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Ancestral ties, civic structure and health in the United States

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ABSTRACT

This study links three streams of literature to explore the relationship between county-level European ancestry, civic structure and health outcomes. Research has shown that areas with high civic structure have better health outcomes compared to those areas low in civic structure. Studies also point out that some communities with higher population densities of certain ancestries have more civic structure than others. Researchers have also found some evidence that ethnic density is related to better mental or physical health. These mechanisms are tested on structural measures, such as county-level civic structure and ancestry (not race or ethnicity) to determine if they are associated with self-reported good health, obesity and diabetes diagnoses.

Data was extracted from several publically available sources such as the U.S. Census Bureau, Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS), the University of Wisconsin's County Health Rankings, Rupasingha and Goetz (2008) index, and the Economic Research Services' Environmental Food Atlas. The data were compared across two different periods in time; early and late 2000s.

This study finds that counties high in civic structure have higher self-reported good health, but it does not consistently show lower obesity and diabetes diagnoses. Further, civic structure added very little or in some cases no explained variance to the models. Norwegian and German ancestries were associated with higher civic structure, but they were not consistently related to better health outcomes. Ethnic density is associated with better health outcomes, but the results are not consistent. Further work should investigate the cultural activities of ancestries, such as food, holidays or celebrations and its potentially related health implications.

CHAPTER 1.

INTRODUCTION

Obesity is a public health problem (HHS 2001). In the last quarter of a century, obesity rates have more than doubled (Finkelstein, Ruhm and Kosa 2005:239). In the U.S., 72 percent of men and 64 percent of women are overweight or obese (Flegal, Carroll, Ogden et al. 2010; U.S. Department of Agriculture and U.S. Department of Health and Human Services 2010). In 2010, the Surgeon General noted that the obesity epidemic "threatens the historic progress" for "increasing American's quality and years of life" (HHS 2010:1). In fact research shows that obesity reduces life expectancy (Fontaine, Redden, Wang et al. 2003; Peeters, Barendregt, Willekens et al. 2003) and is responsible for roughly 300,000 deaths per year (Allison, Fontaine, Manson et al. 1999).

Obesity is associated with a number of diseases, including diabetes (Centers for Disease Control and Prevention 2006; Morland, Roux and Wing 2006; Must, Spadano, Coakley et al. 1999), high blood pressure, high cholesterol, asthma, arthritis, poor health status, and premature mortality (Allison et al. 1999; Fontaine et al. 2003; McDowell, Hughes and Borrud 2006; Mokdad, Ford and Bowman 2003; Peeters et al. 2003). Diabetes can cause blindness, kidney failure, and non-traumatic amputations (CDC 2009b). One in three adults in the United States would have diabetes by 2050 should the escalation of this disease continue at current rates (American Diabetes Association 2013; Boyle, Thompson, Gregg et al. 2010). As of 2007, 24 million people had diabetes (CDC 2009b). In 2005, almost half of adults with diabetes reported also having poor health (CDC 2006).

People living in rural areas have many health challenges and have a greater likelihood of obesity than those living in urban or suburban areas (Bennett, Probst and Pumkam 2011;

Patterson, Moore, Probst et al. 2004; Ramsey and Glenn 2002). In general, rural areas have numerous health disparities such as poverty, low socioeconomic status, less health insurance (Eberhardt, Ingram, Mukuc et al. 2001; Yang, Jensen and Haran 2011); unreliable transportation or access to care (Crosby, Wendel, Vanderpool et al. 2012; Morton 2004); deference of health care due to cost; (Beaudoin and Thorson 2004); lower self-rated health (Monnat and Beeler Pickett 2011), shortage of health care providers (Bennett 2008), high proportions of the elderly, less diversified economies and lower tax revenues when compared to urban areas (Morton 2004).

Despite the growing obesity epidemic and related-health problems, such as diabetes, little attention has been given to the implications of the social environment (Wang, Soowon, Gonzalez et al. 2007; Yoon and Brown 2011). Efforts at the individual level to educate people about the virtues of a healthy diet have not resulted in lasting change on obesity (French, Story and Jeffery 2001). Additionally, the focus on obesity-related diseases such as diabetes has also been reduced to managing personal lifestyle, while ignoring the role of social and physical environments (Liburd, Jack, Williams et al. 2005). The Centers for Disease Control and Prevention has noted that more information is needed regarding "the distribution of diabetes and obesity in smaller areas" given "each condition might emanate from behavioral, environmental, and socioeconomic conditions that are rooted in cultural and geographic patterns" (Centers for Disease Control and Prevention 2009b:1260).

Increasing evidence suggests there is an association between community civic activity and public health (Holtgrave and Crosby 2006; Kawachi, Kennedy and Glass 1999; Kim and Kawachi 2006; Mellor and Milyo 2005). This community-level civic phenomena (here forward

referred to as civic structure) has been called many things, such as social capital, civic engagement, and civic community (Kaufman 1959; Morton 2003; Putnam 2000; Putnam 1993; Wilkinson 1991). Civic structure is defined as process where "organizations come together to undertake the obligations of the community and citizenship" (Morton 2001:58), which may influence health outcomes. Areas with higher levels of community-level civic structure have better health, lower incidences of obesity and diabetes compared to areas with less civic structure. Yet, despite these important findings, no single factor necessarily explains how civic structure is developed (Flora 2008).

Research has found civic structure to be associated with ancestry. The level of civic structure found within areas with certain ancestries has important cultural impacts that span across generations (Alba 1990; Greeley 1974; Greeley and McCready 1974; Rice and Feldman 1997; Rothenberg and Licht 1982; Waters 1990). In particular, studies confirm that descendants from certain ancestries such as Scandinavia, for example, exhibit more civic structure compared to other ancestries (Besser 2011; Putnam 2000; Rice and Ling 2002).

Studies into civic structure appear to follow two tracks by evaluating the relationships between civic structure and health, and then civic structure and ancestry. However, research has yet to fully examine the intersection between both streams of focus. A third stream of research has explored the role of ethnic density, which is defined as an area with a higher concentration of people with their own ethnic group (Becares 2013). This research focus shows that areas with a greater concentration of ethnic/race minority groups in some cases have better health outcomes (Becares, Cormack and Harris 2013; Fang, Madhavan, Bosworth et al. 1998; Halpern 1993), and this density could be related to civic structure and consequently improved health (Smaje 1995). If in fact civic structure has positive benefits for health, then theoretically areas with higher

densities of European ancestries that exhibit greater levels of civic structure should display community-level better health, unless there are other intervening variables that dissolve these relationships. A key question is whether counties with a higher percentage of residents with particular ancestries (Norwegian and German) have greater civic structure and consequently better health outcomes? It is also important to know if ethnic density itself is related to better health outcomes.

This research attempts to understand the underpinnings of community-level civic structure and public health through the lens of European ancestry using county-level data from the 2000 U.S. Decennial Census and 2006-2010 American Community Survey for contiguous counties in the lower 48 states of the United States. To be clear, this study is only evaluating county-level structural characteristics, not individuals. Ancestry for this study is defined as a person's heritage, descent, or roots (U.S. Census Bureau 2014b), whether known or believed (for more information on how or why certain European ancestries were chosen see page 30). Further, the association between civic structure and health via ancestry will also be examined by non-metro counties and all counties nationally using the Economic Research Service's rural and urban continuum codes (Economic Research Service 2014d). Lastly, this study is not an evaluation of race and ethnicity as it relates to health outcomes. European ancestries are used for analysis in this study, and given this, the health findings are not intended to be generalized to other ethnicities or race.

CHAPTER 2

THEORETICAL AND CONCEPTUAL FRAMEWORK

Civic participation or engagement is an indicator of social capital (Putnam 2000; Putnam and Feldstein 2003; Rupasingha, Goetz and Freshwater 2006). People who are civically engaged are involved in public affairs (Putnam 2000:87). Membership in organizations is a useful sign to indicate community engagement (Putnam 2000:49). Higher levels of civic participation is credited by Putnam (1993) for making local governments in Italy more efficient or effective when compared to those governments where there was less cooperation and engagement. Putnam borrows some of his theoretical framework from Tocqueville ([1897] 1994) early accounts of America and the proliferation of civic associations and democratic stability.

Different interpretations of social capital exist (Ferlander 2007), but for purposes here it is understood to be a community-level construct. Coleman (1988:S98) describes social capital as "a variety of different entities, with two elements in common: they all consist of some aspect of social structures, and they facilitate certain action of actors, whether personal or corporate actors, within the structure." Putnam (2000:19) describes social capital as the "connections among individuals--social networks and the norms of reciprocity and trustworthiness that arise from them." More specifically, community-level social capital is defined as "the density of social networks that facilitate cooperative actions for mutual benefit among members of a community" (Yoon and Brown 2011:296). These definitions take on qualities that appear to have both cognitive and structural characteristics. For example, structural social capital could include what people actually do, such as belonging to civic associations, whereas cognitive social capital include what people feel, such as trust and reciprocity (Harpham, Grant and Thomas 2002; Subramanian, Kim and Kawachi 2002).

This dissertation is centered on the structural aspects of community social capital and civic engagement. Morton (2001:58) more specifically uses the term civil community or civic structure to describe a process where "organizations come together to undertake the obligations of the community and citizenship" and "coalesces around health." Civic structure is credited as a process to address many kinds of community-level problems, such as watershed management (Morton 2008), rural housing (Morton, Allen and Li 2004), and food security (Morton, Bitto, Oakland et al. 2005; Smith and Miller 2011; Smith and Morton 2009).

The term civic structure is derived from several origins such as civil society, civicness, democracy, and community (Morton, Chen and Morse 2008). For example, civic structure is similar to Wilkinson (1991) use of the term community field. Community field is described as collaborative efforts to address the common interests of a community through consistent social interactions such as through associations or groups. He notes that a community is also a "cultural configuration, a field of collective action" (Wilkinson 1970:317). Wilkinson (1974) notes the work of Kaufman (1959) who also outlines the community field concept. Kaufman (1959:12) argues that the community "may be seen as a network of interrelated associations, formal and informal, whose major function is problem solving for the local society."

For the purposes of this study, community social capital, civic engagement or involvement and community field is called civic structure. Civic structure is measured using Rupasingha and Goetz (2008) social capital index (here forward referred to as the Rupasingha and Goetz index) that includes county-level civic activities such as voter turnout, census response rate, and density of associational groups and religious organizations. This civic activity and density of associations and groups for this study will be a proxy for civic structure. Although related, this definition of civic structure does not include elements of trust, a cognitive

form of social capital. Further, the Rupasingha and Goetz (2008) index does not include measures for trust.

An area with the elements of civic structure would be expected to have better health than those areas with less civic structure. Kawachi and Berkman (2000:184) identify three potential mechanisms in which civic structure may alter individual health outcomes: (1) influencing health-related behaviors through information diffusion (Rogers 1995;2003) or collective control over deviant health-related behavior; (2) access to services and amenities, which could include preventing budget cuts for health-related services and enabling appropriate transportation in a community; and, (3) psychosocial processes, such as support through the caring efforts of a cohesive community. These mechanisms could suggest that areas with more civic structure would mitigate numerous health challenges, such as transportation to supermarkets, number of and access to supermarkets, information diffusion about healthy eating and overall healthcare through annual health checkups and resolving health problems before they become acute.

Civic structure may have cultural components. Ancestry and related culture can be viewed as an important element for civic structure (Gutmann and Pullum 1999; Kliksberg 1999). Shared ancestral background at the community level may create what Morton (2003:105) calls "normative expectations" to solve "collective problems in the broad community interest." Culture itself can have many components, including, but not limited to food, holidays, language, music, or religious celebrations (Waters 1990). These cultural components, however, need not be limited to those ancestries that maintain them. Alba (1990:85) notes that "food or language can provide the basis for celebrating and renewing the solidarity of common ethnic background," but also "fosters a solidarity that transcends conventional ethnic confines." Therefore, ancestry can play a role in the development of civic structure in particular areas.

Research Statement and Question

As noted in the introduction, there are three streams of research that evaluate health outcomes, civic structure and ancestry. However, very little research has been done at the intersection between these three literatures. Do counties with a higher percentage of residents with a particular European ancestry (Norwegian and German) have greater civic structure and consequently better health outcomes? Is ethnic density related to better health outcomes? Given the lack of work at this particular intersection, this research will evaluate whether or not counties with high civic structure have higher self-reported good health, and lower obesity and diabetes diagnoses (hypothesis 1). Conceptually, Figure 1 shows civic structure associated with better health outcomes. Secondly, counties that have a higher population of certain ancestries (Norwegian and German) will have higher levels of civic structure. Further, Norwegian and German ancestries will be associated with higher self-reported good health, lower prevalence of obesity and diabetes diagnoses (hypothesis 2). Figure 1 shows that ancestry can influence health outcomes directly or mediated through civic structure. Third, higher ethnic density will be associated with higher civic structure, higher percent county good health and lower obesity prevalence and diabetes diagnoses when compared to the lowest density levels (hypothesis 3). Conceptually, ethnic density can influence health outcomes either directly or mediated through civic structure (Figure 1). The conceptual model shows ancestry and civic structure having direct or indirect effects on health outcomes across non-metro counties and all counties nationally.

Figure 1 shows controls for demographic/economic structure, food/exercise environment and health indicators. Models are run with and without the food/exercise environment controls to determine if such measures add explained variance, and if such measures influence the health

outcomes. Past research suggests that the food/exercise environment is associated with health outcomes (Ahern, Brown and Dukas 2011; Salois 2012), but few studies have evaluated the food/exercise environment along with civic structure and health outcomes together. Health indicator controls are used selectively following a process established by Ahern et al. (2011) where obesity and diabetes are controlled during analysis on self-reported good health, and obesity is controlled alone for analysis on diabetes diagnoses. A separate analysis will examine whether smoking influences the relationships between civic structure, ancestry and health outcomes.

Hypotheses

Hypothesis 1: Counties rating high in civic structure will have a higher percentage of self-reported good health, lower prevalence of obesity, and lower levels of diabetes diagnoses compared to counties that are low in civic structure.

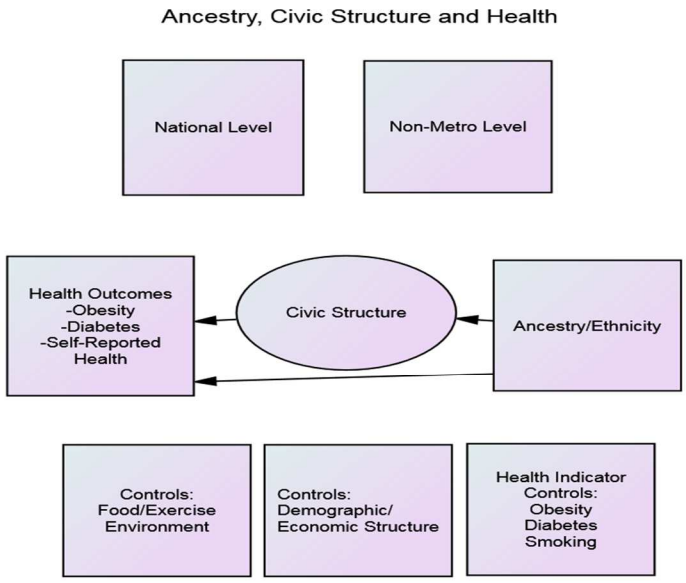

Figure 1. Conceptual model for ancestry, civic structure and health

Hypothesis 2: Counties with higher densities of certain ancestries that have high civic structure (Norwegian and German) will also have higher levels of self-reported good health, lower prevalence of obesity, and lower levels of diabetes diagnoses compared to counties with densities of other ancestries that have low civic structure.

Hypothesis 3. Higher ethnic density will be related to higher levels of civic structure, higher self-reported good health and lower obesity prevalence and diabetes diagnoses compared to the lowest ethnic density level.

CHAPTER 3

LITERATURE REVIEW

The literature review is selective rather than exhaustive. The methodology to identify the relevant literature included a keyword search using JSTOR, EBSCO Host and drawing upon existing research already collected by the investigator using a snowball strategy. Keywords used for searches include: ancestry, ethnicity, ethnic density, obesity, diabetes, self-reported health, social capital, civic engagement, and civic structure/community and community field.

This literature review explores the potential causes of obesity, the health challenges that exist in rural areas, civic structure and health, including civic structure and ancestry, ethnic density and ancestral settlement. This literature review will only include those studies that used civic structure in whole, or in part to derive conclusions. Studies that derive conclusions from the individual-level of focus will not be discussed in this literature review unless noted otherwise.

Potential Causes of Obesity and Diabetes

Obesity has serious health implications and is increasing across the country. Obesity from the most basic explanation occurs due to "an imbalance involving excessive calorie consumption and/or inadequate physical activity" (Miljkovic 2008:49). An adult is considered obese when their body mass index is greater than or equal to 30. Roughly two-thirds of adults and one in three children in the United States are overweight or obese (HHS 2010). In 2008, roughly 34 percent of the U.S. was obese, compared to 13 percent in 1980. Obesity is viewed as a contributor to the risk of diabetes (Centers for Disease Control and Prevention 2006; Jung 1997; Marx 2002; Morland et al. 2006; Must et al. 1999). In fact, since 1980 when the obesity

epidemic started, the incidence of diabetes has tripled in the U.S. (HHS 2010). Obesity has been called a "potent predictor" of diabetes, which itself can cause numerous health complications (Swinburn, Caterson, Seidell et al. 2004:125). Obesity is also associated with a number of other diseases as well. Obesity increases the risks for high blood pressure, high cholesterol, asthma, arthritis, poor health status, or premature mortality (Allison et al. 1999; Fontaine et al. 2003; Jung 1997; McDowell et al. 2006; Mokdad et al. 2003; Peeters et al. 2003). Obesity is responsible for roughly 300,000 deaths per year (Allison et al. 1999).

Obesity also increases overall healthcare and other costs in the United States. These costs are mainly attributed to diabetes, cardiovascular disease and hypertension (Swinburn et al. 2004; Wolf and Colditz 1996). The direct costs associated with the treatment of obesity-related complications account for over 5.3 percent ($52 billion) of national healthcare expenses (Finkelstein, Fiebelkorn and Wang 2003; Wolf and Colditz 1998). But there are also indirect costs due to not being able to go to work, doctor visits, and disability pensions (Wolf and Colditz 1996). These combined costs have been estimated to be over $110 billion (Finkelstein et al. 2003).

There is no clear understanding why obesity has risen so sharply since the 1980s (Finkelstein et al. 2005). In the 1960s and 1970s, obesity rates changed very little (HHS 2010). There can be both individual and community level influences on obesity. Miljkovic (2008:49) notes that there are "genetic, metabolic, behavioral, environmental, cultural and socio-economic influences." At the community-level, there have been a number of plausible explanations for the rise in obesity in the United States. These factors include, but are not limited to lower priced and available energy dense foods (Drewnowski and Specter 2004), food marketing/advertisements (French et al. 2001), consolidation of the retail food system (Smith and Morton 2009), and

technological change (Finkelstein et al. 2005; Lakdawalla and Philipson 2002; Morland et al. 2006; Philipson and Posner 1999).

Socioeconomic status or income inequality is associated with obesity (Ellaway, Anderson and Macintyre 1997; Kahn, Tatham, Pamuk et al. 1998; Reidpath, Burns, Garrard et al. 2002; Sundquist and Johansson 1998). Swinburn, Caterson, Seidell et al. (2004) note that obesity is more of an issue for people of a higher socioeconomic status or living in urban areas in poor countries that generally have lower incomes. Conversely, obesity is related to low socioeconomic status, gender (female) and living in rural areas for the higher income countries. In the United States, from 1988-1994 and 2005-2008, obesity rates continued to climb higher in adults at "all levels of income and education" (Ogden, Lamb, Carroll et al. 2010:6).

Smoking has also been found to be associated with higher levels of obesity and/or diabetes and mortality (Bamia, Trichopoulou, Lenas et al. 2004; Chiolero, Faeh, Paccaud et al. 2008; Houston, Person, Pletcher et al. 2006; John, Hanke, Rumpf et al. 2005; Laaksonen, Rahkonen, Karvonen et al. 2005). There are approximately 46 million people (21 percent of population) in the United States who smoke (CDC 2009a). Areas that are more socioeconomically disadvantaged people are associated with higher levels of smoking (Hiscock, Bauld, Amos et al. 2012; Laaksonen et al. 2005). To be sure, over 30 percent of people at or below the poverty line smoke compared to people at or above the poverty line, which is only 20 percent (CDC 2009a). People living in disadvantaged areas may be less likely to stop smoking, largely due to a number of factors, such as limited social support found with social networks/organizations (Harwood, Salsberry, Ferketich et al. 2007; Hiscock et al. 2012). Given

this, smoking and socioeconomic disadvantage can be related to obesity, diabetes and poor health outcomes.

In recent years, research has evaluated the association between obesity, diabetes or mortality with the density of the community-level food environment. For example, areas with less access to grocery stores or higher density of convenience stores/fast food-restaurants may be related to worse health outcomes. The food environment might be related to civic structure. Further, culture itself might be influenced by the food environment (Morland et al. 2006).

Not all establishments that sell food are the same in terms of location or quality of food items. In general, more healthy food items can be found in grocery stores compared to convenience stores (Glanz, Sallis, Saelens et al. 2007). The size of the grocery store also matters. Small independent grocery stores (not chain or corporate owned) are often found in low-income neighborhoods and tend to carry less healthy food items (Jetter and Cassady 2006). To be sure, the presence of smaller grocery stores are related to a higher incidence of obesity (higher body mass index) or diabetes (Morland et al. 2006), especially in disadvantaged neighborhoods (Inagami, Cohen, Finch et al. 2006). The presence of larger stores, such as supermarkets, have been found to be directly associated with a lower prevalence of obesity/body mass index (Chen, Florax and Snyder 2009; Horowitz, Colson, Hebert et al. 2004; Laraia, Siega-Riz, Kaufman et al. 2004; Larson, Story and Nelson 2009; Morland et al. 2006; Morland 2002; Powell, Auld, Chaloupka et al. 2007; Rose and Richards 2004; Rundle, Neckerman, Freeman et al. 2009; Sallis, Nader, Rupp et al. 1986; Zenk, Schulz, Hollis-Neely et al. 2005).

Distance to a supermarket or grocery store can have health implications depending on if a person has access to a car. People who have irregular or no access to a car and must travel long

distances to a supermarket or grocery store may need to stockpile or buy in bulk (Inagami et al. 2006), which may increase obesity given such food products may be consumed at a faster pace (Chandon and Wansink 2002). Ahern et al. (2011) evaluated the percent of households in counties without a car and living more than one mile from a large grocery store or supermarket to be significantly associated with higher levels of diabetes in non-metro and metro counties (and nationally), but lower obesity in non-metro counties and higher obesity in metro counties (national data was negative but not significant). Other research has shown that owning a car or increased time spent in a car (also due to urban sprawl) to be related to increased weight (Frank, Andresen and Schmid 2004; Inagami et al. 2006; Kim, Subramanian, Gortmaker et al. 2006).

