica Y Geografia*, *3*(2), 14–31. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/24660053

Riosmena, F., Kuhn, R., & Jochem, W. C. (2017). Explaining the Immigrant Health Advantage: Self-selection and Protection in Health-Related Factors Among Five Major National-Origin Immigrant Groups in the United States. *Demography*, *54*(1), 175–200. https://doi.org/10.1007/s13524-016-0542-2

Riosmena, F., Wong, R., & Palloni, A. (2013). Migration Selection, Protection, and Acculturation in Health: A Binational Perspective on Older Adults. *Demography*, *50*(3), 1039–1064. https://doi.org/10.1007/s13524-012-0178-9

Ross, C. E., & Jang, S. J. (2000). Neighborhood disorder, fear, and mistrust: the buffering role of social ties with neighbors. *American Journal of Community Psychology*, *28*(4), 401–20. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10965384

Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. *Science*, *277*(5328).

Shell, A. M., Peek, M. K., & Eschbach, K. (2013). Neighborhood Hispanic composition and depressive symptoms among Mexican-descent residents of Texas City, Texas. *Social*

Science & Medicine (1982), *99*, 56–63. https://doi.org/10.1016/j.socscimed.2013.10.006

Spence, R. T., & Wallisch, L. S. (2007). Alcohol and Drug Use in Rural Colonias and Adjacent Urban Areas of the Texas Border. *The Journal of Rural Health*, *23*(s1), 55–60. https://doi.org/10.1111/j.1748-0361.2007.00124.x

Stephen, E. H., Foote, K., Hendershot, G. E., & Schoenborn, C. A. (1994). Health of the foreign-born population: United States, 1989-90. *Advance Data*, (241), 1–12. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10132138

Subramanian, S. V., Acevedo-Garcia, D., & Osypuk, T. L. (2005). Racial residential segregation and geographic heterogeneity in black/white disparity in poor self-rated health in the US: a multilevel statistical analysis. *Social Science & Medicine*, *60*(8), 1667–1679. https://doi.org/10.1016/j.socscimed.2004.08.040

Szumilas, M. (2010). Explaining odds ratios. *Journal of the Canadian Academy of Child and Adolescent Psychiatry = Journal de l'Academie Canadienne de Psychiatrie de L'enfant et de L'adolescent*, *19*(3), 227–9. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/20842279

Turra, C. M., & Elo, I. T. (2008). The Impact of Salmon Bias on the Hispanic Mortality Advantage: New Evidence from Social Security Data. *Population Research and Policy Review*, *27*(5), 515–530. https://doi.org/10.1007/s11113-008-9087-4

Vaeth, P. A. C., Caetano, R., & Mills, B. A. (2015). Binge Drinking and Perceived Neighborhood Characteristics Among Mexican Americans Residing on the U.S.-Mexico Border. *Alcoholism: Clinical and Experimental Research*, *39*(9), 1727–1733. https://doi.org/10.1111/acer.12818

Weeks, W. B., Kazis, L. E., Shen, Y., Cong, Z., Ren, X. S., Miller, D., … Perlin, J. B. (2004).

Differences in health-related quality of life in rural and urban veterans. *American Journal of Public Health*, *94*(10), 1762–7. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15451747

West, K. M., Blacksher, E., Burke, W., & M, P. (2017). Genomics, Health Disparities, and Missed Opportunities for the Nation’s Research Agenda. *JAMA*, *290*(15), 2001–2007. https://doi.org/10.1001/jama.2017.3096

Winters, P., De Janvry, A., & Sadoulet, E. (n.d.). Family and Community Networks in Mexico-U.S. Migration Working Paper Series in Agricultural and Resource Economics Family and Community Networks in Mexico-U.S. Migration. Retrieved from http://www.une.edu.au/febl/EconStud/wps.htm

WOOLDREDGE, J. (2002). EXAMINING THE (IR)RELEVANCE OF AGGREGATION BIAS FOR MULTILEVEL STUDIES OF NEIGHBORHOODS AND CRIME WITH AN EXAMPLE COMPARING CENSUS TRACTS TO OFFICIAL NEIGHBORHOODS IN CINCINNATI*. *Criminology*, *40*(3), 681–710. https://doi.org/10.1111/j.1745-9125.2002.tb00970.x

Zambrana, R. E., & Carter-Pokras, O. (2010). Role of Acculturation Research in Advancing Science and Practice in Reducing Health Care Disparities Among Latinos. *American Journal of Public Health*, *100*(1), 18–23. https://doi.org/10.2105/AJPH.2008.138826

Zhang, Z., Hayward, M. D., & Lu, C. (2012). Is There a Hispanic Epidemiologic Paradox in Later Life? A Closer Look at Chronic Morbidity. *Research on Aging*, *34*(5), 548–571. https://doi.org/10.1177/0164027511429807