Proximity to and density of fast-food establishments, full-service restaurants and convenience stores (establishments that carry a limited variety of foods, mainly snack items and may or may not sell gasoline) also has been found to have health implications. The U.S. economy has become "increasingly service-oriented" with both parents working and having less time to prepare healthier home-cooked meals (Jekanowski 1999:15). Past data shows that fast-food expenditures increased dramatically (130 percent) between 1972 and 1992 (Jekanowski 1999; Wang, Cubbin, Ahn et al. 2008). Satia, Galanko and Siega-Riz (2004:1090) cite data by the U.S. Department of Agriculture noting that in 1997 fast-food represented 34 percent of total sales for food eaten away from home, yet this value was only four percent in 1953. In general, research shows that the density/proximity of fast-food restaurants and convenience stores to be associated with higher levels of obesity/body mass index (Chen et al. 2009; Chou, Grossman and Saffer 2004; Currie, Vigna, Moretti et al. 2010; Maddock 2004; Mehta and Chang 2008; Morland and Evenson 2009; Morland et al. 2006; Powell et al. 2007; Spence, Cutumisu,

Edwards et al. 2009), including diabetes (CCPHA 2008; Salois 2012). These associations between obesity/diabetes and convenience stores and fast-food restaurants can be found in both low and high income areas (CCPHA 2008). In contrast, studies find that living near or among a high-density of full-service restaurants to be related to lower body mass index (Mehta and Chang 2008; Morland 2002), including less diabetes or mortality (Ahern et al. 2011; Salois 2012).

The food environment also can encompass farmers' markets or direct farm sales and be an important source of healthy food to combat obesity and other health risks. Farmers' markets across the country have increased in number dramatically, providing additional avenues for people with limited or no access to supermarkets to purchase fresh fruits and vegetables. In 1994, there were only 1,755 farmers' markets; however, by 2014 there are over 8,000. Farmers' markets tend to be more concentrated in the Northeast, Midwest and West Coast (ERS 2014c). Roughly 25 percent of these farmers' markets accept Supplemental Nutrition Assistance Program (SNAP) benefits, but they are more likely to be found in the Northeast or West Coast (ERS 2014e). These program benefits can assist lower-income families who are at a greater risk of obesity to gain access to fruits and vegetables. In general, research finds that farmer's markets or direct farm sales to be inversely related to obesity or diabetes (Jilcott, Keyserling, Crawford et al. 2011; Roth, Foraker, Payne et al. 2014; Salois 2012), including less mortality (Ahern et al. 2011). Although results can vary depending on the area of focus (metro, non-metro, national level).

Proximity or availability to recreational/exercise facilities may also be related to better health outcomes. Higher levels of exercise has been found to lower obesity (Frank et al. 2004). Ahern et al. (2011) found that having a greater density of recreational facilities per thousand

county residents to be related to lower obesity, but the results for diabetes and mortality were not statistically significant. Other research finds that recreational facility density to be inversely related to both obesity and diabetes (Jilcott, Edwards, Moore et al. 2013; Salois 2012).

Rural Health Disparities

Research shows that rural areas exhibit numerous structural and health disparities when compared to urban areas. Rural areas have lower socioeconomic status, higher poverty, lower rates of health insurance (Eberhardt et al. 2001; Yang et al. 2011); shortage of health care providers (Bennett 2008); high proportions of the elderly and people with low levels of education, less diversified economies and have lower tax revenues when compared to urban areas (Morton 2004). Health outcomes in rural areas are also worse compared to urban areas. Rural areas have a higher prevalence of obesity (Beaudoin and Thorson 2004; Liu, Bennett, Harun et al. 2008; Patterson et al. 2004; Ramsey and Glenn 2002) and lower self-rated health (Monnat and Beeler Pickett 2011).

As discussed previously, the food environment is associated with health outcomes. Access to healthy food establishments is more challenging in rural areas. Further, rural health disparities are directly tied to nutrition. Obesity is linked to food insecurity due to an inadequate availability of healthy food in particular areas (Hendrickson, Smith and Eikenberry 2006; Smith and Morton 2009). For many rural communities, local grocery stores have simply withered away leaving fewer options for purchasing food (Bailey 2010). Further, supermarket use can vary by place of rural residence, income and age, which makes having a good functioning car and the ability to drive very important (Bitto, Morton, Oakland et al. 2003). Many rural people are not near supermarkets where there is affordable, healthy food and instead must rely on smaller

grocery or convenience stores (Ford and Dzewaltowski 2010; Kaufman 1999; Larson et al. 2009; Liese, Weis, Pluto et al. 2007; Morris, Neuhauser and Cambell 1992), which hinders fruit and vegetable intake (Dean and Sharkey 2011). This is important because as stated previously, areas that are able to maintain supermarkets may have better diets (Morland 2002). Despite this, research on food establishments and health outcomes in non-metro or remote counties have puzzling outcomes. Ahern et al. (2011) found that living in a non-metro county with a greater density of fast-food establishments was associated with lower obesity. Further, grocery stores/supermarket density was related to higher obesity. Other studies have found that people living in low-density populated areas actually have more risk of being overweight the closer they are to a supermarket (Liu, Wilson, R et al. 2007).

Civic Structure and Health

Research has found that the social environment has important linkages with health. Studies outline that areas with higher levels of civic structure also have higher levels of self-rated health when compared to areas with less civic structure (Kawachi et al. 1999; Kim and Kawachi 2006; Mellor and Milyo 2005; Veenstra, Luginaah, Wakefield et al. 2005). Research finds that higher civic structure to be inversely related to physical inactivity (Jones-Legh and Moore 2012; Kim et al. 2006; Mummery, Lauder, Schofield et al. 2008). Civic structure is associated with having fewer diseases, such as cardiovascular disease (Kawachi, Kennedy, Lochner et al. 1997; Lochner, Kawachi, Brennan et al. 2003; Scheffler, Brown, Syme et al. 2008), including infectious diseases (Holtgrave and Crosby 2004; Holtgrave and Crosby 2003). Areas with higher civic structure is associated with consuming lower levels of calories, lower body mass, obesity or

diabetes (Holtgrave and Crosby 2006; Kim et al. 2006; Veenstra et al. 2005; Yoon and Brown 2011).

Studies into civic structure, obesity or diabetes have not been consistent. Research with regard to participation in organizations suggests that such participation is associated with lower diabetes; however, the data were not statistically significant (Long, Field, Armstrong et al. 2010). Kim et al. (2006) used civic and political participation, combined with trust indicators to measure civic structure, and found it to not be significantly associated with county-level obesity, although the signs were in the expected negative direction.

Despite mounting evidence of health disparities in rural areas, civic structure would be expected to be negatively associated with obesity and diabetes diagnoses. Putnam (2000) argues that civic participation is a characteristic of small towns and rural areas. This could be due to greater "social integration and attachment" in rural areas compared to urban areas (Beaudoin and Thorson 2004). Sampson, Morenoff and Felton (1999:656) found that reciprocal exchange was more associated with low population density. Rupasingha et al. (2006) notes that rural counties tend to have more civic structure than urban counties. Civic structure may contribute to positive health outcomes in rural areas. Other studies have found that the mortality rate is lower in rural areas than in urban settings (McLaughlin, Stokes and Nonoyanta 2001; Yang et al. 2011). Yang et al. (2011) using Rupasingha et al. (2006) social capital index (including other measures) found that mortality was lower and civic structure was higher in counties with lower population density and not adjacent to metro areas. Other research shows that civic structure is related to lower levels of hunger (Morton et al. 2005; Smith and Miller 2011; Smith and Morton 2009). Community-level solutions to address hunger related issues can include "food pantries, senior

meal programs, and farmers markets;" however, these options "require partnerships among multiple groups with norms of civic responsibility" (Morton et al. 2005:98).

Civic structure and health outcomes vary across communities and academic findings have not all been consistent. Studies show that levels of civic structure vary across communities (Rupasingha et al. 2006). This could explain why researchers have noted that some communities are able to work together to meet their needs, while others do not (Flora, Sharp, Flora et al. 1997; Morton 2003). Studies regarding civic structure and health in rural areas are also inconsistent. Beaudoin and Thorson (2004) found that rural areas had higher levels of interpersonal trust when compared to urban areas, but associational membership was not statistically significant. Research has also found that rural areas, even those most remote, have higher community involvement when compared to less remote or urban areas, but this engagement does not necessarily relate to better health outcomes (Greiner, Li, Kawachi et al. 2004; Ziersch, Baum, Darmawan et al. 2009). This disconnect found in some research between civic structure and health could be due to these communities not being able to mobilize for health purposes due to environmental impediments (Beaudoin, Wendel and Drake 2014).

Civic Structure and Ancestry

Despite years of ethnic assimilation, and fears by early sociologists, such as Karl Marx (1983), Max Weber (2002), Ferdinand Tönnies ([1887] 2001) and Emile Durkheim (1979; 1951) about how a rationalized society would hinder social connections, some aspects of the old world remain through ancestral ties (Greeley and McCready 1974). Greeley and McCready (1974:18, 26-27) argue that ancestry "is a form of Gemeinschaft that has survived in a rationalized, bureaucratized society." Research shows that Americans take on particular characteristics of

their ancestral origins (Alba 1990; Cross, Jackson-Smith and Barham 2000; Greeley 1974; Greeley and McCready 1974; Rothenberg and Licht 1982; Waters 1990). Rice and Feldman (1997:1159-1162) found that descendants of European immigrants retain their culture and civic structure even generations later, suggesting that such characteristics are durable and carry on.

Research shows that areas with higher proportions of certain European ancestries have more civic structure than others. Studies have found that areas with more Nordic ancestries are have higher levels of civic structure when compared to other ancestries (Besser 2011; Greeley 1974). Some studies have found that areas with greater densities of English and German ancestries have similar civic structure (Greeley and McCready 1974; Rice and Feldman 1997). Civic structure for Irish ancestries can vary widely depending if they are Catholic (high civic structure) or Protestant (low civic structure) (Greeley and McCready 1974). Other studies have found that the civic culture for Irish ancestry to be somewhat in the same realm as German and English ancestries (Rice and Feldman 1997; Rice and Ling 2002).

Studies have also examined whether living among certain ancestries is associated with civic structure. Ethnic cultural influences may not be known by the people living there (Greeley 1974; Waters 1990). In the United States, areas inhabited by people whose ancestors were from Nordic countries have more civic structure when compared to those areas with fewer concentrations (Besser 2011; Putnam 2000; Rice and Ling 2002).

The potential reasons to explain the association between ancestry and civic structure is not fully known. The life chances of certain European ancestries varied a century ago, but these variations now have largely diminished (Alba 1990; Waters 1990). Research has found that people with knowledge of their ancestral background is tied to socioeconomic status or stable conditions in the home (Lieberson and Waters 1986; Smith 1980; Waters 1990), including

generational degrees of separation from country of origin and age (Alba 1990). In other words, ancestral identity strengthens with better income, education and age. In fact, studies have found that identifying as "American," has been associated with lower socioeconomic status and family structure instability (Lieberson 1985; Waters 1990). People identifying with American is the second most common response in most Southern states (Alexander and Berry 2010), an area with greater economic disparities when compared to other parts of the country. These findings lead to important questions. Can socioeconomic status or where people live explain away the association between civic structure and ethnic ties? Not necessarily. Greeley and McCready (1974) note that political participation, either through voting, campaigning and other activities in general changes only a little among several ethnicities when region and social class are controlled. Other research also suggests that ethnicity is more important for gauging civic-related activities than socioeconomic status (Nelson 1979; Rothenberg and Licht 1982; Wilson and Banfield 1964).

In some regions of the United States, county ethnic cohesion could develop "community sensibility and, in turn, civic organization" (Gutmann and Pullum 1999:760). Culture within an ethnic group can be very important and be a "decisive factor in social cohesion" even within areas with income inequality (Kliksberg 1999:88). Therefore, ancestry after all these years still appears to be relevant.

Ethnic Density

Another potential explanation for the creation of civic structure and health outcomes could be ethnic density. Ethnic density can be defined simply as areas with a higher concentration of people of their own ethnic group (Becares 2013). This parallel area of research alongside civic structure and health has found that areas with a greater composition of a particular ethnic/racial minority group to be associated with better mental or physical health

using community level (Fang et al. 1998; Halpern 1993; Neeleman and Wessely 1999), individual level or multi-level methods (Franzini and Spears 2003; Pickett, Shaw, Atkin et al. 2009). This phenomena is called the "ethnic density effect" (Halpern 1993). Elements of civic structure have been suggested as the underlying mechanism of ethnic density for providing positive health outcomes (Smaje 1995). Specifically, Smaje (1995:256) describes a community that has patterns of "residence, economic activity, kinship relations, social interaction and religious worship" to enable a "self-consciously realized community." Ethnic density research has been largely limited to minority groups.

In more recent years, researchers have made attempts to understand the underlying mechanisms between ethnic density and health. Mental health studies have looked into trust or community satisfaction, a cognitive form of social capital (Becares 2013; Hong, Zhang and Walton 2014). These studies found weak or no support for social capital as an underlying mechanism and were limited to an individual-level of focus. However, research to date has not fully evaluated ethnic density in relationship to civic structure or European ancestries.

The ethnic density and health research focus does have unknowns and contradictory findings. Research shows that the positive health benefits associated with ethnic/racial density are not consistent across ethnic groups (Becares, Nazroo and Stafford 2009; Hong et al. 2014; Pickett et al. 2009). Other studies have either found no ethnic density effect on health for ethnic minority groups (Karlsen, Nazroo and Stephenson 2002) or worse health outcomes in some situations (McLaughlin and Stokes 2002). In fact there is substantial research showing that health inequalities are worse for minorities due to environmental and economic disparities, including racial discrimination or segregation (Acevedo-Garcia 2001; Acevedo-Garcia, Lochner, Osypuk et al. 2003; Braveman, Egerter and Williams 2011; Collins and Williams 1999; Shaw,

Dorling and Smith 1999; Subramanian, Acevedo-Garcia and Osypuk 2005; Williams and Collins 1995) and uneven health care delivery (Barr 2008; Geiger 2006). Lastly, Pickett and Wilkinson (2008) point out that more research is needed to understand the connections between ethnic density and health given much remains unknown about the ethnic density that is required, the unit of analysis or the underlying mechanisms that bind ethnic density and health together.

Homogeneity

Homogeneity has been extensively studied and found to be associated with civic structure in some situations. As it relates to Nordic exceptionalism, some researchers suspect the higher levels of civic structure is due in part to ethnic homogeneity (Besser 2011; Delhey and Newton 2005). Research into heterogeneity appears to follow two tracks; diversity can either assist in reducing conflict or suspicion, or it causes it to continue (Rice and Steele 2001), which can then either increase or thwart civic structure (Alesina and Ferrara 2000; Coffé and Geys 2006; Rupasingha et al. 2006). Alesina and Ferrara (2000) found that community diversity was related to lower participation in social activities, such as participation in associations or groups. Although they do note that nationality groups were positively associated with community diversity, suggesting people in those areas want to preserve their cultural backgrounds. Rupasingha et al. (2006) confirm these findings using civic structure as a measure and note that civic structure is higher in regions that have homogeneous populations. Both Alesina and Ferrara (2000) and Rupasingha et al. (2006) measured diversity by creating a fragmentation index that includes the share of the population that self-identified race (White, Black, Asian, Pacific Islander, American Indian, and other).

Civic structure also appears dampened in communities when there is white ancestral diversity as well. Past research makes clear that people remain tied to their ancestral

backgrounds (Alba 1990). Given this, Rice and Steele (2001) wanted to know if white ancestral diversity in small towns could be related to civic structure. They found that white ancestral diversity was associated with lower levels of civic structure.

Historical Ancestry Review

Many European ancestries settled in different parts of the United States, and mapping reveals that for the most part their descendants remain in those areas. For many immigrants, they "looked for ways to reconnect and maintain their ties with their past" (Walch 1994:175). To better understand these ancestral ties, the following section will outline basic time periods when European ancestries settled in the United States, unique ethnic characteristics, and the geographic areas they lived in. Although this section is not to be considered an exhaustive historical biography of all European ancestries, attempts are made to include those ancestries that came in particularly large numbers, moved to non-metro counties, and had the potential to influence the culture of certain areas.

European ancestry

Immigration to the United States from Europe occurred in waves or during specific time frames. Between 1841 and 1890, roughly two-thirds of immigrants to the United States came from Northern/Western Europe. Then from 1891 to 1920, a majority of immigration occurred from Southern/Eastern Europe. Northern/Western Europe again had the most immigrants to the United States from 1921 to 1960. Not until after 1970 did Europe no longer represent the larger proportion of immigration (American History 2006).

Between 1820 and 1930, over 37 million people immigrated to the United States (Dinnerstein and Reimers 2009). During this time period most immigrants were from Germany (5,947,883), Italy (4,751,311), Ireland (4,579,182), England, Scotland, Wales (4,225,812),

Austro-Hungary (4,279,285), Russia, Baltic States (3,370,427) and Scandinavia (2,343,667). In the years between 1854 and 1892, Germans had the largest immigration numbers for "all but three" of those years (2009:27).

Although there are certain to be deviations to where immigrants from Europe settled, heavier concentrations of certain ancestries can be found in specific geographical areas. Many German and Scandinavian Protestants and Catholics settled in the north central (Great Plains) region. Irish Protestants settled mostly in the South (west south-central) and Irish Catholics settled in the Northeast and Mid-Atlantic areas. The English were a little more evenly distributed across the United States (Greeley and McCready 1974), and sought employment in "all phases of the U.S. economy." In general, the larger fluxes of immigration from Europe did not move to the Southern region of the United States because they feared they would need to compete for work due to slavery, although some Germans and Irish did settle there (Dinnerstein and Reimers 2009).

Some ancestries were more inclined to seek rural areas than others. Irish Catholics gravitated toward urban areas, particularly the Northeast (Daniels 1990; Fischetti 2000; Greeley and McCready 1974). Irish often worked on infrastructure projects in urban areas, but also moved west for railroad construction (Daniels 1990). German and Scandinavian ancestries were more inclined to move to the Mid/Upper Midwest (Dinnerstein and Reimers 2009; Lichter 2012; Walch 1994). For many of these immigrants, the ultimate goal was farm ownership and being farm laborers helped generate the funds needed to purchase their own farms. They moved to rural areas despite the potential for industrial income in larger urban areas (Gates 1960).

Some of these ancestries were less migratory than others. For example, Germans and Scandinavians once settled were less likely to move compared to the Irish or English (British)

(Gutmann and Pullum 1999). Cross et al. (2000) highlights the work of Gerlach (1992) and Zeitlin (1977) who find that farmers of British ancestry viewed land more of an asset to be sold, whereas Germans viewed farms as a way of life, an entity to remain in the family over generations. More recent research has found that these ancestry differences toward agriculture can still be found in Wisconsin highlighting the fact that ancestry has staying power in rural areas (Cross et al. 2000).

Certain ancestries also were quicker to assimilate to American ways of life than others. Education, religion and newspapers were avenues where ethnicities sought to preserve their traditions. For example, Germans and Scandinavians established schools where native language was used instead of English (Dinnerstein and Reimers 2009). In several Midwestern states, laws either required or ensured German to be taught in schools when the community requested it (Daniels 1990; Ramsey 2002). Until World War I, "less than one/third of all the parochial schools" in Minnesota actually gave instruction in English (Dinnerstein and Reimers 2009:50).

The Lutheran faith is also "pervasive and persistent" for Scandinavian descendants (2009:53). In Sweden, it was customary for pastors to perform "annual intelligence evaluation" to ensure that parishioners had a certain level of "literacy and general knowledge" (Daniels 1990:166). Not surprisingly then, Swedish and Norwegian descendants established a large number of Lutheran affiliated colleges. Dinnerstein and Reimers (2009:53) notes that in 1934 two-thirds of "all Protestant church members in Minnesota, Wisconsin, and the Dakotas still identified themselves as Lutherans.

The press was also used by several ancestries to provide information in their native languages. Over 750 newspapers in German could be found across the United States around the year 1900. Of these, 64 German papers could be found in the Dakotas (Dinnerstein and Reimers

2009). Norwegian-Americans created over 800 types of publications (Daniels 1990). This enabled information on current events and culture to be disseminated without having to assimilate fully to American ways of life.

CHAPTER 4:

RESEARCH DESIGN

This research design will assess the degree to which civic structure and ancestry are associated with health. More specifically, this study will control for county demographic/economic structure and the food/exercise environment to: (1) determine if civic structure is related to health; (2) if the density of certain European ancestries are associated with civic structure; and (3) if population density of civically inclined ancestries or ethnic density itself is related to better health outcomes. Counties with greater population densities of particular ancestries that appear positive and statistically significant with civic structure will be deemed "civically-inclined ancestries." The unit of analysis will be at the county-level for the 3,107 counties in the lower 48 states of the United States. The county-level is chosen because research shows that larger areas of analysis may not fully capture the association between health and ethnic density (Franzini and Spears 2003; Halpern 1993). The county has also been characterized as a unit large enough to conduct meaningful health analysis (McLaughlin et al. 2001).

This study will evaluate civic structure, ancestry and health from two time periods. The first examination will cover roughly the 2000 to 2005 time period, whereas the second examination will cover approximately the 2006 to 2010 time period. These time periods were chosen for several reasons. The last U.S. Census to include ancestry related questions was in 2000, whereas the next available time period to include all U.S. county ancestry information was through the American Community Survey for the years 2006-2010. The earliest publically available data from the Centers for Disease Control and Prevention including all U.S. county-level obesity and diabetes diagnoses was 2004. The years 2006-2012 were the only time period

available for self-reported health. Publically available data for civic structure where comparisons could be made was 2005 and 2009. Given this, two time periods were created. The two time periods will provide another check to ensure measures are reliable, even over time, and also contributes to further research into ancestry given differences exist in the methodology of how self-reported ancestry was collected in 2000 compared to later points in time (see below).

The data will also be examined by county population density. Analysis will evaluate all counties nationally and all non-metro counties. The Economic Research Service (ERS) groups metropolitan counties by the density of their metro area, whereas nonmetropolitan counties are classified by population size and whether or not they are adjacent to metro areas (ERS 2014d). A verbatim description of ERS' rural-urban continuum non-metro codes are as follows: (4) urban population of 20,000 or more, adjacent to a metro area; (5) urban population of 20,000 or more, not adjacent to a metro area; (6) urban population of 2,500 to 19,999, adjacent to a metro area; (7) urban population of 2,500 to 19,999, not adjacent to a metro area; (8) completely rural or less than 2,500 urban population, adjacent to a metro area; and, (9) completely rural or less than 2,500 urban population, not adjacent to a metro area (ERS 2014d). This study will include analysis of non-metro counties, which are those counties designated as ERS codes 4-9.

Data for ancestry in more recent years is only derived from the American Community Survey, and is no longer available in the decennial censuses (U.S. Census Bureau 2014b). Some caution is warranted given there were a higher number of missing ancestry answers in 2000, than with American Community Survey 2006-2010 time period. The response rate differences could result in differing distributions between the two datasets (U.S. Census Bureau 2014a). However, mapping reveals very little variation of county ancestries when comparing the year 2000 and the

2006-2010 time period. Past research comparing the American Community Survey and the 2000 Decennial Census reveal that the two data sources are generally in agreement (Gage 2006).

The 2000 U.S. Decennial Census and American Community Survey provide numerous European ancestries. Additionally, several ancestries, including different races may have very low concentrations in any county across the United States. To resolve this, three criteria were developed and used to assist in narrowing down the number of available ancestries. To be included in the analysis, an ancestry needed to be among the five largest ancestries in the United States and have a concentration of at least 35 percent or more in multiple counties and states in either of the 2000 and 2006-2012 time periods. Additionally, mapping needed to show a concentration of an ancestry in an area where there were either high or low percentages of county good health, obesity and diabetes diagnoses.

Thirty-five percent was used as an ancestry cut-off point for several reasons. Mapping revealed that very few ancestries had concentrations of 50 percent or more in a county, with the exception of German, Norwegian, and American. Yet, even counties with an ancestry that reached 50 percent or more in density were few in number. In most cases, mapping revealed that ancestries with 35 percent or more in concentration represented a larger number of counties and located across regional areas, not just a few isolated spots in the United States. The following ancestries met the criteria outlined above and were chosen for analysis: American, English, German, Irish, and Norwegian. Although these ancestries were chosen for analysis, it is not intended for findings to be generalized to other European ancestries, nor to other ethnicities or races not covered in the analysis.

African-American and Hispanic/Latino origin are used as control variables. Race data were taken from the 2000 Decennial Census (U.S. Census Bureau 2000c) and 2006-2010

American Community Survey (U.S. Census Bureau 2006-2010c). Race alone was used for analysis and did not include categories that provided mixed race. Hispanic/Latino origin was used and could represent any race. African-American and Hispanic/Latino origin are used instead of one of the ancestry measures given the large discrepancy between people who answered the race question compared to the ancestry question. For example, the Census Bureau indicates that in 2000 roughly 12 million fewer people selected African-American on the ancestry question compared to the race question. Further, two million fewer people indicated "Mexican" than specified as Hispanic Origin (U.S. Census Bureau 2000a). Mapping also shows very little variation when using individual African or Hispanic ancestry data.

Data

The data included for analysis come from several publically available sources such as the 2000 Decennial SF3 Sample Data ancestry file from the U.S. Census Bureau (U.S. Census Bureau 2000b) and 2006-2010 American Community Survey 5-year estimates (U.S. Census Bureau 2006-2010f); Centers for Disease Control and Prevention's Obesity and Diabetes Estimates for 2004-2010 (Centers for Disease Control and Prevention 2004-2010a; Centers for Disease Control and Prevention 2004-2010b); Rupasingha and Goetz (2008) index for the years 2005 and 2009; Catlin, Remington and Dijk (2013) County Health Rankings for 2006-2012; and the Economic Research Service's Environmental Food Atlas (2006-2012) (Economic Research Service 2014b). The data sources and time frames were chosen based on the availability of existing publically available data and to ensure measures were within roughly 5 to 6 years of each other.

Measures

Health Outcomes

The dependent variables for this study include the percent of adults in a county reporting a body mass index (BMI)≥30 (obesity), percent of adults reporting a diagnosis of diabetes, and the percent of the population reporting excellent, very good or good health (referred as good health going forward) (aged-adjusted) (Table 1). Obesity and diabetes were estimated from the Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS), which a continuous survey of the adult population's personal health behavior in the United States for over the past 30 years (Centers for Disease Control and Prevention 2014a). Surveys are administered by state health departments in respondent's homes or by telephone using Random Digit Dialing (RDD) for both cellphones and landline phones (Centers for Disease Control and Prevention 2014b).

Obesity estimates and diabetes diagnoses are obtained in different ways. County level diabetes estimates for 2004 were developed from three years of data (2003, 2004 and 2005) and (2009, 2010, and 2011) for the year 2010 for adults 20 years of age or older. Percent county diabetes diagnoses is measured as the number of people in a county told by a doctor they have diabetes divided by the total number of county residents (Table 1). County-level obesity was determined by respondents self-reporting their weight and height, using the following formula: weight (lbs)/[height (inches)]^2 X 703 (CDC 2015). For example, an individual who is 5' 9" and 203 pounds or more would be considered obese. Pregnant respondents are excluded. Percent-county obese is calculated as the number of people in a county with a body mass index of 30 or more out of the total number of county residents. County estimates were drawn from roughly

3,200 counties in all 50 states utilizing the modern small area estimation technique (Centers for Disease Control and Prevention 2014a).

The percentage of a county self-reporting good health came from the University of Wisconsin Population Health Institute's County Health Rankings (Catlin et al. 2013)(Table 1). They derive the percent of the population reporting self-reported health from the Behavioral Risk Factor Surveillance System (BRFSS) during the 2006-2012 time period (Catlin et al. 2013). This data was already adjusted for age, meaning analysis was conducted on it to enable communities with differing ages to be more easily compared, especially across years and geographical regions.

The BRFSS asks respondents to rate their health ranging from excellent, very good, good, fair and poor. The University of Wisconsin's County Health Rankings dataset includes only county-level fair and poor health. In other words, the number of respondents in a county self-reporting fair and poor health is divided by the total number of county residents. However, to better understand where pockets of excellent, very good or good health is located in the United States and allow easier interpretation of regression analysis, county-level percentage of fair and poor health was subtracted from 100 percent to derive a percent value for county-level good health.

Self-rated health has been cited as a reliable measure of overall personal health (Ferraro, Farmer and Wybraniec 1997). Further, self-reported health is also an important predictor of mortality (Idler and Benyamini 1997). Studies evaluating the BRFSS find that the data are valid and reliable (Pierannunzi, Hu and Balluz 2013).

Table 1. Health Outcomes

Variables	Survey Questions
Percent of county reporting excellent, very good and good health (Catlin et al. 2013; Centers for Disease Control and Prevention 2004)	Would you say that in general your health is— 1 Excellent 2 Very good 3 Good 4 Fair 5 Poor
Percent of county adults reporting a body mass index of ≥30 (obesity) (Centers for Disease Control and Prevention 2004-2010b)	About how much do you weigh without shoes? About how tall are you without shoes?
Percent of county adults reporting a diabetes diagnosis (Centers for Disease Control and Prevention 2004-2010a)	Has a doctor ever told you that you have diabetes? 1 Yes 2 Yes, but female told only during pregnancy 3 No 4 No, pre-diabetes or borderline diabetes

Civic Structure and Ancestry

Civic structure is measured using the Rupasingha and Goetz (2008) index. This index was created using the U.S. Census Bureau's County Business Patterns to determine the number of civic, religious, business, political, professional, labor and recreational organizations and facilities per 10,000 people in each county in 2005 and also in 2009 (Table 2). Additionally, the index for 2009 included county-level decennial census response rate in 2010, voter turnout in 2008, and the number of non-profit organizations per 10,000 people in 2009 collected from the National Center for Charitable Statistics (Rupasingha et al. 2006). The same method was used for the 2005 time period and used 2004 voter turnout, census response rate in 2005, and the number of non-profit organizations in 2005. Rupasingha and Goetz (2008) developed the index scores by first taking an aggregate of all the associations and groups divided by the population per 10,000, then divided by 10 (first factor). The second factor is voter turnout. The third factor

is census response rate. The fourth factor is the number of non-profit organizations divided by the population per 10,000. This index (proxy for civic structure) is then developed utilizing principal component analysis using the four factors described above, with the first principal component determined to be the index of civic structure. This measure as used in this study is untransformed for normality. Factor scores from the 2005 dataset can range from a low of -3.9 (low civic structure) to a high of 5.7 (high civic structure). This measure was then developed into a dichotomous variable for analysis on health outcomes. A frequency was conducted and all values above the median was coded as 1, with everything below it coded 0 to enable easier interpretation of the hypotheses. This index has been noted to be valid and reliable for research on civic structure and health (Lee and Kim 2012).

The second variable measures individual European ancestries by taking the total number of respondents specifying a specific ancestry and dividing this value by the total number of people in a county (Table 2). The ancestry question in the U.S. Census and from American Community Surveys identifies a person's "ethnic origin, or descent, roots, or heritage or place of birth before arrival in the United States" (U.S. Census Bureau 2014b). This question could also represent simply a "memory of ancestors several generations removed from the individual" (2014b). The ancestry data used (total ancestry) allow a respondent to denote a single ancestry, or indicate one or more ancestries (U.S. Census Bureau 2007). In other words, if someone indicated Irish and German, this information would be included in the total county percentages for both Irish and German. A majority (58 percent) surveyed in 2000 gave only one ancestry, 22 percent gave two ancestries and 19 percent gave no ancestry at all (Brittingham and Cruz 2004).

Ancestry measures were developed into a categorical variable to allow insight into how the different degrees of concentration are related to civic structure and health outcomes. Several

studies have examined ethnic density by creating categorized levels of the proportion of ethnicity/race to area population (Becares et al. 2009; Karlsen et al. 2002; Pickett et al. 2009). Research has also found an association between civic structure and ethnic density (Fieldhouse and Cutts 2008). Given this, ethnic density is measured using density categories. Frequencies were conducted to evaluate the distribution of counties across ancestries. Efforts were made to have similar density categories across ancestries, although some adjustments were made for those ancestries that had a large range or small densities.

An index was developed to assess county-level homogeneity. Research finds that racial and European ancestry diversity can dampen civic structure (Alesina and Ferrara 2000; Coffé and Geys 2006; Rice and Steele 2001; Rupasingha et al. 2006). Other research has found that homogeneity/segregation to be associated with negative health outcomes (Collins and Williams 1999; McLaughlin and Stokes 2002; Subramanian et al. 2005). As such, an index was used to measure the degree of homogeneity in a county by combining self-identified race, Hispanic/Latino origin and European ancestry from the 2000 U.S. Census and the American Community Survey, 2006-2010 into one county-level index ranging from 0 (homogenous) to 1 (heterogeneous). Roughly following a process outlined by Alesina and Ferrara (2000), Rupasingha et al. (2006) and Rice and Steele (2001), a diversity index was developed using the following formula:

$\text{Diversity}_i = 1 - \sum_k s_{ki}^2$

For ancestry, the subscript i represents the county. The subscript k represents the following ancestries: German, Dutch, English, French, French Canadian, Irish, Italian, Norwegian, Polish, Scots Irish, Scottish, Swedish, and Danish. The ancestry variable "American" was included in the equation given the large percentages that were found in Kentucky, West Virginia and

Tennessee during the mapping of variables. To determine which ancestries should be included in the equation, this study followed a different process for preparing the variables for analysis than conducted by Alesina and Ferrara (2000) or Rice and Steele (2001). A frequency was conducted of all of the self-reported ancestries. Any ancestry that reached a mean of approximately 1 nationally was included into the equation. In almost all cases a mean of 1 nationally indicated that one or more counties had a concentration of an ancestry in a county somewhere in the United States. This was done to ensure that even ancestries that had a low national mean, but high density within a few counties or pocket of counties in a state were included.

The subscript k also represents race and Hispanic/Latino origin. Race includes: (1) African American, (2), American Indian or Alaska Native, (3) Asian, (4) Native Hawaiian or Island Pacific, and (5) Hispanic/Latino (of any race). White was not included in the equation given European ancestries were already included the equation. Preliminary analysis shows that whether ancestry diversity or racial diversity are calculated separately or together in the index, the associations with civic structure are similar. Further, mapping of the index found that homogeneity in the upper Midwest (Norwegian and German ancestry), the Southeast (African-American), and the Southwest (Hispanic/Latino origin), look the same whether mapped together or separately. For purposes of this study, the equation includes European ancestry, race and Hispanic/Latino origin.

Table 2. Civic Structure and Ancestry

Variables	Survey Questions
County-level civic structure factor scores; 2005 and 2009 (Rupasingha and Goetz 2008) High=1	Not Applicable
Proportion of ancestry in county 2000 (U.S. Census Bureau 2000b; U.S. Census Bureau 2000c) and 2006-2010 (U.S. Census Bureau 2006-2010c; U.S. Census Bureau 2006-2010f)	What is this person's ancestry or ethnic origin? *(For example: Italian, Jamaican, African Am., Cambodian,Cape Verdean, Norwegian, Dominican, French Canadian,Haitian, Korean, Lebanese, Polish, Nigerian, Mexican,Taiwanese, Ukrainian, and so on.)*
Diversity Index, 2000 and 2006-2010 This index includes race, Hispanic origin and European ancestries.	Not Applicable

Controls

The selection of control variables for this study is largely based on existing literature, mapping, and the availability of county-level data. The organization and presentation of all data, including controls is largely based on a process established by Ahern et al. (2011). Controls are organized by health indicators, county demographic/economic structure, and food/exercise environment.

Three measures are health indicator controls. Research shows that obesity and diabetes are related to lower self-rated health (Centers for Disease Control and Prevention 2006; Mokdad et al. 2003). Further, studies point to obesity as a potential contributor to the escalation of diabetes diagnoses (CDC 2006). Research also shows that health outcomes relating to self-rated health, obesity and diabetes can be associated with smoking (Bamia et al. 2004; Chiolero et al. 2008; Houston et al. 2006). Ahern et al. (2011) used obesity and diabetes as controls for their study of the food environment and mortality. Additionally, Ahern et al. used obesity as a control

for their work on diabetes. They also used county-level smoking rates as a control as well. Other studies have used smoking as a control for self-rated health (Kawachi et al. 1999; Subramanian, Kawachi and Kennedy 2001). Following Ahern (2011), obesity is used as a control for county-level diabetes diagnoses, and both obesity and diabetes are used as controls for self-rated health. County-level smoking is measured using data from the University of Wisconsin's County-Health Rankings compilation of CDC's Behavioral Risk Factor Surveillance System data. The BRFSS provides information on the percent of adults who report smoking less than 100 cigarettes in their entire life and currently smoking during the 2006-2012 time period (Catlin et al. 2013). A separate analysis and discussion of the results using county-level smoking as a control will occur on page 102.

Twelve controls fall under the general category of county demographic/economic structure, such as educational attainment, median household income, unemployment, health insurance coverage, residential stability, mean travel time to work, age (65 years of age or older), percent female, percent married, percent Black/African-American, percent Hispanic/Latino origin, Hispanic/Latino county population change (Table 3). Following Rupasingha et al. (2006) educational attainment is measured as the percent of county population 25 years of age or older who are high school graduates or higher (U.S. Census Bureau 2000e; U.S. Census Bureau 2006-2010e). Following Morton (2003) median household income is used to assess county economic well-being. The unemployment rate is an indicator of poor economic conditions in an area (Yang et al. 2011). County-level unemployment rate (annual average) is calculated as the ratio of unemployed to the civilian labor force for the years 2000 and 2010 (U.S. Bureau of Labor Statistics 2000;2010). The lack of health insurance is often a hurdle for appropriate health diagnosis and care, specifically in rural areas (Bennett 2008). Health insurance coverage is

measured as the percent of the population under 65 years of age without health insurance in 2011 (Catlin et al. 2013).

County residential stability and lengthy commuting times that go beyond average may have health implications. Migration may have a negative relationship with interpersonal contacts within a community (Glaeser, Laibson and Sacerdote 2000) and less residential stability may hinder civic activity (Rupasingha et al. 2006). Residential stability is measured as the percent of people within a county who lived in their residence and did not move between 1995 and 2000 (U.S. Census Bureau 2000e). Urban sprawl or commuting has been found to be related to increased odds of obesity (Frank et al. 2004; Kim et al. 2006), which can lead to poor health outcomes given less time is allocated to exercise (Christian 2012). Commuting is measured using mean county travel time to work (in minutes)(U.S. Census Bureau 2000d; U.S. Census Bureau 2006-2010d).

County demographic/economic measures also can reflect differing health outcomes. Research has shown that older people have higher levels of civic engagement (Putnam 1995), but have greater challenges accessing healthy food especially when they no longer can drive (Bitto et al. 2003). Morton, Worthen and Weatherspoon (2004) cite the work of Tarasuk and Beaton (1999) who note there are 1.1 million households with a member 65 years of age or older and food insecure. A measure for 65 years of age or older is included in this study for both 2000 (U.S. Census Bureau 2000c) and the 2006-2010 time period (U.S. Census Bureau 2006-2010b). Marriage has been found to be related to obesity (Chou et al. 2004) and is measured as the percent of married people among all people in a county (U.S. Census Bureau 2000e; U.S. Census Bureau 2006-2010a). Percent county married was developed into a dichotomous variable with all values above the median coded as 1 and all values below the median coded as 0. The female

gender is related to higher levels of obesity (Chou et al. 2004; Rooney and Schauberger 2002; Swinburn et al. 2004). Percent female is derived from the U.S. Census Bureau in 2000 and the American Community Survey for the 2005-2009 time-period (Bureau 2005-2009; U.S. Census Bureau 2000c). The 2005-2009 time period was used over 2006-2010 due to a large amount of missing data, which would have substantially reduced the overall sample size when regressed with the other measures. Percent female was developed into a dichotomous variable with all values above the median coded as 1.

Obesity has been found to be associated with particular ethnic/racial origins. African-Americans have the highest prevalence of obesity and diabetes compared to all other races (Mokdad et al. 2003). Given this, African-Americans are measured as the percentage of Blacks among all county residents (U.S. Census Bureau 2000c; U.S. Census Bureau 2006-2010c). Compared to white ethnic groups, Hispanics have a higher prevalence of obesity and diabetes (Mokdad et al. 2003). Hispanic origin is one of the fastest growing population groups in the United States, particularly in rural areas (Parrado and Kandel 2010). One study in particular suggests that racial/ethnic changes will increase obesity until about 2014, "after which time subsequent composition changes are forecasted to decrease obesity" (Baum 2007:702). Given this, the proportional percent county change in Hispanic/Latinos is measured from 2000 to 2010 (U.S. Census Bureau 2000c; U.S. Census Bureau 2006-2010b). This was done by taking the percentage of Hispanic/Latino origin out of all county residents in both 2000 and 2010 and then calculating the percent change. This variable was this developed into a dichotomous variable with all values above the median coded as 1. Additionally, Hispanic/Latino origin is measured as the number of people self-reporting Hispanic/Latino origin divided by the total number of county residents (U.S. Census Bureau 2000c; U.S. Census Bureau 2006-2010b).

The food environment has been found to be related to obesity/diabetes. Controls for measuring the food environment are largely based on a study by Ahern et al. (2011) and use measures from the Economic Research Services' Environmental Food Atlas (ERS 2014a) (Table 3). Food security and health can be tied to owning a vehicle and proximity to a grocery store (Kaufman 1999). Ahern et al. (2011) found that not owning a car and living a long distance from a large grocery store or supermarket to be related to obesity and diabetes. Car access/grocery store access is measured as the percent of county housing units who have no car and are more than one mile from a supermarket or large grocery store in 2010 (Economic Research Service 2014b). In general, research finds that the density/proximity of fast-food restaurants or convenience stores to be associated with higher obesity/body mass index (Chen et al. 2009; Chou et al. 2004; Currie et al. 2010; Maddock 2004; Mehta and Chang 2008; Morland and Evenson 2009; Morland et al. 2006; Powell et al. 2007; Spence et al. 2009), including diabetes (CCPHA 2008; Salois 2012). Fast food restaurants and convenience stores are measured as the number of such establishments per 1000 county residents (Economic Research Service 2014b). Research shows that limited availability of farmers' markets, supermarkets or exercise/recreational facilities may be a risk factor for poor health outcomes (Chen et al. 2009; Jilcott et al. 2013; Jilcott et al. 2011; Kaufman 1999). Given this, farmers' markets, grocery store/supermarkets and recreational areas are measured as the number of such establishments/areas per 1000 county residents (Economic Research Service 2014b). With the exception of the measure percent no car/access to grocery store, frequencies were run on all of the food/exercise environment variables. Values that fell above the median were codes as 1, and all values below the median were coded as 0.

Table 3. Control Variables

Variables	Survey Questions (based on 2000 census)
Health Indicators	
Percent of adults in a county who report smoking less than 100 cigarettes in their entire life and currently smoking during the 2006-2012 time period (Catlin et al. 2013)	Have you smoked at least 100 cigarettes in your entire life? 1 Yes 2 No 7 Don't know / Not sure 9 Refused Do you now smoke cigarettes every day, some days, or not at all? 1 Every day 2 Some days 3 Not at all 7 Don't know / Not sure 9 Refused
County Demographic/Economic Structure	
Percent of county 25 years or older who are high school graduates or higher 2006-2010 (U.S. Census Bureau 2006-2010e) and 2000 (Rupasingha et al. 2006; U.S. Census Bureau 2000e).	What is the highest degree or level of school this person has COMPLETED? Mark ONE box. If currently enrolled, mark the previous grade or highest degree received. No schooling completed, Nursery school to 4th grade, 5th grade or 6th grade, 7th grade or 8th grade, 9th grade, 10th grade, 11th grade,. Some college credit, but less than 1 year 12th grade, NO DIPLOMA HIGH SCHOOL GRADUATE — high school DIPLOMA or the equivalent (for example: GED) 1 or more years of college, no degree Associate degree (for example: AA, AS) Bachelor's degree (for example: BA, AB, BS) Master's degree (for example: MA, MS, MEng, MEd, MSW, MBA) Professional degree (for example: MD, DDS, DVM, LLB, JD) Doctorate degree (for example: PhD, EdD)

Table 3. (continued)

Median county household income in 1999 (U.S. Census Bureau 2000d) and 2006-2010 (U.S. Census Bureau 2006-2010d).	INCOME IN 1999 — Mark the "Yes" box for each income source received during 1999 and enter the total amount received during 1999 to a maximum of $999,999. Mark the "No" box if the income source was not received. If net income was a loss, enter the amount and mark the "Loss" box next to the dollar amount. For income received jointly, report, if possible, the appropriate share for each person; otherwise, report the whole amount for only one person and mark the "No" box for the other person. If exact amount is not known, please give best estimate. Wages, salary, commissions, bonuses, or tips from all jobs — Report amount before deductions for taxes, bonds, dues, or other items. 1. Yes Annual Amount (dollars) 2. No
Percent of county population unemployed and looking for work (Kim, Baum, Ganz et al. 2011; U.S. Bureau of Labor Statistics 2000;2010)	
Percent of county population under 65 years old without health insurance in 2011 (Catlin et al. 2013)	Not applicable
Percent of county with same residence between 1995-2000(U.S. Census Bureau 2000e).	Did this person live in this house or apartment 5 years ago (on April 1, 1995)? Person is under 5 years old Yes, this house No, outside the United States — *Print name of foreign country, or Puerto Rico, Guam, etc.*
County mean travel time to work(U.S. Census Bureau 2000d; U.S. Census Bureau 2006-2010d)	How many minutes did it usually take this person to get from home to work LAST WEEK? 1. Minutes
Percent of population in county 65 years old or older in 2000 (U.S. Census Bureau 2000c) and 2006-2010(U.S. Census Bureau 2006-2010b).	2000: What is this person's age and what is this person's date of birth? 1. Age on April 1, 2000 2. Month, Day, Year of Birth

Table 3. (continued)

Percent female in county (Bureau 2005-2009; U.S. Census Bureau 2000c) High=1	What is this person's sex? Mark ONE box. 1. Male 2. Female
Percent of county Black/African-American (U.S. Census Bureau 2000c; U.S. Census Bureau 2006-2010c)	What is this person's race? Mark one or more races to indicate what this person considers himself/herself to be. White, Black, African Am., or Negro American Indian or Alaska Native — Print name of enrolled or principal tribe. Asian Indian, Chinese, Filipino, Japanese Korean, Vietnamese, Other Asian — Print race. Native Hawaiian, Guamanian or Chamorro Samoan. Other Pacific Islander —*Print race Other Asian — Print race.* Some other race — Print race.
Percent married in county (U.S. Census Bureau 2000c; U.S. Census Bureau 2006-2010a) High=1	What is this person's marital status? Now married Widowed Divorced Separated Never married
Percent proportional Hispanic/Latino change in county from 2000 to 2010 (U.S. Census Bureau 2000c; U.S. Census Bureau 2006-2010b) High=1	Not Applicable
Percent of county Hispanic/Latino origin U.S. Census Bureau 2006-2010c)	Is this person Spanish/Hispanic/Latino? *Mark the "No" box if not Spanish/Hispanic/ Latino.* 5 Yes, Mexican, Mexican Am., Chicano Yes, Puerto Rican Yes, Cuban Yes, other Spanish/Hispanic/Latino.
Food and Exercise Environment	
Percent housing units lacking transportation and low access to a large grocery store/supermarket in 2010 (Economic Research Service 2014b)	Not applicable
Fast-food restaurants per 1000 county residents in 2007 and 2011 (Economic Research Service 2014b) High=1	Not applicable
Full-service restaurants per 1000 county residents in 2007 and 2011 (Economic Research Service 2014b) High=1	Not applicable

Table 3. (continued)

Grocery store/supermarkets per 1000 county residents (Economic Research Service 2014b) High=1	Not applicable
Convenience stores per 1000 county residents in 2007 and 2011 (Economic Research Service 2014b) High=1	Not applicable
Farmers' markets per 1000 county residents in 2009 and 2013 (Economic Research Service 2014b) High=1	Not applicable
Recreational facilities per 1000 county residents in 2007 and 2011(Economic Research Service 2014b) High=1	Not applicable

Missing Data/Outliers

Health Outcomes

Two of the three health outcome variables did not have any missing values. The 2004 and 2010 obesity and diabetes variables had zero missing values. However, the variable good health had 397 missing values (12.8 percent of 3,109 counties) fairly scattered across the United States with heavier concentrations in Texas and Illinois. Overall, missing values represent 1.4 percent of the general population in the lower 48 states. Most missing values were also more prevalent in non-metro areas. Of the 1,948 non-metro counties (ERS rural/urban continuum codes 4-9), 319, or 16 percent of values were missing. In total, missing values represent 6 percent of the non-metro population nationally. Listwise deletion was used to handle the missing values.

In Illinois, 43 counties are missing, out of 102 overall counties (42 percent). In total, missing values represent six percent of Illinois' population. Of the 102 counties, 62 are non-metro with 33 of them missing (53 percent); a third of the non-metro population. In Texas, there are 254 counties, of which 136 of them were missing (54 percent). Overall, missing values

contain 6 percent Texas' population. Of the 172 non-metro counties, 110 were missing (64 percent); roughly a third of the non-metro population.

Some outliers were identified through the use of boxplots and mapping for the variable county-level good health. Counties were considered outliers if dramatic changes across all boxplots (counties) were observed by removing a county. Counties with outliers include: Martin, Floyd, Magoffin and Owsley, Kentucky; Greene, North Carolina, Hickory and Dent, Missouri; Scott, Tennessee and Chambers, Alabama. The values for these counties were replaced with a state average.

Civic Structure

Civic structure had two missing values in 2005, and one in 2009. For both years, Broomfield County, Colorado was missing. In 2005, the other missing value was Miami-Dade County, Florida. Listwise deletion was used to handle the missing values.

Mapping and boxplots were performed to help identify outliers. Outliers were identified in the Rupasingha and Goetz index for Edgefield County, South Carolina for the years 2005 and 2009. Extreme outliers were also identified in Thomas, Nebraska, Hooker, Nebraska and San Juan, Colorado. The counties specified above were removed and replaced with a state average, which appeared more in line with surrounding counties in those states.

Controls

Mapping and boxplots identified two outliers for the variable no car access in Holmes County, Ohio and LaGrange, Indiana. Outliers were found in the variable educational attainment in 2000 in the counties La Grange, Indiana, Holmes, Ohio, Seward, Kansas and McDowell, West Virginia. These averages were removed and replaced with the state average. Outliers were also found for unemployed in 2000 and 2010. In 2000, a state average was used for the counties:

Yuma, Arizona, Presido, Texas, and Imperial, California. In 2010, these counties included Imperial, California and Yuma, Arizona. Preliminary tests identified the District of Columbia and Los Angeles County, California as exerting undue influence on the models and given this were removed from the dataset.

Assumptions and Transformations

Normality of the dependent variables was assessed using several tests. The Kolmogorov-Smirnoz test for county-level self-rated health, $D(2712)=0.15$, $p<.001$, was significantly non-normal. However, given the very large sample size this non-normal finding is not unexpected (Field 2009), and statistical significance is found in most variables within this dataset, including the independent and control variables. As such, other tests for normality such as histograms, Q-Q and P-P plots and values for skew and kurtosis are also examined.

Two of the three health outcome variables had slight kurtosis. The dependent variables diabetes 2004 and 2010 had no skew or kurtosis. The variable, good health had minor kurtosis of just over 1. Obesity 2004 and 2010 had kurtosis levels of 1.98 and 1.24 respectively, but skew levels were less than 1. Transformations on county-level obesity were conducted to improve kurtosis but all methods failed.

The histograms for good health show a fairly normal distribution. The Q-Q plot shows a fairly normal distribution with some deviation at the tails. The histograms and Q-Q plots for diabetes 2004 and 2010 show normal distributions. The histograms for obesity 2004 and 2010 reveal normal distributions; however, the Q-Q plots reveal deviation from normal.

To improve normality for obesity 2004 and 2010, these values were converted to z-scores following a process outlined by Field (2009). Field (2009) identifies extreme values that fall outside of the acceptable range for a normal distribution as those values that fall outside of 3.29.

Four values were above 3.29 and were replaced with a value three times the standard deviation plus the mean for the years 2004 and 2010. Kurtosis of 1.8 and 1.1 continued for 2004 and 2010 respectively. Q-Q plots continued to show some deviation at the tails. Histograms continued to reveal a normal distribution for both 2004 and 2010 (bimodal).

Five ancestry, race/ethnicity variables had normality concerns that needed to be addressed. Normality was assessed for each ancestry starting with those from the year 2000. The following ancestries/ethnicities that gained normality after transformation include: American (natural log), German (natural log), Irish (square root), Black/African-American (natural log), and Hispanic/Latino (natural log). The histograms for these corrected variables resembled a normal distribution.

Success was limited to address normality for two ancestries. English had positive skew and kurtosis and was corrected with a square root transformation; however, kurtosis was only improved to 2.07. Norwegian had high skew and kurtosis and was slightly improved with a natural log transformation, although 1.8 skew and 2.5 kurtosis remained after correction. A z-score transformation to address extreme outliers above 3.29 also failed to reduce skew and kurtosis, and given this, the natural log transformation as described previously was used.

To gain normality, four control variables were also corrected with natural log transformations. The natural log transformation method successfully normalized the variables median household income for the years 2000 and 2006-2010; 65 years of age and older for the 2006-2010 time period; unemployed for the 2000 and 2006-2010 time periods; and no car/access to grocery stores. Other control variables, such as percent married, percent female, and the food/exercise environment measures showed minor skew, but transformation processes failed to successfully correct it. These measures were instead developed into categorical variables.

CHAPTER 5

ANALYSIS

Several methods were used for analysis. Maps were created utilizing Tableau 8.2. Descriptive statistics and means, Bivariate Pearson correlation coefficients, and Ordinary Least Squares (OLS) multiple regression were conducted to evaluate the strength and direction of relationships between civic structure, ancestry and health outcomes for 3,107 counties and non-metro counties in the contiguous United States.

County-Level Mapping/Descriptive Statistics

Extensive mapping of the dependent, independent and control variables were conducted using Tableau 8.2. This mapping provided visual perspective and served several purposes to: (1) determine where high scores of health outcomes exist in the United States; (2) identify potential patterns or overlap between health outcomes, civic structure and county ancestry; (3) assist in the selection of individual ancestries by revealing density levels; (4) reveal county structural patterns for assisting in the selection of controls; and, (5) cleaning of the data by identifying outliers and finding where missing data concentrations exist in the dataset.

The maps below evaluate two time periods to assess change over time. Darker shaded counties indicate worse health outcomes. Darker colors indicate counties rating higher in civic structure, and a greater percentage of population for a particular ancestry.

Bar charts provide a quick visual assessment of the descriptive statistics for both the 2000 and 2006-2010 time periods. The bar charts show the contrasts between non-metro counties and the national level (x-axis). The maps and figures will be followed by the descriptive statistics tables for both the national level and non-metro counties.

Health Outcomes

Percent of County with Good Health: County aggregated self-reported good health ranged from a low of 62 percent (dark brown) to a high of almost 96 percent (light brown) (Figure 2). Lighter shaded counties indicate higher percentage of good health. Counties with a greater percentage of people reporting good health appear concentrated in the upper Midwest region of the United States, including the Northeast. In contrast, counties with a lower percentage with self-reported good health are clustered in the Southeast. Please note that the Northwest part of Texas and Illinois reflect a lower percentage of good health in comparison to surrounding areas, but this is largely due to missing data so caution is recommended for these two states (see page 46 for further information). Data

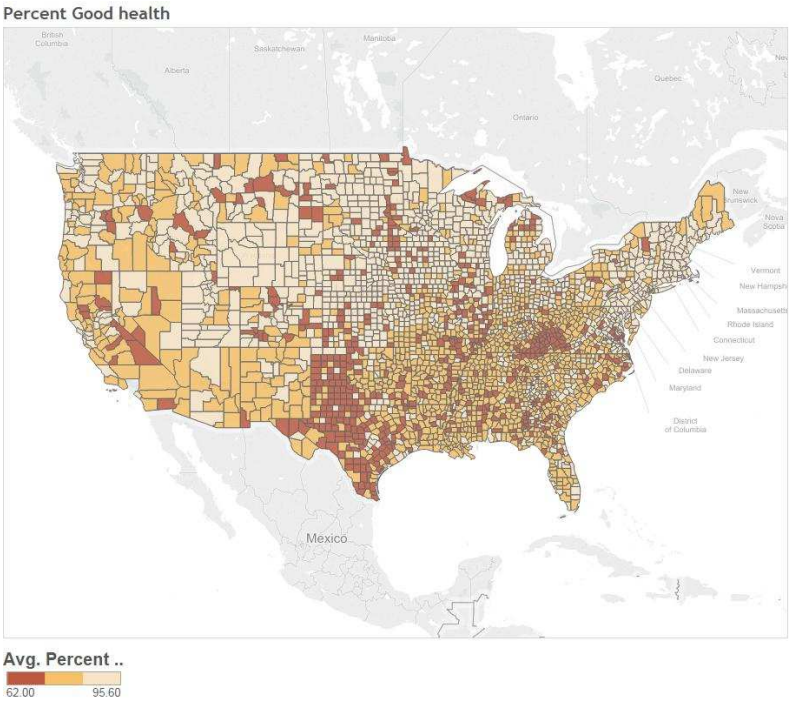

Figure 2. Percent of county with good health in the United States, 2006-2010.

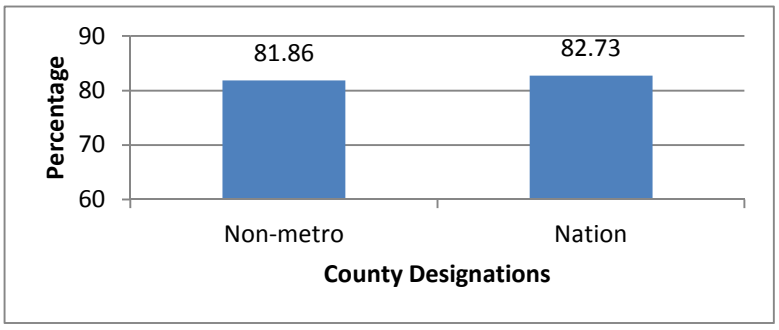

Figure 3. Percent county with good health in non-metro and all counties nationally, 2006-2012.

availability was limited to the 2006-2012 time period only.

In general, county-level self-reported good health appeared very similar across non-metro counties and all counties nationally. On average, roughly 82-83 percent of the United States reported having good health nationally and in non-metro counties (Figure 3).

Obesity: Counties with a population having a body mass index greater or equal to 30 in 2004 appear more heavily concentrated in some parts of the upper Midwest and the Southeastern region of the United States. Counties ranged from roughly 12 percent to a high of 38 percent having populations with a body mass index designated as obese (Figure 4). By 2010, counties with obesity ranged from a low of 13 percent to a high of almost 48 percent (Figure 5).

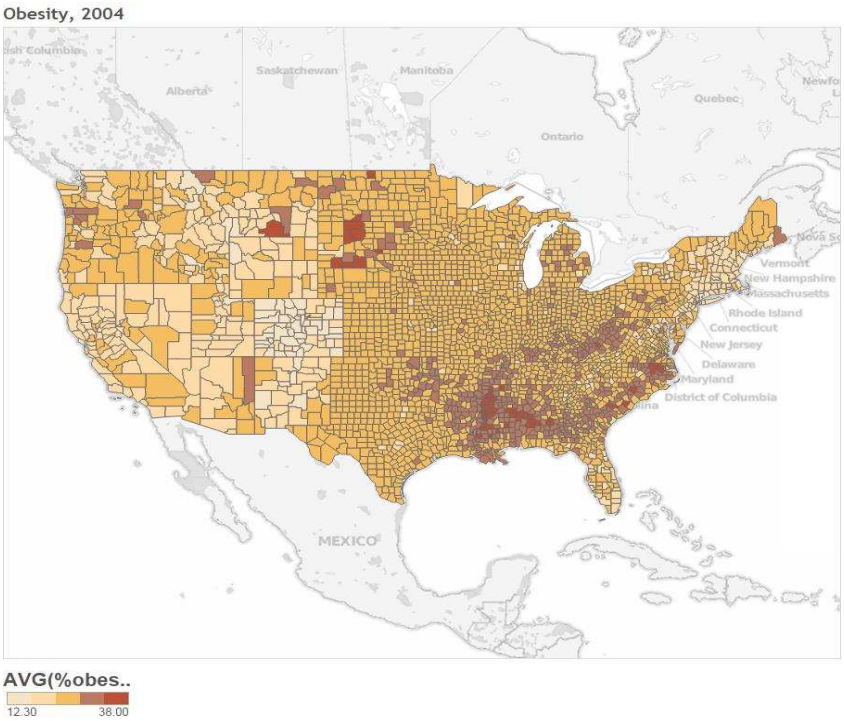

Figure 4. Percent of county with obesity nationally, 2004.

Comparison of the 2004 and 2010 maps show that obesity has increased almost uniformly across the nation with areas with heavier concentration of obesity such as in the Southeast becoming more scattered upward toward the Midwest.

In general, county obesity increased across non-metro and all counties nationally. County-level obesity in non-metro counties, including the national level increased from roughly 26 percent to just over 30 percent (Figure 6).

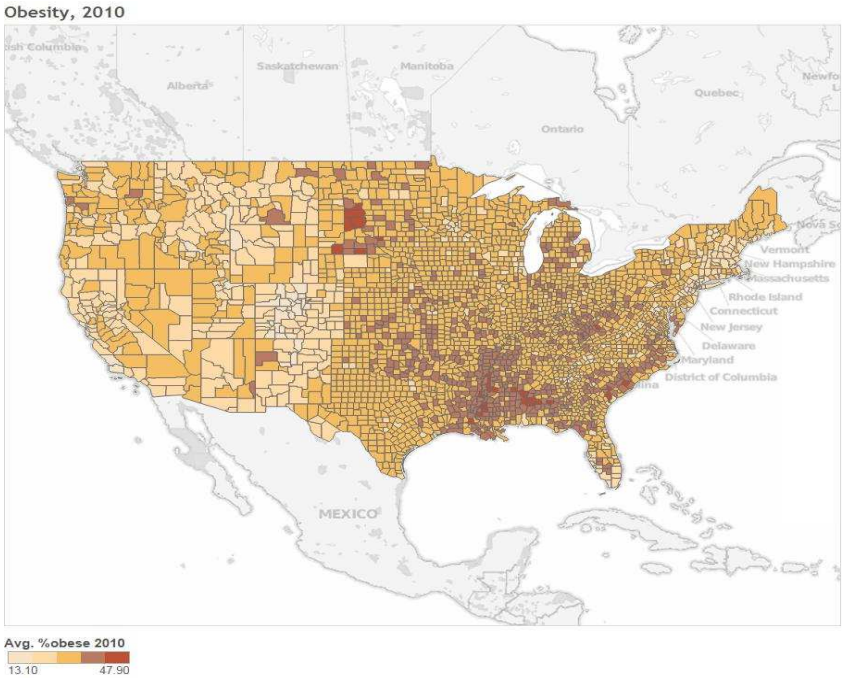

Figure 5. Percent of county with obesity nationally, 2010

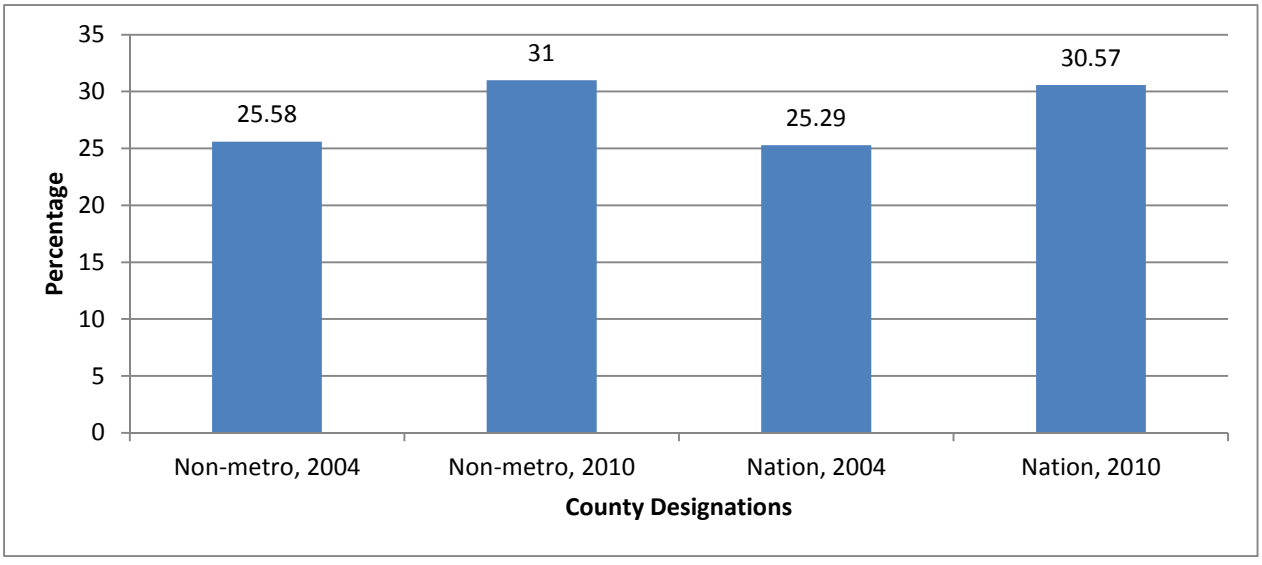

Figure 6. Percent of county with obesity in non-metro and all counties nationally, 2004 and 2010.

Diabetes: Counties with people indicating diabetes diagnoses ranged from a low of three percent to a high of roughly 15 percent in 2004 (Figure 7). In 2010, counties with a diabetes diagnoses ranged from roughly 3 percent to a high of 19 percent (Figure 8). Counties in darker color represent the high end of county diabetes diagnoses. Counties with a higher percentage of diabetes diagnoses appear to be concentrated in the Southeast region of the United States in both 2004 and 2010.

Diabetes diagnoses increased across non-metro and all counties nationally. All counties nationwide with

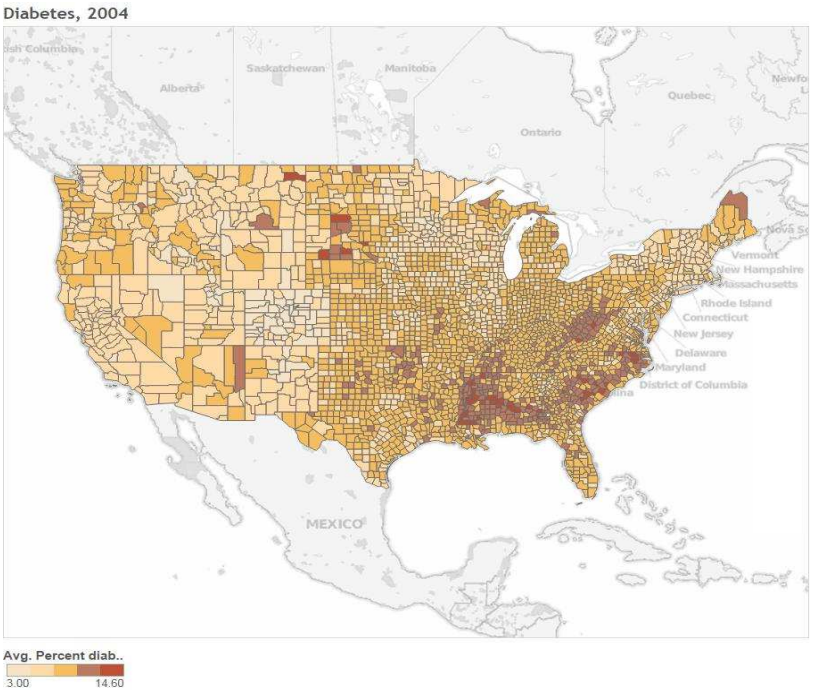

Figure 7. Percent of county with diabetes diagnoses nationally, 2004.

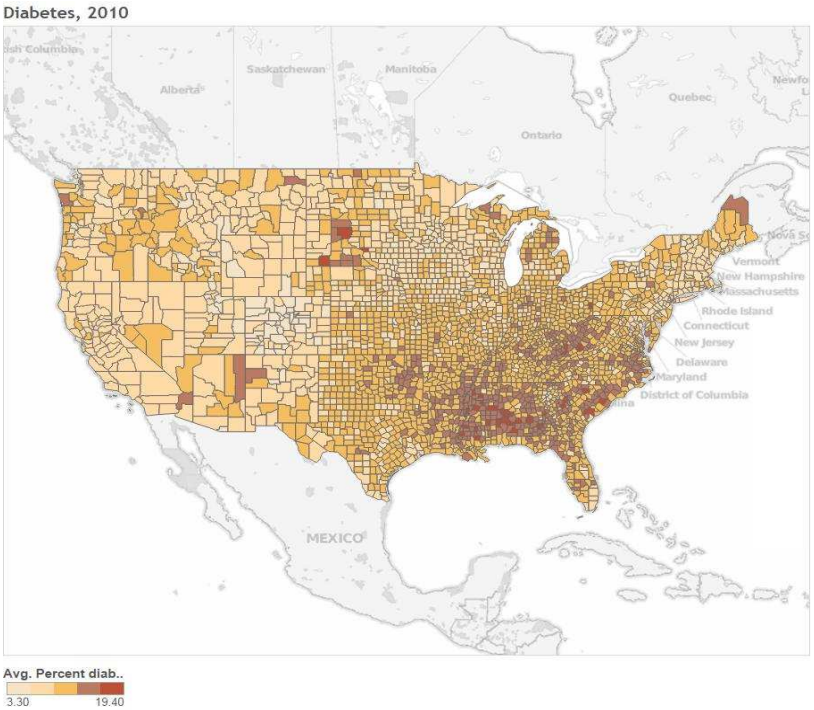

Figure 8. Percent of county with diabetes diagnoses nationally, 2010.

diabetes diagnoses increased from roughly 8 percent to almost 11 percent. Non-metro counties increased from roughly 9 percent to 11 percent (Figure 9).

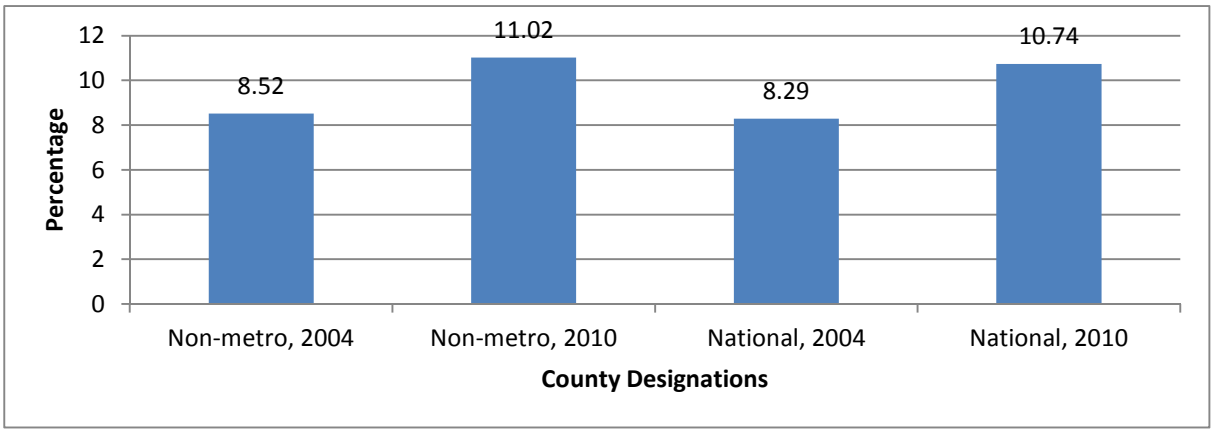

Figure 9. Percent of county with diabetes diagnoses in non-metro and all counties nationally; 2004, 2010.

Civic Structure and Ancestry

Civic Structure. Civic structure rates the highest in the Upper/Plains region (dark brown). Pockets of counties with more civic structure can be found in some parts of the Northwest as well as the Northeast (Figures 10 and 11). The Southeast and Southwest (light brown) appear to have low civic structure when compared to Northern regions.

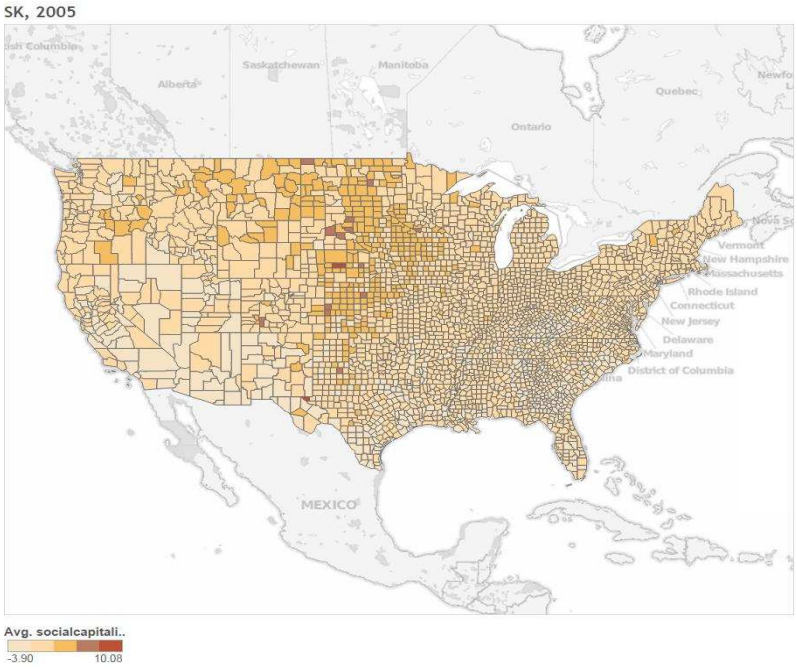

Figure 10. County-level civic structure in 2005.

Civic structure values appear fairly consistent across the two time periods. The Rupasingha and Goetz index ranged from a negative 3.9 to a high positive 5.7 in 2005 and negative 3.9 to positive 8.9 in 2009. In remote and all non-metro counties taken together appear to have increased in civic structure from 2005 to 2009 (Figure 12). Nationally, civic structure decreased slightly. In general, civic structure is higher in remote counties compared to all non-metro counties and all counties nationally (not shown).

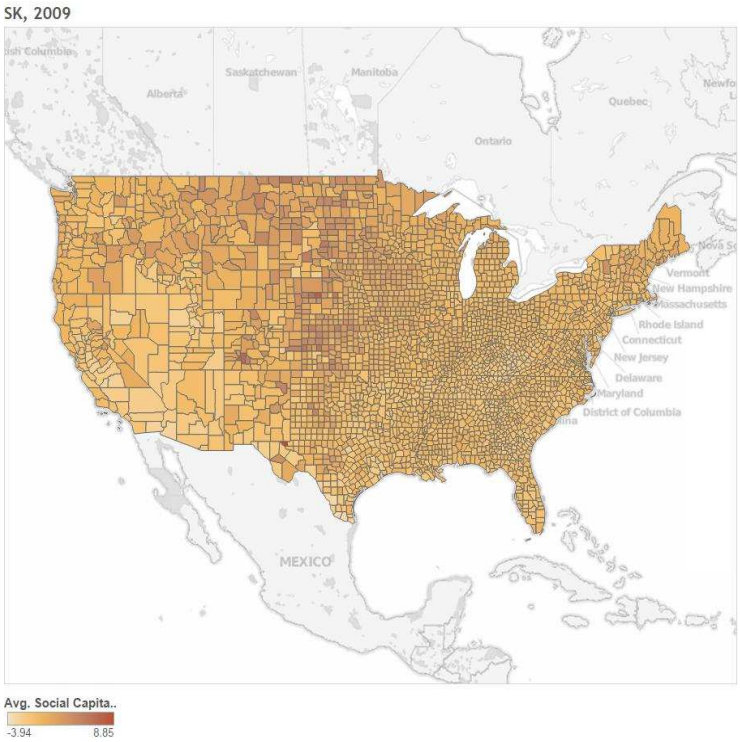

Figure 11. County-level civic structure in 2009.

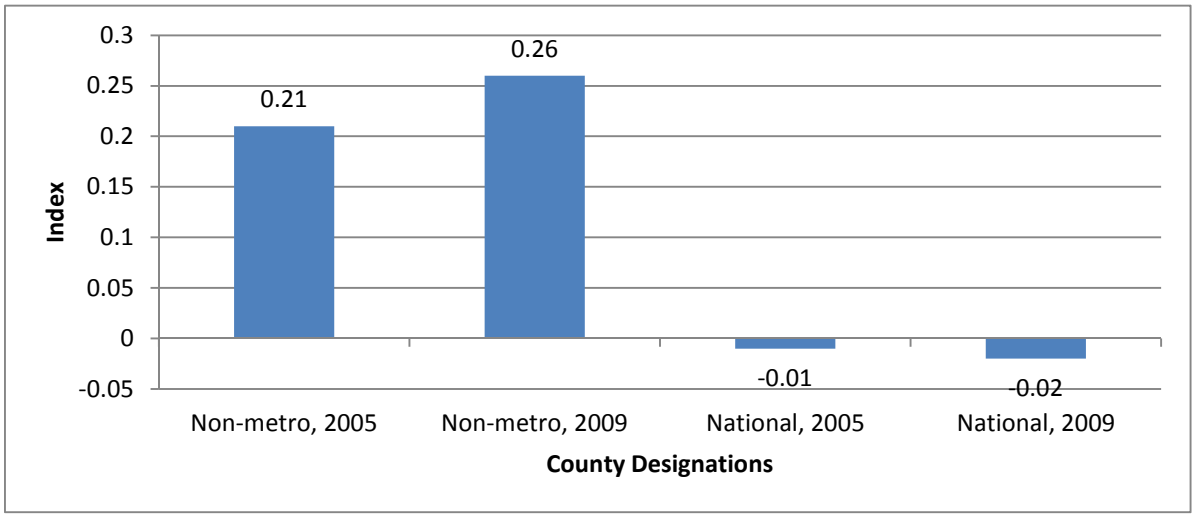

Figure 12. Mean county-level civic structure in non-metro and all counties nationally; 2005, 2009.

Ancestries: American ancestry is the second largest ancestry in this study. In 2000, almost 12 percent nationally self-reported American ancestry. Counties with populations that indicated American as their ancestry in 2000 are most heavily concentrated in the Southeast with counties reaching even greater densities in the Appalachian region and upward to 35 percent for a handful of counties in Kentucky and Tennessee. Nationally, counties with American ancestry ranged from a low of just over 1 percent to a high of roughly 54 percent (Figure 13). The map from 2000 compared to the 2006-2010 map appear very similar; however, heavier concentrations of American ancestry can be found in Nevada and Montana in the 2006-2010 time period (Figure

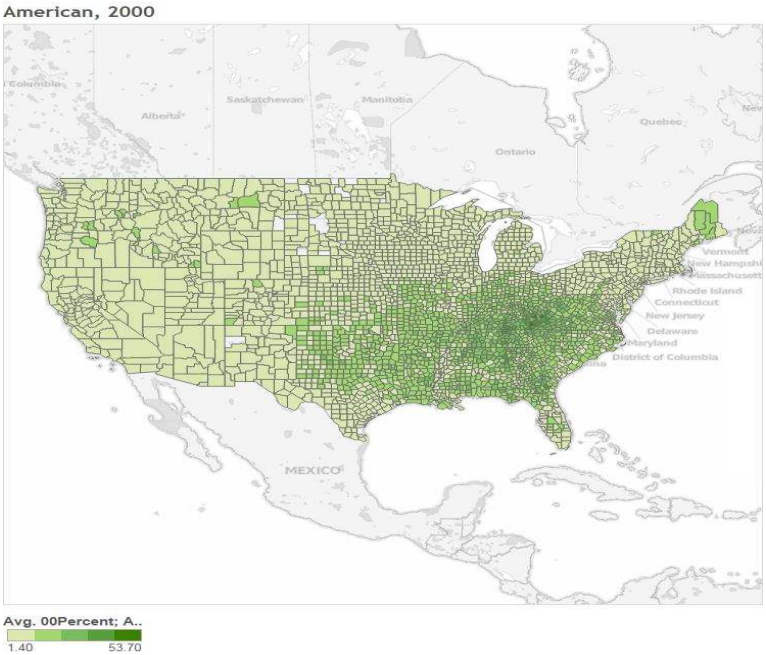

Figure 13. Percent of county with self-reported American ancestry; 2000.

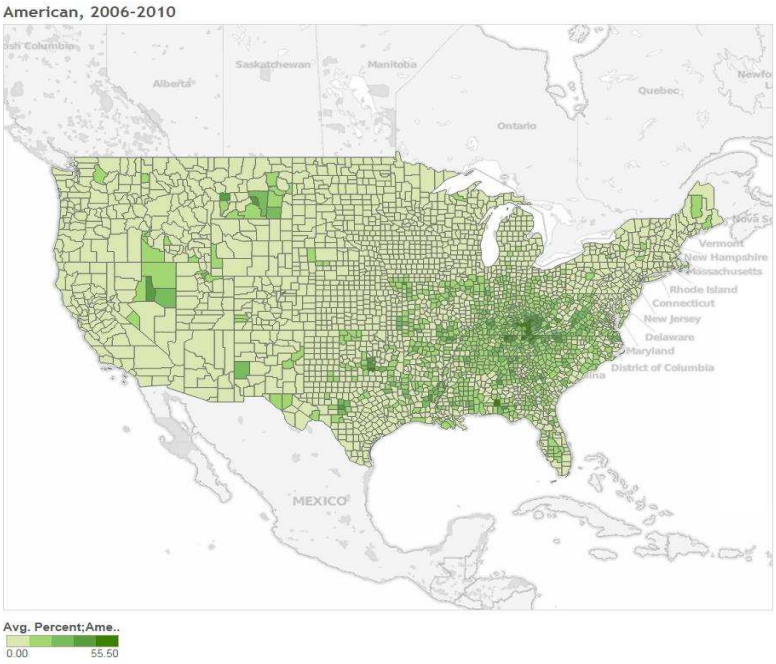

Figure 14. Percent of county with self-reported American ancestry; 2006-2010.

14. Identification with American ancestry has been found to be associated with lower socioeconomic status (Lieberson 1985).

Over time, some research would suggest that counties identifying with American ancestry would increase over time, consistent with a melting pot theory. However, evaluating American ancestry by non-metro and all counties nationwide suggests that during the time period evaluated (2000 to 2006-2010), American ancestry is instead going down (12 percent to 10 percent) (Figure 15). It is possible that the decrease in American ancestry is associated with the different methodologies used by the Census Bureau and the American Community Survey in collecting the ancestry data. For example, there are fewer missing answers to self-reported ancestry questions during the 2006-2010 time period compared to the year 2000 (U.S. Census Bureau 2014a).

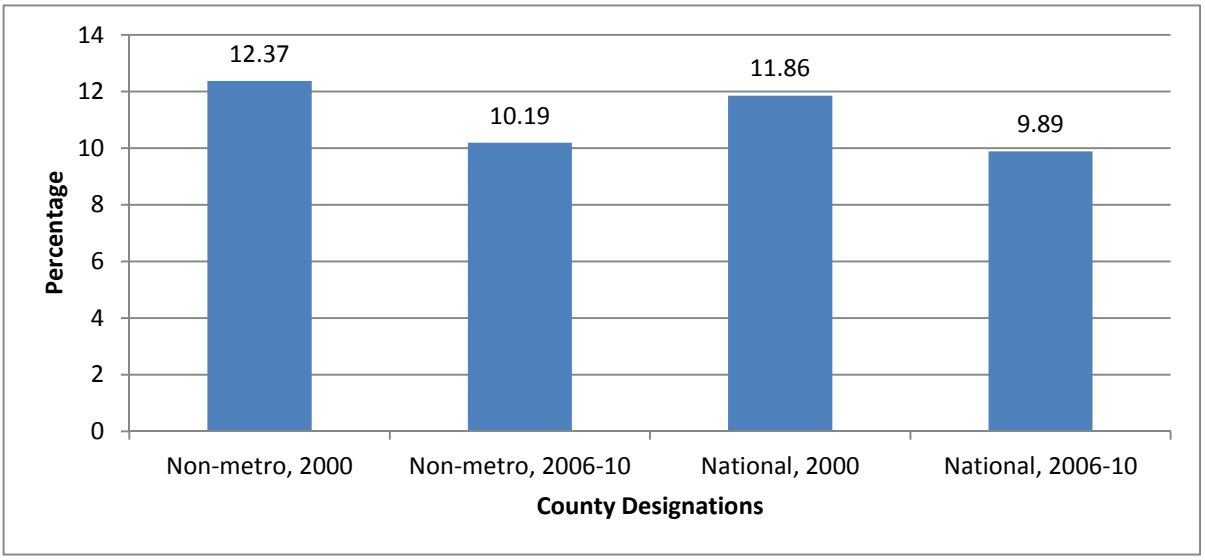

Figure 15. Percent of county with self-reported American ancestry in non-metro and all counties nationally; 2004, 2006-2010.

English ancestry is the fourth largest ancestry in the United States and in this study. English ancestry is more evenly dispersed across the United States with heavier concentrations found in the Northeast and the Rocky Mountain regions (Figures 16 and 17). Utah in particular has several counties with concentrations reaching over 30 percent. English ancestry during the 2006-2010 time period appears to mirror the 2000 Census data. In general, counties with English ancestry ranged from a low of less than 1 percent to a high of roughly 45 percent in 2000.

English ancestry increased in non-metro counties and all counties nationwide over the time period evaluated (9 percent to 11 percent) (Figure 18).

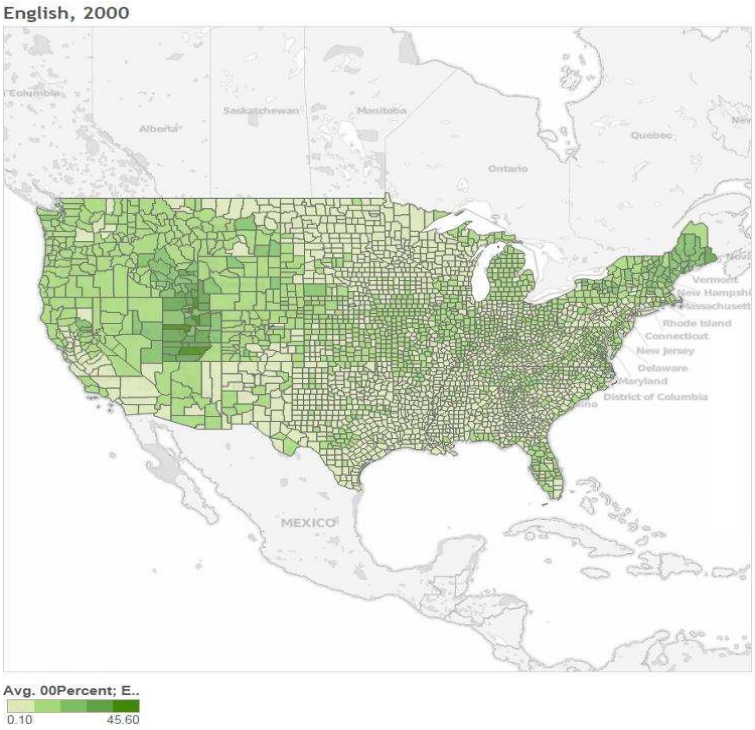

Figure 16. Percent of count with self-reported English ancestry in 2000.

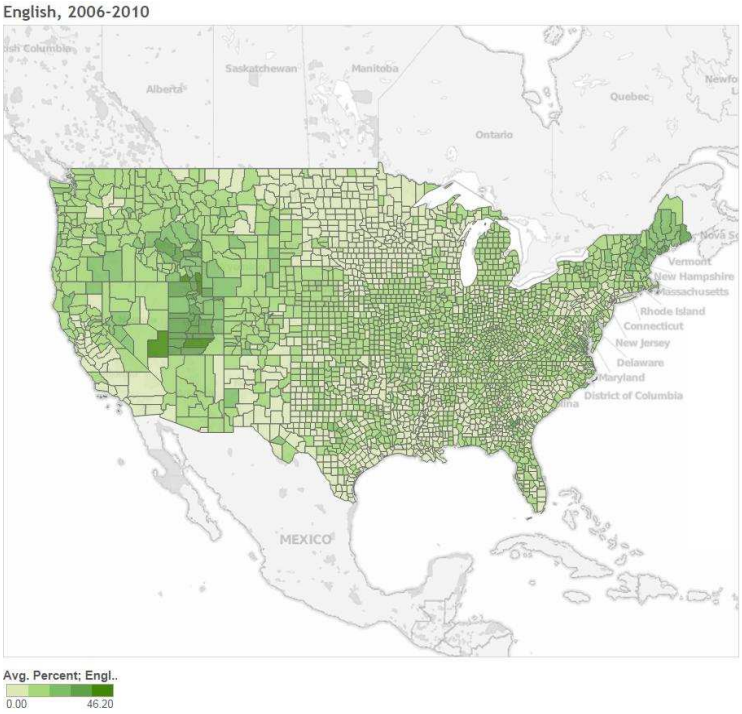

Figure 17. Percent of county with self-reported English ancestry; 2006-2010.

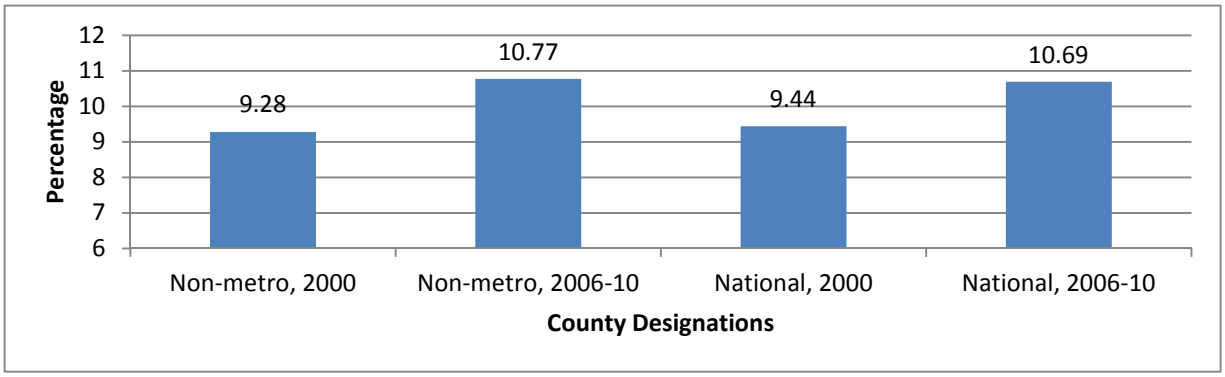

Figure 18. Percent of county with self-reported English ancestry in non-metro and all counties nationally; 2000, 2006-2010.

German ancestry is the largest self-reported ancestry in the United States. In 2000, roughly 19 percent of the U.S. self-reported German ancestry. Counties with German ancestry ranged from zero percent to roughly 73 percent in 2000 (Figure 19). In 2006-2010, counties with German ancestry ranged from 0 to almost 77 percent (Figure 20). German ancestry is more heavily concentrated in the Mid/Upper Midwest. For the most part, counties that reached 35 percent or more in German ancestry are found in the Northern half of Iowa, Eastern Nebraska, South and Northwestern Minnesota, and Eastern half of North Dakota (remote counties). The maps for both time periods appear very similar (Figures 19 and 20).

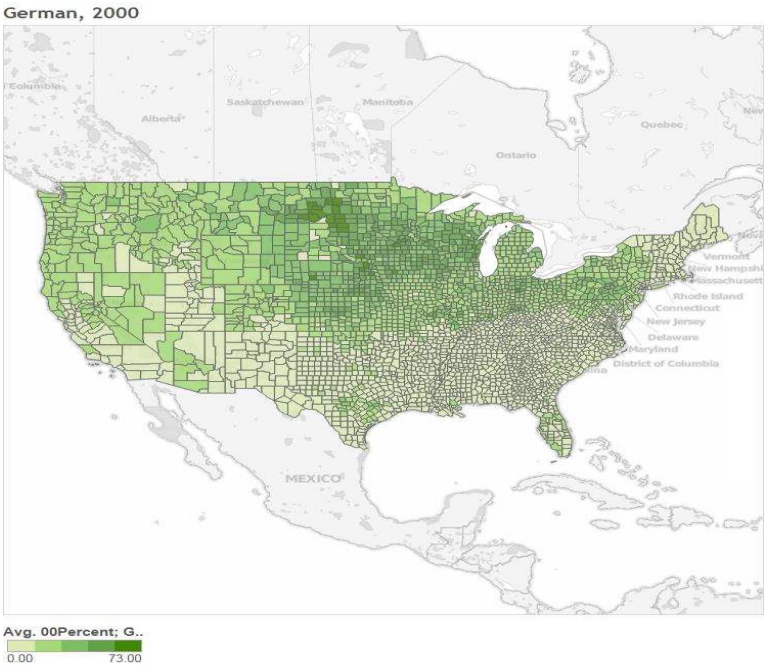

Figure 19. Percent of county with self-reported German ancestry, 2000.

German ancestry increased across non-metro and all counties nationally for the time periods evaluated (2000 to 2006-2010). Nationally, German ancestry increased from 19 percent to 22 percent. Non-metro counties increased 19 percent to 23 percent (Figure 21).

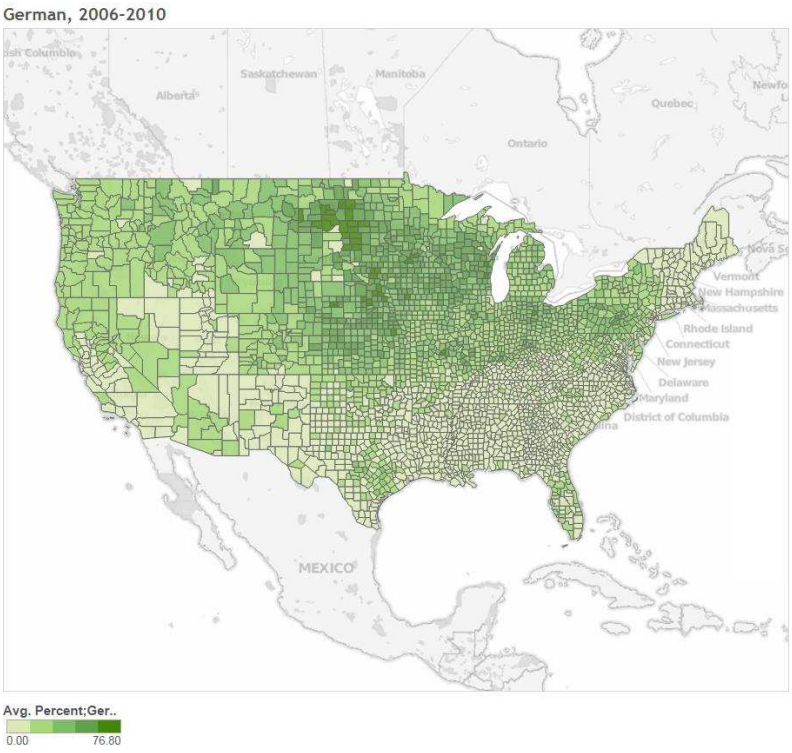

Figure 20. Percent of county with self-reported German ancestry, 2006-2010.

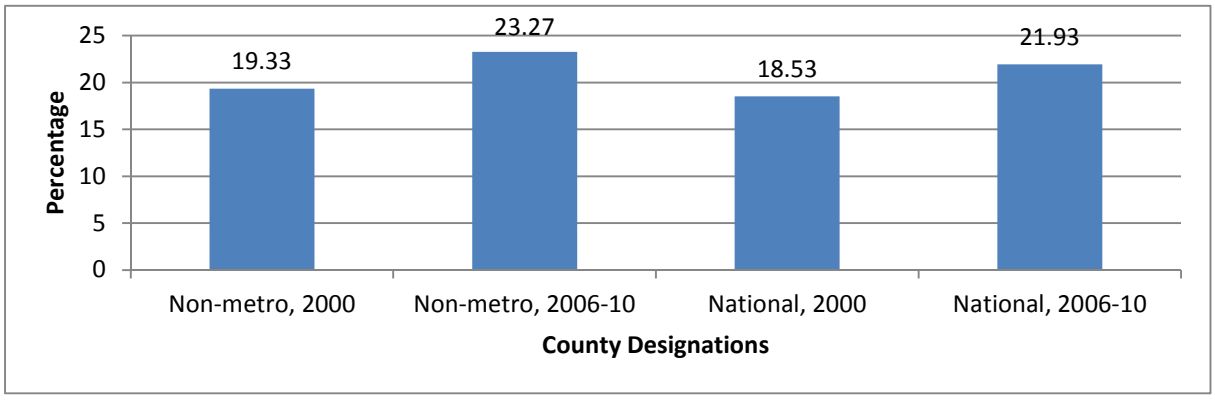

Figure 21. Percent of county with self-reported German ancestry in non-metro and all counties nationally; 2000, 2006-2010.

Irish ancestry is the third largest ancestry in this study. In 2000, almost ten percent of the United States self-reported Irish ancestry. Counties with Irish ancestry ranged from less than 1 percent to roughly 30 percent in 2000 (Figure 22). Irish ancestry appears to be evenly distributed across the United States with heavier concentrations in the Northeast. Maps for the two time periods appear roughly the same. Irish ancestry increased across non-metro and all counties nationally (9 to 12 percent) (Figure 24).

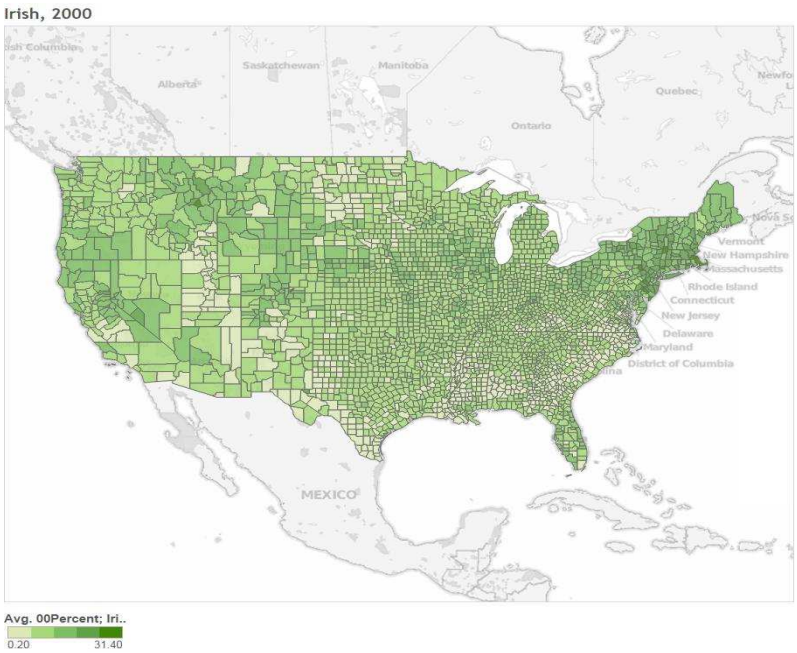

Figure 22. Percent of county with self-reported Irish ancestry in 2000.

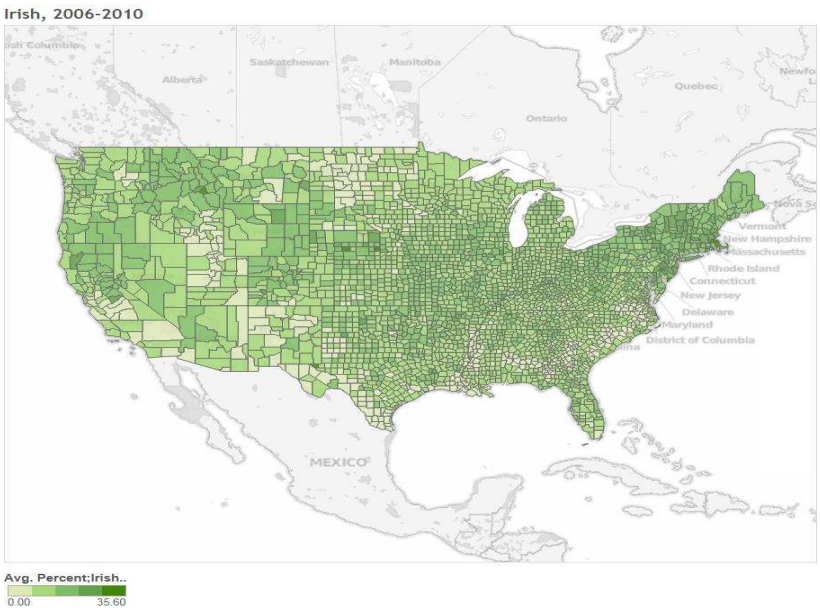

Figure 23. Percent of county with self-reported Irish ancestry, 2006-2010.

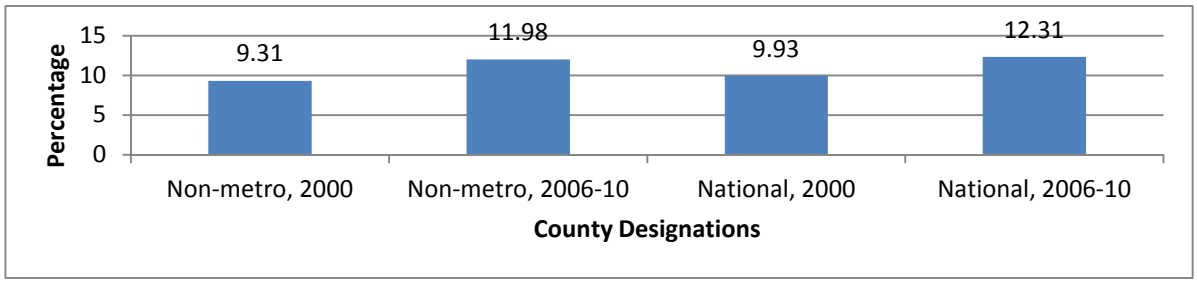

Figure 24. Percent of county with self-reported Irish ancestry in non-metro and all counties nationally; 2000, 2006-2010.

Norwegian ancestry is most heavily concentrated in Minnesota and the Dakotas. Counties with Norwegian ancestry ranged from a low of zero to almost 65 percent in 2000 (Figure 25). Although Norwegian ancestry is high in many Upper Midwest counties, nationally they make up only 3 percent. Maps for both time periods appear relatively the same. Norwegian ancestry is more heavily concentrated in remote counties. During the time periods evaluated, Norwegian ancestry remained fairly stable in non-metro counties (4 percent) and all counties nationally (3 percent) (Figure 27).

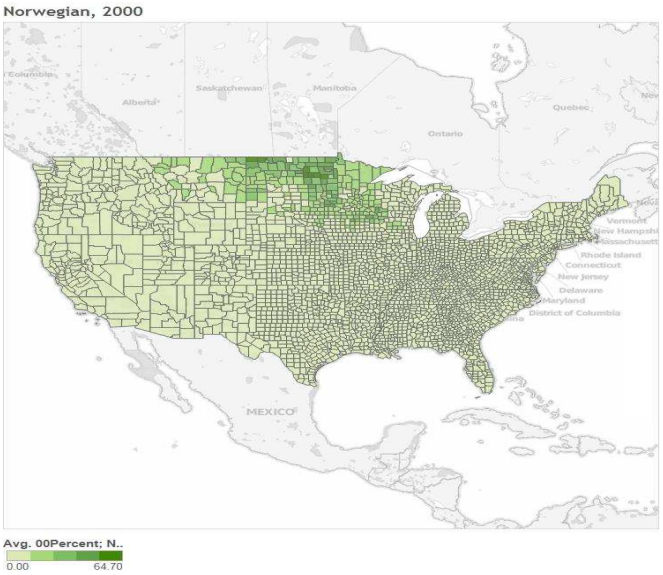

Figure 25. Percent of county with self-reported Norwegian ancestry; 2000.

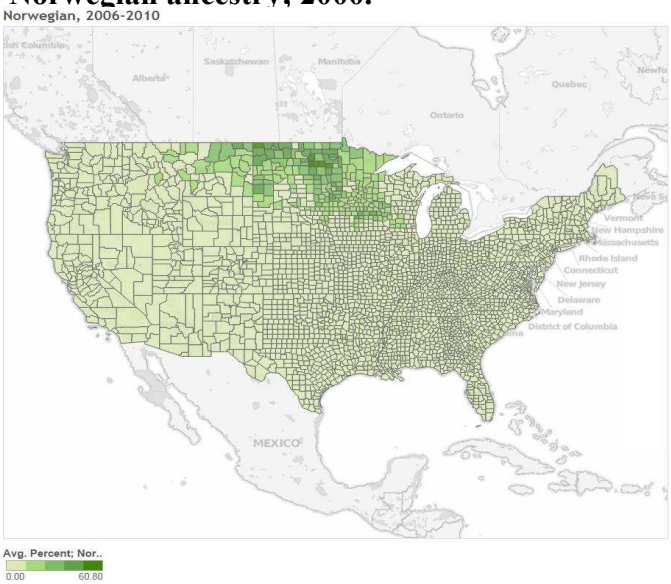

Figure 26. Percent of county with self-reported Norwegian ancestry; 2000.

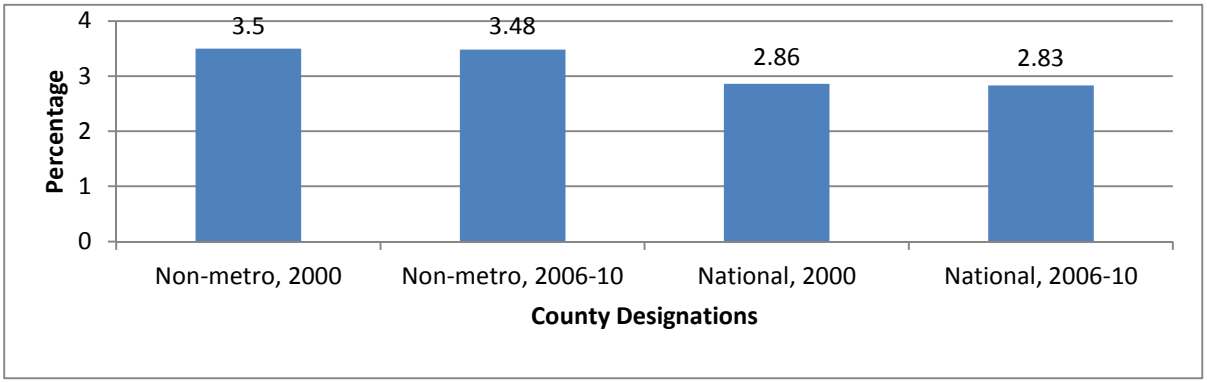

Figure 27. Percent of county with self-reported Norwegian ancestry in non-metro and all counties nationally; 2000, 2006-2010.

The diversity index includes European ancestry, race and Hispanic origin. The index ranges from 0 (homogenous) to 1 (heterogeneous). Counties in darker green indicate homogeneity. These maps show more homogeneity in the Mid/Upper Midwest where there are higher concentrations of Norwegian or German ancestries. The Southwest shows homogeneity, which is where there are larger concentrations of Hispanic/Latino origin. The Southeast shows homogeneity where there are larger densities of Black/African-American. (Figures 28 and 29).

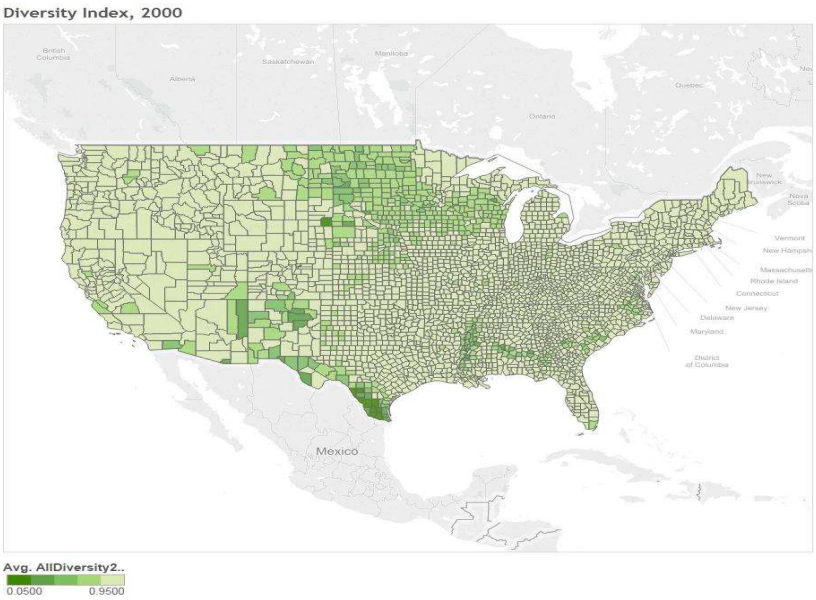

Figure 28. Diversity Index in 2000.

In general, remote counties appear the most homogenous when compared to all counties nationally or in non-metro counties. In non-metro counties the index value was .82 (2000) and

.80 (2006-2010). Nationally, the index decreased from .84 in 2000 to .81 during the 2006-2010 time period (Figure 30).

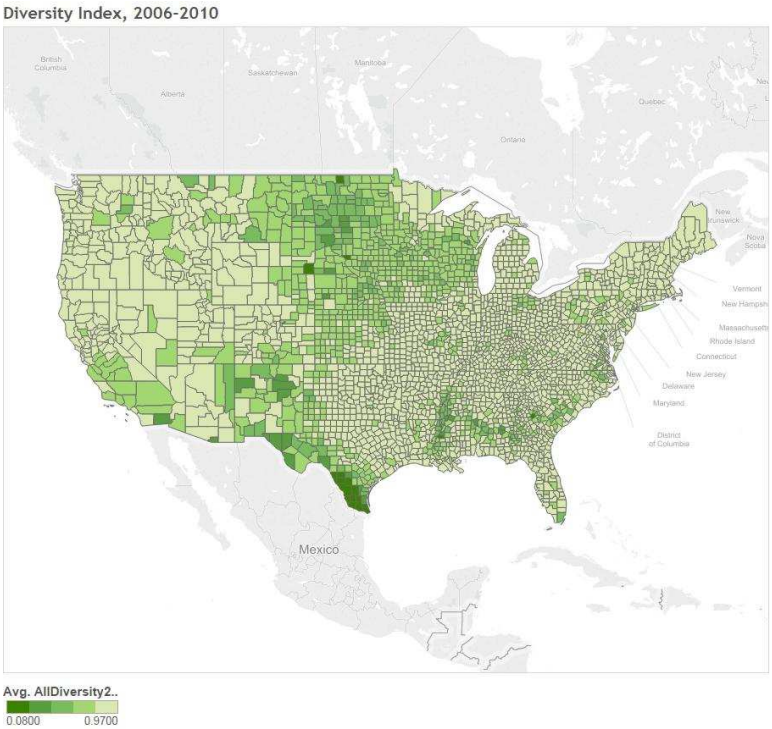

Figure 29. Diversity Index in 2000.

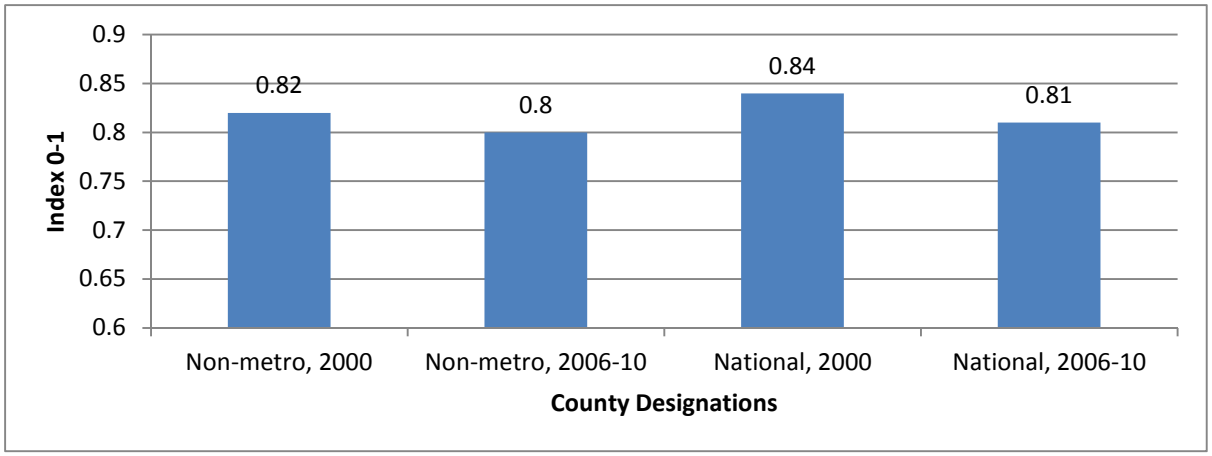

Figure 30. Diversity index by non-metro and all counties nationally; 2000, 2006-2010.

Table 4. Descriptive statistics summary of variables for non-metro counties and nationally*

	Non-metro 2000	Non-metro 2006-2010	All counties 2000	All counties 2006-2010
N**	1948	1948	3107	3107
Health Outcomes				
Percent good health, 2006-2012	81.86(6.51)		82.73(6.05)	
Percent obesity, 2004; 2010	25.58(3.24)	31(4.12)	25.29(3.23)	30.57(4.23)
Percent diabetes, 2004; 2010	8.52(1.59)	11.02(2.28)	8.29(1.58)	10.74(2.24)
County Demographic/Economic Structure				
Educational attainment, 2000; 2006-2010	75.86(8.87)	81.88(7.65)	77.38(8.66)	83.07(7.34)
Median household income, 2000; 2006-2010	31,734(5781)	39,968(8033)	35,225(8755)	44,082(11395)
Percent unemployed, 2000; 2010	4.59(1.67)	9.12(3.40)	4.31(1.57)	9.15(3.07)
Percent uninsured, 2010	22.63(6.44)		21.69(6.52)	
Percent same residence, 2000	60.89(6.67)		58.95(7.39)	
Mean travel time to work, 2000; 2006-2010	22.35(5.39)	21.53(5.16)	23.52(5.58)	22.83(5.39)
Percent 65 years of age or older, 2000; 2006-2010	16.09(3.88)	17.25(3.94)	14.81(4.11)	15.95(4.14)
Percent female, 2000; 2006-2010	50.33(2.09)	49.75(2.40)	50.47(1.91)	50.04(2.17)
Percent Black/African-American, 2000; 2006-2010	7.80(15.05)	7.88(15.18)	8.83(14.54)	9.01(14.68)
Percent married, 2000; 2006-2010	59.23(5.59)	54.54(7.37)	58.62(5.85)	54.04(7.24)
Percent Hispanic/Latino change, 2000-2010	75.45(102.10)		74.97(86.26)	
Percent Hispanic/Latino, 2000; 2006-2010	6.08(12.71)	7.96(13.84)	6.20(12.03)	8.31(13.34)
Food and Exercise Environment				
Percent No car/access to grocery store, 2010	3.33(2.21)		3.00(2.06)	
Fast-food restaurants per 1,000, 2007; 2011	0.57(0.34)	0.53(0.32)	0.59(0.32)	0.56(0.30)
Full-service restaurants per 1,000, 2007; 2011	0.88(0.68)	0.83(0.69)	0.80(0.59)	0.77(0.59)
Grocery/supermarkets per 1,000, 2007; 2011	0.33(0.26)	0.29(0.24)	0.28(0.22)	0.25(0.21)
Convenience stores per 1,000, 2007; 2011	0.72(0.35)	0.67(0.34)	0.64(0.32)	0.60(0.31)
Farmers' markets per 1,000, 2009; 2013	0.04(0.08)	0.07(0.10)	0.04(0.07)	0.05(0.09)
Recreational facilities per 1,000, 2007; 2011	0.08(0.10)	0.06(0.08)	0.09(0.09)	0.07(0.07)
Civic Structure				
Rupasingha and Goetz Index, 2005; 2009	0.21(1.47)	0.26(1.37)	-0.01(1.34)	-0.02(1.25)
Ancestry and Diversity				
Percent American, 2000; 2006-2010	12.37(7.86)	10.19(8.31)	11.86(7.49)	9.89(7.77)

Table 4. (continued)

Percent English, 2000; 2006-2010	9.28(4.84)	10.77(5.26)	9.44(4.63)	10.69(4.90)
Percent German, 2000; 2006-2010	19.33(15.03)	23.27(16.06)	18.53(13.92)	21.93(14.90)
Percent Irish, 2000; 2006-2010	9.31(3.61)	11.98(4.47)	9.93(3.93)	12.31(4.52)
Percent Norwegian, 2000; 2006-2010	3.50(8.02)	3.48(7.78)	2.86(6.91)	2.83(6.70)
Diversity index, 2000; 2006-2010	0.82(0.12)	0.80(0.12)	0.84(0.11)	0.81(0.11)

* Values are county means with standard deviations in parentheses.

** N=2710 for percent of county with good health in all counties; N=1629 non-metro counties.

First time period analyses are indicated by the year listed following the independent/control variable name; with the second time period listed second

Bivariate Correlations

Bivariate Pearson Product Correlations were conducted to examine relationships between the dependent, independent and control variables in non-metro and all counties nationally using a two-tailed test (Table 5). Correlations were conducted for the two time periods evaluated to observe if correlations appear similar. Given the sample size of the dataset, most independent and control variables correlated with the health variables regardless of the time period evaluated. This section will discuss correlations for the earlier time period (year 2000 and 2004 data) at the national level and if major variation exists with the second time period or in non-metro counties such distinctions will be noted.

Health Outcomes

As expected, some of the dependent variables are moderately or highly correlated with each other. Percent county good health is significantly correlated with obesity 2004 ($r=-.43$, $p<.01$) and diabetes 2004 ($r=-.52$, $p<.01$) (Table 5). Obesity 2004 is correlated with diabetes 2004 ($r=.77$, $p<.01$). This association is not as strong when correlating obesity 2010 with diabetes 2010 ($r=.72$, $p<.01$). The magnitude and statistical significance of these correlations between the dependent variables varied little across non-metro and all counties nationally.

Civic Structure

Civic structure appeared to have stronger relationships with the health variables in non-metro counties compared to all counties nationally. Civic structure was positive and significantly related to good health ($r=.54$, $p<.01$) and negatively related to obesity 2004 ($r=-.20$,

p<.01) and diabetes 2004 (r=-.20, p<.01) nationally. The magnitude of the correlations are larger for more remote counties.

Ancestry and Diversity Index

In general, most of the ancestry variables correlate with the health outcome variables. German ancestry is positive and significantly correlated with good health (r=.63, p<.01) and negatively related to obesity 2004 (r=-.36, p<.01) and diabetes 2004 (r=-.51, p<.01). Percent American is negative and significantly related to good health (r=-.51, p<.01) and positively related to obesity 2004 (r=.32, p<.01) and diabetes 2004 (r=.42, p<.01). Additionally, percent Norwegian is positive and significantly related to good health (r=.49, p<.01) and negatively related to obesity 2004 (r=-.27, p<.01) and diabetes 2004 (r=-.45, p<.01). Yet, other ancestries also showed similar relationships. Percent English is positive and significantly related to good health (r=.35, p<.01) and negatively related to obesity 2004 (r=-.47, p<.01) and diabetes 2004 (r=-.34, p<.01). Percent Irish is positive and significantly related to good health (r=.42, p<.01) and negatively correlated with obesity 2004 (r=-.45, p<.01) and diabetes 2004 (r=-.43, p<.01).

Table 5. Bivariate correlations*

	Good Health**	Obesity 2004	Obesity 2010	Diabetes 2004	Diabetes 2010
Health Outcomes					
Percent good health, 2006-2012					
Non-metro		-.416**	-.435**	-.497**	-.586**
National		-.433**	-.462**	-.519**	-.595**
Percent obesity, 2004; 2010					
Non-metro				.794**	.717**
National				.768**	.723**
Percent diabetes, 2004; 2010					
Non-metro		.794**	.672**		
National		.768**	.723**		
County Demographic/Economic Structure					
Educational attainment, 2000; 2006-2010					
Non-metro	.718**	-.477**	-.424**	-.538**	-.524**
National	.741**	-.488**	-.436**	-.561**	-.539**
Median household income, 2000; 2006-2010					
Non-metro	.546**	-.437**	-.464**	-.525**	-.600**
National	.570**	-.445**	-.496**	-.539**	-.584**
Percent unemployed, 2000; 2010					
Non-metro	-.513**	.297**	.222**	.364**	.434**
National	-.544**	.311**	.192**	.376**	.379**
Percent uninsured, 2010					
Non-metro	-.464**	.107**	.105**	.275**	.289**
National	-.520**	.172**	.172**	.318**	.330**
Percent same residence, 2000					
Non-metro	-.061*	.324**	.278**	.367**	.308**
National	-.166**	.352**	.340**	.426**	.392**
Mean travel time to work, 2000; 2006-2010					
Non-metro	-.497**	.280**	.246**	.390**	.395**
National	-.312**	.154**	.108**	.228**	.229**

Table 5 (continued)

Percent 65 years of age or older, 2000; 2006-2010					
Non-metro	.253**	-.073**	-.141**	.112**	.066**
National	.054**	.011	.007	.260**	.235**
Percent female, 2000; 2006-2010					
Non-metro	-.104**	.248**	.135**	.361**	.246**
National	-.070**	.177**	.060**	.311**	.183**
Percent Black/African-American, 2000; 2006-2010					
Non-metro	-.442**	.489**	.441**	.547**	.545**
National	-.318**	.387**	.313**	.438**	.423**
Percent married, 2000; 2006-2010					
Non-metro	.225**	-.339**	-.344**	-.310**	-.355**
National	.158**	-.202**	-.237**	-.194**	-.251**
Percent Hispanic/Latino change, 2000-2010					
Non-metro	.117**	.062**	.027	.035**	-.039
National	.102**	.086**	.059**	.063**	.006
Percent Hispanic/Latino, 2000; 2006-2010					
Non-metro	-.003	-.333**	-.274**	-.285**	-.256**
National	-.026	-.362**	-.326**	-.329**	-.308**
County Food and Exercise Environment					
Percent No car/access to grocery store, 2010					
Non-metro	-.489**	.452**	.404**	.509**	.542**
National	-.495**	.477**	.448**	.539**	.567**
Fast-food restaurants per 1,000, 2007; 2011					
Non-metro	.097**	-.181**	-.190**	-.154**	-.136**
National	.127**	-.187**	-.216**	-.147**	-.164**
Full-service restaurants per 1,000, 2007; 2011					
Non-metro	.454**	-.410**	-.254**	-.312**	-.220**
National	.373**	-.355**	-.294**	-.237**	-.214**
Grocery/supermarkets per 1,000, 2007; 2011					
Non-metro	.230**	-.097**	-.158**	-.034	-.129**
National	.103**	-.030	-.085**	.052**	-.047**

Table 5. (continued)

Convenience stores per 1,000, 2007; 2011					
Non-metro	-.013	.046*	.041	.141**	.144**
National	-.141**	.164**	.167**	.259**	.257**
Farmers' markets per 1,000, 2009; 2013					
Non-metro	.227**	-.114**	-.151**	-.123**	-.160**
National	.153**	-.073**	-.090**	-.071**	-.104**
Recreational facilities per 1,000, 2007; 2011					
Non-metro	.263**	-.217**	-.223**	-.206**	-.240**
National	.298**	-.251**	-.281**	-.228**	-.287**
Civic Structure					
Rupasingha and Goetz index, 2005; 2009					
Non-metro	.621**	-.256**	-.291**	-.277**	-.326**
National	.541**	-.196**	-.177**	-.199**	-.201**
Ancestry and diversity					
Percent American, 2000; 2006-2010					
Non-metro	-.545**	.240**	.254**	.375**	.420**
National	-.506**	.315**	.300**	.424**	.448**
Percent English, 2000; 2006-2010					
Non-metro	.330**	-.509**	-.350**	-.377**	-.189**
National	.346**	-.467**	-.286**	-.338**	-.156**
Percent German, 2000; 2006-2010					
Non-metro	.665**	-.405**	-.348**	-.544**	-.557**
National	.625**	-.361**	-.271**	-.509**	-.489**
Percent Irish, 2000; 2006-2010					
Non-metro	.379**	-.450**	-.249**	-.434**	-.198**
National	.424**	-.454**	-.241**	-.426**	-.195**
Percent Norwegian, 2000; 2006-2010					
Non-metro	.546**	-.271**	-.315**	-.452**	-.505**
National	.493**	-.267**	-.289**	-.451**	-.487**
Diversity index, 2000; 2006-2010					
Non-metro	-.136**	-.189**	-.097**	.139**	.059**
National	-.074**	-.177**	-.111**	-.065**	.040*

Table 5. (continued)

N					
Non-metro	1629	1948	1948	1948	1948
National	2710	3106	3106	3106	3106

*Bivariate correlations were conducted for time periods closest to each other (the year 2000 independent/control variables were correlated with the dependent variables for the year 2004). The second time period of bivariate correlations used the 2006-2010 time period and the dependent variables for the year 2010. **Percent county good health, 2006-2010 was correlated with the first time period data (year 2000 independent/control variables) only.

CHAPTER 6

REGRESSION RESULTS

Models

Tables 9, 11, and 13 each outline four models examining both non-metro counties and all counties nationally during two different time periods. The first time period uses variables that are closest together in years for OLS multiple regression. For example, civic structure, ancestry and control variables are regressed using the year 2000 on obesity 2004 (dependent variable). The second time period uses civic structure, ancestry and control variables regressed using the time period 2006-2010 (or later year if available) on obesity 2010 (dependent variable).

Regression results are presented in one block following a process similar to Ahern et al. (2011) who examined the associations between the food environment/accessibility and health outcomes. However, each time period was regressed in three steps, examining the change in variance for each step (for more information on the change in explained variance at each step see the appendix on page 151). The multiple regression models were developed in the following manner: (1) the first step regressed health indicators, and county demographic/economic structure, and food/exercise environment on health outcomes; (2) the second step added civic structure; and (3) the third step added the ancestry measures. In general, the health indicators, county demographic/economic structure, food/exercise environment and civic structure appear to not dramatically change the relationships of ancestry to predict health outcomes. Given this, regression results are presented in one block, but changes in explained variance across steps will be noted.

Civic Structure

A goal of this study was to determine if counties with higher densities of certain European ancestries (Norwegian and German) with high civic structure would also have better health compared to those ancestries with low civic structure. As such, the first step was to determine which ancestries rated higher in civic structure and if such findings were consistent with past research. Civic structure was regressed on individual ancestries using two different time periods for both non-metro counties and all counties nationally. Further, civic structure was also regressed on the diversity index to evaluate its relationship with levels of homogeneity.

Table 6 shows civic structure for both non-metro counties and all counties nationally for the two different time periods. The results reveal that German and Norwegian ancestries are associated with higher civic structure in non-metro counties and all counties nationally, compared to American, English and Irish ancestries, where an inverse relationship is found. Counties with a higher percentage of residents with German ancestry have higher civic structure than counties with Norwegian ancestry (Figure 31), which is a departure from past research. Counties with a higher percentage of residents with Irish ancestry have the lowest levels of civic structure. Past research have found positive associations between areas with

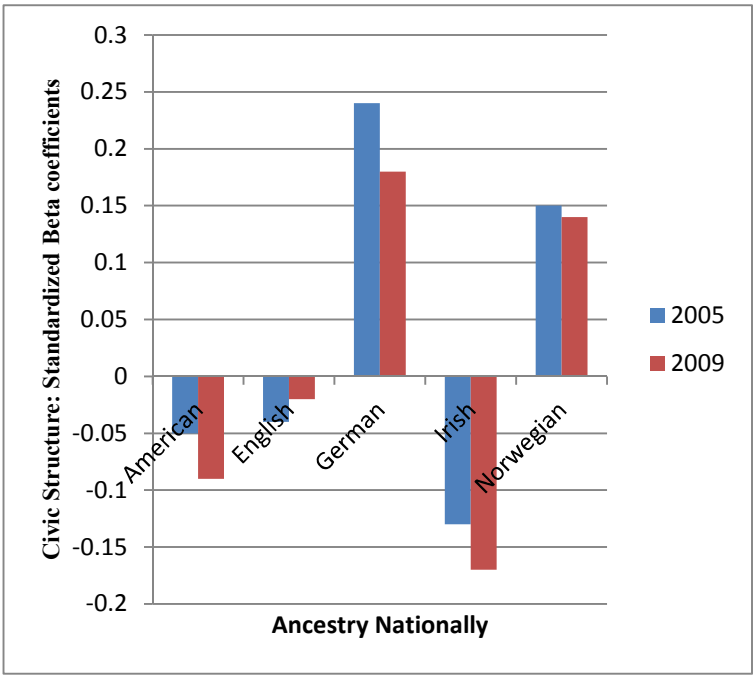

Figure 31. Civic Structure Standardized Beta Regression Coefficients; 2005 and 2009

greater densities of Norwegian or German ancestries and civic structure (Greeley and McCready 1974; Rice and Feldman 1997); however, this study actually found even higher levels of civic structure in areas with greater German ancestry compared to Norwegian ancestry.

Diversity has been claimed to have an adverse relationship with civic structure (Alesina and Ferrara 2000; Rupasingha et al. 2006). A diversity index that includes ancestry, race and Hispanic/Latino origin were developed that range from 0 to 1, with 0 homogenous and 1 as heterogeneous. Confirming past research, diversity was inversely related to civic structure in non-metro counties and across counties nationally for both time periods evaluated (Table 7).

Table 6. Civic structure for non-metro and all counties, 2005; 2009 (Dependent Variable)a

	Non-metro 2005	Non-metro 2009	All counties 2005	All counties 2009
N	1948	1939	3105	3105
Adjusted R^2	0.67	0.60	0.65	0.58
County Demographic/Economic Structure				
Educational attainment, 2000; 2006-2010	0.05(0.01)***	0.06(0.01)***	0.05(0.00)***	0.05(0.00)***
Median household income, 2000; 2006-2010	0.04(0.16)	0.56(0.15)***	-0.10(0.10)	-0.06(0.10)
Percent female High=1, 2000; 2006-2010	0.22(0.04)***	0.17(0.04)***	0.20(0.03)***	0.12(0.03)***
Percent Black/African-American, 2000; 2006-2010	-0.02(0.03)	0.05(0.02)	-0.04(0.02)	0.04(0.02)**
Percent Hispanic/Latino, 2000; 2006-2010	-0.10(0.02)***	-0.04(0.03)	-0.15(0.01)***	-0.11(0.02)***
Percent married High=1, 2000; 2006-2010	0.16(0.05)***	0.07(0.05)	0.14(0.04)***	0.06(0.04)
Percent 65 years of age and older, 2000; 2006-2010	0.13(0.01)***	2.44(0.11)***	0.12(0.05)***	2.22(0.07)***
Ancestry				
Percent American, 2000; 2006-2010	-0.15(0.05)**	-0.19(0.04)***	-0.10(0.04)**	-0.17(0.03)***
Percent English, 2000; 2006-2010	-0.11(0.04)**	-0.09(0.03)**	-0.08(0.03)**	-0.03(0.03)
Percent German, 2000; 2006-2010	0.39(0.05)***	0.24(0.05)***	0.41(0.04)***	0.32(0.04)***
Percent Irish, 2000; 2006-2010	-0.17(0.05)***	-0.25(0.04)***	-0.26(0.03)***	-0.31(0.03)***
Percent Norwegian, 2000; 2006-2010	0.21(0.03)***	0.18(0.03)***	0.23(0.03)***	0.21(0.03)***

a Multiple linear regression results for non-metro and all counties nationally. Values are non-standardized coefficients with standard errors in parentheses.

All models are significant at *p<.05; **p<.01; ***p<.001

First time period analyses are indicated by the year listed following the independent/control variable name; with the second time period listed second.

Civic structure (Rupasingha and Goetz index) (Dependent variable) is analyzed using the year 2005 for the first time period and 2009 for the second time period. Civic structure is a continuous variable.

High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

Table 7. Civic structure and diversity Index for non-metro and all counties, 2005; 2009 (Dependent Variable)a

	Non-metro 2005	Non-metro 2009	All counties 2005	All counties 2009
N	1948	1939	3105	3105
Adjusted R^2	0.59	0.64	0.60	0.60
County Demographic/Economic Structure				
Educational attainment, 2000; 2006-2010	0.09(0.00)***	0.07(0.00)***	0.08(0.00)***	0.08(0.00)***
Median household income, 2000; 2006-2010	-0.31(0.10)**	0.82(0.14)***	-0.31(0.10)**	-0.10(0.09)
Percent female High=1, 2000; 2006-2010	0.03(0.03)	0.08(0.04)	0.03(0.03)***	0.02(0.03)
Percent married High=1, 2000; 2006-2010	0.29(0.03)***	0.06(0.05)	0.29(0.03)***	0.08(0.03)*
Percent 65 years of age and older, 2000; 2006-2010	0.16(0.01)***	2.64(0.10)***	0.15(0.01)***	2.39(0.07)***
Diversity				
Diversity Index, 2000; 2006-2010	-2.69(0.15)***	-3.01(0.16)***	-2.69(0.15)***	-2.97(0.13)***

a Multiple linear regression results for non-metro and all counties nationally. Values are non-standardized coefficients with standard errors in parentheses.

All models are significant at *p<.05; **p<.01; ***p<.001

First time period analyses are indicated by the year listed following the independent/control variable name; with the second time period listed second.

Civic structure (Rupasingha and Goetz index) (Dependent variable) is analyzed using the year 2005 for the first time period and 2009 for the second time period.

High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

German ancestry was found to be associated with higher civic structure. Given this, it would also be important to know if different levels of density make a difference for civic structure. Past research into ethnic density created density categories of minority groups to see if higher density levels are statistically significant with a reference group. Given this, dummy variables were created that compare differing European ancestry density categories to a low density category (reference group)[1]. Since counties with residents of Norwegian ancestry are mostly concentrated across two categories, it was not included in the ethnic density analysis below, but is still included as a continuous variable. In general, density appears to be important for some European ancestries, but not all. Counties with densities of German ancestry of 35 percent or more have higher civic structure when compared to the lowest density category in both non-metro and all counties nationally (Table 8). Further, German ancestry density ranging between 5-10 percent was negatively related to civic structure when compared to the reference group (not statistically significant).

Counties with higher percentage levels of Irish and English residents have lower civic structure (Table 8). Specifically, counties with an Irish population density of 10 percent or higher have lower civic structure in all counties nationally (all, $p<.05$). Counties with English ancestry were found to have lower civic structure at population densities of 5-10 percent and 15 percent or higher (all, $p<.05$) in all counties nationally when compared to the lowest density group. In non-metro counties, higher densities of English ancestry were associated with lower civic structure at all levels when compared to the lowest density group. Irish ancestry was related to lower civic structure at the 10-15 percent density group only ($p<.01$).

[1] For full discussion on how ethnic density categories were created see page 35.

Table 8. Civic Structure, 2005 (Dependent Variable)a
with ancestry density categories

	Non-metro	All counties
Ancestry		
N	1948	3105
Adjusted R^2	.67	.65
County Demographic/Economic Structure		
Educational Attainment, 2000	0.06(0.00)***	0.06(0.00)***
Median Household Income, 2000	0.15(0.16)	-0.03(0.11)
Percent female High=1	0.17(0.03)***	0.17(0.03)***
Percent Black/African-American, 2000	0.20(0.04)***	-0.09(0.02)***
Percent Hispanic/Latino origin, 2000	-0.09(0.03)***	-0.13(0.01)***
Percent married, 2000 High=1	0.15(0.05)**	0.11(0.04)**
Percent 65 years of age and older, 2000	0.13(0.01)***	0.12(0.01)***
Ancestry		
American, 2000		
5-10 percent	0.04(0.07)	0.01(0.05)
10 percent or higher	-0.05(0.08)	-0.01(0.06)
English, 2000		
5-10 percent	-0.21(0.07)**	-0.13(0.05)*
10 to 15 percent	-0.23(0.09)**	-0.11(0.07)
15 percent or higher	-0.34(0.11)***	-0.20(0.08)*
German, 2000		
5-10 percent	-0.05(0.08)	-0.02(0.06)
10-35 percent	0.13(0.09)	0.12(0.07)
35 percent or higher	0.61(0.12)***	0.70(0.09)***
Irish, 2000		
5-10 percent	-0.11(0.08)	-0.12(0.06)
10-15 percent	-0.25(0.09)**	-0.29(0.07)***
15 percent or higher	-0.15(0.12)	-0.39(0.09)***
Norwegian, 2000	0.24(0.03)***	0.25(0.03)***

a Multiple linear regression results for non-metro and all counties nationally.
Values are non-standardized coefficients with standard errors in parentheses.
All models are significant at *p<.05; **p<.01; ***p<.001
Reference category is 0 to 5 percent for all European ancestries.
County Norwegian ancestry was not made into categories given the overall small density.

Good Health

Age-adjusted county-level self-reported good health was evaluated across four models. The non-metro models used predictors from two different time periods; 2000 and 2006-2010. Likewise, all counties across the nation were also evaluated across two different time periods. As mentioned previously, Table 9 reports the full models with all independent and control variables included. However, to fully understand how civic structure and ancestry influences health outcomes, civic structure and ancestry measures were regressed in three steps. This section will first outline the three multiple regression steps taken and the change in adjusted R^2. The overall results will be given using the full models in Table 9; however, regressions for each model detailing each step can be found in tables 1 and 2 in the Appendix on pages 151-154.

In all counties nationally, health indicators such as obesity and diabetes along with county demographic/economic structure and the food/exercise environment explained 62 percent of the variance for both time periods. Adding civic structure to the models in both time periods appears to provide minor additional predictive ability. A significant, but not substantial R^2 change of .002 (both, $p<.001$) was observed with the addition of civic structure to the models (Table 1 of appendix). A statistically significant R^2 change was also observed in non-metro counties for both time periods (Table 2 of appendix). A significant R^2 change of .011 and .021 was observed during the second period of analysis in non-metro and all counties nationally ($p<.001$). Taken together, the four full models for non-metro and all counties nationally explained between 63 and 65 percent of variance. The Analysis of Variance for each of the models were statistically significant ($p<.001$).

Hypothesis 1: Theory suggests that areas high in civic structure will have better health than areas low in civic structure (Kawachi et al. 1999; Kim and Kawachi 2006). This study goes

further than past research into civic structure and self-reported health because it also controls for the food environment and access to food. A significant, but not substantial .006 R^2 change ($p<.001$) was observed with the addition of the food/exercise environment measures at the national-level and non-metro county level ($p<.01$) (Table 7 of appendix). This research hypothesized that counties rating high in civic structure would have better self-reported good health compared to those counties rating low in civic structure. In general, the results appear to support the hypothesis, regardless if food/exercise environment measures are included or not. Counties high in civic structure have higher levels of good health compared to those counties low in civic structure (all, $p<.01$ or $p<.001$). These findings are similar across non-metro and all counties nationally. However, there are some distinctions that should be noted. In both time periods evaluated, there appears to be influence coming from the ancestry measures (non-significant coefficients become significant when German, Irish and Norwegian ancestries are not controlled). Given this, regression results for civic structure in Table 9 do not show statistical significance for all models. For regression results specific to civic structure where European ancestries are allowed to influence the models, see Table 1 of the appendix on page 151. The results discussed above are not controlled for ancestry because it would be expected that European ancestries influence civic structure. What this does show is that ancestry does matter in terms of civic structure and self-reported health.

Hypothesis 2: Research has found that areas with higher densities of some European ancestries have more civic structure when compared to others (Besser 2011; Greeley and McCready 1974), which was also confirmed in this study. This study hypothesized that German and Norwegian ancestries will be associated with higher civic structure compared to other

ancestries. Further, Norwegian and German ancestries will be associated with higher self-reported good health compared to other ancestries. This hypothesis is only partially supported given the findings were not uniform. At the national and non-metro levels, counties with a higher percentage of residents with German ancestry have higher levels of good health (all, $p<.001$), whereas counties with higher densities of Irish (all, $p<.001$), and American ancestries (first time period, $p<.001$; second time period $p<.05$ and $p<.01$), have lower levels of good health (Table 9). Counties with higher densities of English ancestry also have higher levels of good health at the national and non-metro levels (first time period, $p<.001$; second time period, $p<.01$ national only). This is worth noting given that English ancestry was found to be negatively related to civic structure. Regressions were also performed to determine if food/exercise environment measures influenced the relationships between ancestry and self-reported health; however, outcomes appeared the same whether such food/exercise environment measures were included in the models or not.

Norwegian ancestry, which was found to be associated with civic structure, was not consistently related to better self-reported good health across models (Table 9). In the first time period of analysis, counties with higher densities of Norwegian ancestry have higher levels of good health in non-metro ($p<.05$) and all counties nationally ($p<.001$). However, in the second time period of analysis, Norwegian ancestry was positive, but not associated with good health in non-metro or all counties nationally. The differences observed across time periods could be due to the contrast in methodologies used in collecting ancestry data by the Census Bureau and the American Community Survey.

Table 9. Percent of county with self-reported good health (age-adjusted), 2006-2012 (Dependent Variable)a

	Non-metro 2000-2005	Non-metro 2006-2010	All counties 2000-2005	All counties 2006-2010
N	1627	1620	2705	2695
Adjusted R^2	0.63	0.63	0.65	0.65
Health Indicators				
Percent obesity, 2004; 2010	-0.08(0.06)	-0.11(0.04)**	-0.09(0.04)*	-0.10(0.03)***
Percent diabetes, 2004; 2010	-0.26(0.14)	-0.29(0.09)***	-0.20(0.09)*	-0.30(0.07)***
County Demographic/Economic Structure				
Educational attainment, 2000; 2006-2010	0.20(0.03)***	0.29(0.03)***	0.24(0.02)***	0.30(0.02)***
Median household income, 2000; 2006-2010	4.71(0.95)***	5.26(0.89)***	4.32(0.63)***	5.40(0.61)***
Percent unemployed, 2000; 2010	-2.78(0.39)***	-1.98(0.35)***	-2.93(0.28)***	-1.83(0.26)***
Percent uninsured, 2010	0.04(0.03)*	0.01(0.03)	0.01(0.02)	-0.02(0.02)
Percent same residence, 2000	0.08(0.02)***	0.04(0.02)	0.07(0.02)***	0.04(0.02)**
Mean travel time to work, 2000; 2006-2010	-0.08(0.03)**	-0.08(0.03)**	-0.05(0.02)**	-0.06(0.02)**
Percent female High=1, 2000; 2005-2009	-0.39(0.23)	-0.56(0.23)**	-0.33(0.16)*	-0.27(0.16)
Percent Black/African-American, 2000; 2006-2010	0.43(0.14)**	0.40(0.13)**	0.43(0.10)***	0.51(0.10)***
Percent married High=1, 2000; 2006-2010	-0.15(0.25)	-0.03(0.26)	0.10(0.18)	0.35(0.18)
Percent Hispanic/Latino change High=1, 2000-2010	-0.09(0.25)	0.18(0.21)	0.20(0.16)	0.32(0.15)*
Percent Hispanic/Latino origin	-0.33(0.15)*	-0.47(0.18)*	-0.75(0.17)***	-1.13(0.15)***
County Food and Exercise Environment				
Percent No car/access to grocery store, 2010	-0.11(0.31)	-0.04(0.31)	-0.05(0.22)	0.08(0.23)
Fast-food restaurants per 1,000 High =1, 2007; 2011	-0.04(0.22)	-0.09(0.22)	-0.13(0.16)	-0.12(0.16)
Full-service restaurants per 1,000 High=1, 2007; 2011	0.34(0.26)	1.01(0.25)***	0.52(0.18)**	0.86(0.17)***
Grocery/supermarkets per 1,000 High=1, 2007; 2011	0.29(0.22)	-0.20(0.22)	0.20(0.16)	-0.13(0.16)
Convenience stores per 1,000 High=1, 2007; 2011	0.40(0.22)	0.10(0.22)	0.25(0.16)	0.06(0.16)
Farmers' markets per 1,000 High=1, 2009; 2013	0.14(0.22)	0.34(0.22)	-0.11(0.15)	0.26(0.15)
Recreational facilities per 1,000 High=1, 2007; 2011	0.19(0.22)	0.25(0.23)	0.08(0.16)	-0.11(0.17)
Civic Structure				
Rupasingha and Goetz index High =1, 2005; 2009	0.90(0.31)**	0.44(0.27)	0.54(0.20)**	0.29(0.18)
Ancestry				
Percent American, 2000; 2006-2010	-1.66(0.29)***	-0.51(0.21)*	-1.41(0.20)***	-0.46(0.17)**
Percent English, 2000; 2006-2010	0.77(0.21)***	0.29(0.17)	0.67(0.15)***	0.31(0.13)**

Table 9. (continued)

Percent Irish, 2000; 2006-2010	-0.88(0.26)***	-1.50(0.21)***	-0.75(0.17)***	-1.13(0.15)***
Percent Norwegian, 2000; 2006-2010	0.39(0.19)*	0.06(0.17)	0.47(0.14)***	0.18(0.13)

a Multiple linear regression results for non-metro and all counties nationally. Values are non-standardized coefficients with standard errors in parentheses.

All models are significant at *p<.05; **p<.01; ***p<.001

First time period analyses are indicated by the year listed following the independent/control variable name; with the second time period listed second.

Three predictor variables (percent uninsured, percent same residence, and percent housing units with no car/access to grocery store) only had one time period available, and are used again for the second time period.

Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.

Percent of county with good health (dependent variable) was only available for one time period and is used in both the first and second time periods of analysis.

High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

Hypothesis 3: Research shows that higher ethnic density is associated with better health outcomes (Fang et al. 1998; Franzini and Spears 2003) and the underlying mechanism may be related to civic structure (Smaje 1995). However, ethnic density research thus far has been largely limited to the individual-level of analysis, and minority populations. This research expands this theoretical perspective to European ancestries as well. To determine if an ethnic density effect is observed, ancestries were developed into density categories, which is similar to past research (Becares 2013; Becares et al. 2009; Karlsen et al. 2002). Ethnic density categories were not analyzed for Norwegian ancestry given that counties with this ancestry were heavily concentrated in just a few categories. Given this, Norwegian ancestry is only included in the regression models as a continuous variable.

This study hypothesizes that higher ethnic density will be positively associated with self-reported good health compared to the lowest density level. This hypothesis is not supported. Similar to what has been found in ethnic density research evaluating minority populations (Becares et al. 2009), there appears to be inconsistency in the results among ancestries. When analyzed as a continuous variable, counties with greater densities of German ancestry have higher percent county good health. But when density categories are used, the results show that higher densities are needed before statistical significance is observed. In general, counties with German ancestry needed higher densities (10 percent or higher) before statistical significance was observed. However, higher population density levels were not related to better health for American, English and Irish ancestries. In fact, American ancestry at densities of 10 percent or higher became statistically significant and negatively related to good health when compared to zero to five percent in non-metro counties and all counties nationally. Greater density levels of

Irish ancestry were also associated with a lower percentage of good health when compared to the lowest density category.

Few differences were observed depending on if civic structure was controlled. The level of statistical significance and magnitude of the coefficients for counties with higher density levels of German ancestry were stronger when civic structure was not controlled (10 to 35 percent density only). In general, very few changes were observed regarding whether or not civic structure was controlled. These findings suggest that there are other more important mediators at play.

Table 10. Percent of county with self-reported good health(age-adjusted) (2006-2012) (Dependent Variable)a with ancestry density categories

	Non-metro Unadjusted	Non-metro Adjusted	All counties Unadjusted	All counties Adjusted
N	1628	1628	2708	2706
Adjusted R^2	.62	.62	.64	.64
Health Indicators				
Percent obesity, 2004	-0.08(0.06)	-0.07(0.06)	-0.09(0.04)*	-0.08(0.04)*
Percent diabetes, 2004	-0.23(0.14)	-0.24(0.14)	-0.20(0.10)*	-0.20(0.10)*
County Demographic/Economic Structure				
Educational attainment, 2000	0.26(0.03)***	0.24(0.03)***	0.28(0.02)***	0.27(0.02)***
Median Income, 2000	5.07(0.97)***	5.22(0.96)***	4.53(0.64)***	4.61(0.64)***
Percent unemployed, 2000	-2.29(0.40)***	-2.82(0.40)***	-2.97(0.29)***	-2.91(0.29)***
Percent uninsured, 2010	0.03(0.03)	0.04(0.03)	0.01(0.02)	0.01(0.02)
Percent same residence, 2000	0.10(0.02)***	0.09(0.02)***	0.08(0.02)***	0.08(0.02)***
Mean travel time to work, 2000	-0.12(0.03)***	-0.11(0.03)***	-0.08(0.02)***	-0.07(0.02)***
Percent female, 2000 High=1	-0.40(0.23)	-0.45(0.23)	-0.34(0.16)*	-0.38(0.16)*
Percent African-American, 2000 High=1	0.30(0.14)*	0.32(0.14)*	0.34(0.10)***	0.36(0.18)***
Percent married, 2000 High=1	-0.16(0.25)	-0.15(0.25)	-0.01(0.18)	-0.01(0.18)
Percent Hisp/Lat chng, 2000-10 High=1	-0.08(0.23)	-0.08(0.23)	0.12(0.16)	0.14(0.16)
Percent Hispanic/Latino, 2000	-0.22(0.14)	-0.20(0.31)	-0.18(0.11)	-0.15(0.11)
County Food/Exercise Env.				
Percent No car/access to store, 2010	-0.08(0.31)	-0.05(0.31)	-0.09(0.23)	-0.06(-0.06)
Fast-food rest. per 1,000 High=1 2007	-0.06(0.23)	-0.07(0.23)	-0.11(0.16)	-0.12(0.16)
Full-service rest. per 1,000 High=1 2007	0.33(0.26)	0.27(0.26)	0.54(0.18)**	0.51(0.18)**
Groc./supmrkets per 1,000 High=1 2007	0.28 (0.23)	0.26(0.23)	0.23(0.16)	0.20(0.16)
Convenience stores per 1,000 High=1	0.40(0.22)*	0.42(0.22)	0.19(0.16)	0.21(0.16)
Farmers'markets per 1,000 High=1 2009	0.09(0.22)	0.11(0.22)	-0.11(0.15)	-0.12(0.15)**
Recr. facilities per 1,000 High=1 2007	0.24(0.22)	0.19(0.22)	0.10(0.16)	0.06(0.16)
Civic Structure				
Rupasingha/Goetz index, 2005 High=1		0.83(0.19)***		0.60(0.21)**

Table 10. (continued)

Ancestry				
American, 2000				
5-10 percent	-0.37(0.38)	-0.38(0.38)	-0.04(0.27)	-0.04(0.25)
10 percent or higher	-0.92(0.47)*	-0.97(0.46)*	-0.64(0.30)*	-0.63(0.30)*
English, 2000				
5-10 percent	-0.48(0.37)	-0.44(0.37)	-0.35(0.27)	-0.33(0.27)
10-15 percent	0.48(0.47)	0.49(0.47)	0.31(0.33)	0.33(0.33)
15 percent or higher	0.35(0.61)	0.44(0.61)	0.36(0.43)	0.41(0.43)
German, 2000				
5-10 percent	0.44(0.41)	0.46(0.41)	0.47(0.29)	0.49(0.29)
10-35 percent	1.36(0.51)**	1.21(0.51)*	0.91(0.35)**	0.85(0.35)*
35 percent or higher	2.11(0.64)***	1.92(0.64)**	1.71(0.46)***	1.61 (0.46)***
Irish, 2000				
5-10 percent	-1.42(0.40)***	-1.45(039)***	-1.27(0.31)***	-1.25(0.31)***
10-15 percent	-1.56(0.47)***	-1.63(0.47)***	-1.47(0.35)***	-1.50(0.35)***
15 percent or higher	-1.21(0.65)	-1.24(0.65)	-1.44(0.43)***	-1.41(0.43)***
Norwegian, 2000	0.72(0.19)***	0.70(0.19)***	0.76(0.14)***	0.75(0.14)***

a Multiple linear regression results for non-metro and all counties nationally.
Values are non-standardized coefficients with standard errors in parentheses.
All models are significant at *p<.05; **p<.01; ***p<.001
Models are unadjusted (civic structure not controlled) and adjusted (controlled for civic structure, 2005).
Reference category is 0 to 5 percent for all European ancestries.
County Norwegian ancestry was not made into categories given the overall small density.

Obesity

County-level obesity was regressed across four models. The non-metro models used predictors from two different time periods (2000 and 2006-2010). Likewise, all counties across the nation were also evaluated across the same two time periods identified previously. Using the same process outlined for percent county good health, this section will first outline the three multiple regression steps taken and the change in adjusted R^2 followed by the ancestry/health results. For more information detailing the regressions at each step see Tables 3 and 4 of the appendix on pages 155-158.

Demographic/economic structure, food/exercise environment and ancestry appear to explain the most variance in the models, whereas civic structure does not add any. At the national level, county demographic/economic and food/exercise measures explained 53 percent of the variance in 2000 (46 percent for 2006-2010) (Table 3 in appendix). At the non-metro

level, county demographic/economic structure and food/exercise environment measures explained 51 percent of variance in 2000 (42 percent for 2006-2010) (Table 4 in appendix). Adding civic structure to the four models failed to make any difference in explained variance and the R^2 changes were not statistically significant for both time periods. Adding individual ancestries significantly, but not substantially increased explained variance across the four models for both time periods. At the national level, a significant R^2 change of .043 was observed with the addition of ancestry measures in the first time period (2000) ($p<.001$) and .037 for the second time period (2006-2010) ($p<.001$). In non-metro counties, a significant R^2 change of .046 was observed with the addition of ancestry measures in the first time period (2000) ($p<.001$) and .043 in the second time period ($p<.001$). Taken together, the full models explained between 49 and 57 percent of variance in non-metro and all counties nationally.

Hypothesis 1: Theory suggests that areas with high civic structure will have lower obesity (Holtgrave and Crosby 2006; Yoon and Brown 2011). This study goes further by also controlling for the food environment and food access, which has previously not been taken into account in research (Holtgrave and Crosby 2006; Kim et al. 2006; Yoon and Brown 2011). This study hypothesized that counties rating high in civic structure will have lower obesity compared to counties rating low in civic structure. From the outset, this study shows that civic structure does not explain additional variance in any of the models. Further, civic structure does not appear to be statistically significant in any of the models except at the national level for the second time period where ancestries are controlled (Table 11). The only way that high civic structure counties have lower obesity compared to low civic structure counties was through manipulating which ancestries were not controlled (German). However, as stated previously, it is fully expected that counties with European ancestries are allowed to influence the models.

Given this, hypothesis 1 is not supported (see Tables 3 and 4 of the appendix for regression coefficients specific to civic structure on pages 155-158).

Another interesting finding is that results could differ depending on if the food/exercise environment measures were included in the models. These outcomes were not consistent across the different time periods, however. In the first time period of analysis at the national-level, a significant R^2 change of .031 was observed with the addition of the food/exercise environment measures ($p<.001$) (Table 8 of appendix). Civic structure was negative and not significant with only demographic/economic structure included in the model. However, once the food/exercise environment measures were added, civic structure became positive (but still not significant). In the second time period, a significant R^2 change of .027 was observed with the addition of the food/exercise environment measures ($p<.001$). If the model only included demographic/economic structure, which is what is often only found in civic structure and obesity research, then there is a negative and significant relationship ($p<.001$). Yet, when food/exercise measures are included in the model, then the negative relationship loses statistical significance. This may suggest that past research into civic structure and obesity may have not taken into account the full array of factors that could explain these relationships. At the non-metro level, the magnitude of the unstandardized coefficients changed, but not the direction of signs or statistical significance.

Hypothesis 2: This study hypothesized that counties with higher percentages of residents with German and Norwegian ancestries will have lower obesity compared to those counties with other European ancestries that rated lower in civic structure. This hypothesis is not supported. German ancestry was positive and significantly related to obesity in both time periods in non-metro and all counties ($p<.001$). The positive association with German ancestry and obesity

remained regardless if other ancestries were included in the models and whether or not civic structure was controlled. Norwegian ancestry was significantly related to lower obesity in non-metro ($p<.001$) and all counties nationally ($p<.01$, 2000; $p<.001$, 2006-2010) for both time periods evaluated.

Although counties with higher population densities of Norwegian ancestry would suggest partially confirming the hypothesis, the preponderance of evidence from the other ancestries suggests that counties with greater densities of civically inclined ancestries do not have lower obesity. Further, counties with higher percentages of residents with German ancestry, a high civic structure ancestry, showed higher obesity in all models for both time periods. Again, this hypothesis is not supported.

Table 11. Percent of county with obesity, 2004; 2010 (Dependent Variable)a

	Non-metro 2000-2005	Non-metro 2006-2010	All counties 2000-2005	All counties 2006-2010
N	1946	1934	3101	3085
Adjusted $\mathbf{R^2}$	0.56	0.49	0.58	0.53
County Demographic/Economic Structure				
Educational attainment, 2000; 2006-2010	0.00(0.01)	-0.03(0.02)	-0.00(0.01)	-0.02(0.02)
Median household income, 2000; 2006-2010	-1.57(0.49)***	-4.56(0.59)***	-1.567(0.37)***	-5.74(0.45)***
Percent unemployed, 2000; 2010	0.58(0.19)**	-0.64(0.23)**	0.80(0.15)***	-0.22(0.19)
Percent uninsured, 2010	0.03(0.01)*	-0.00(0.02)	0.03(0.01)**	0.02(0.01)
Percent same residence, 2000	0.04(0.01)***	0.07(0.02)***	0.04(0.01)***	0.10(0.01)***
Mean travel time to work, 2000; 2006-2010	-0.05(0.01)***	-0.01(0.02)	-0.05(0.01)***	-0.03(0.01)**
Percent 65 years of age or older	-0.05(0.02)**	-2.84(0.42)***	-0.08(0.02)***	-3.25(0.32)***
Percent female High=1, 2000; 2005-2009	0.33(0.12)**	0.21(0.15)	0.29(0.09)***	0.06(0.12)
Percent Black/African-American, 2000; 2006-2010	0.68(0.07)***	0.91(0.08)***	0.73(0.05)***	0.91(0.07)***
Percent married High=1, 2000; 2006-2010	0.19(0.13)	0.58(0.18)***	0.29(0.10)**	0.71(0.14)***
Percent Hispanic/Latino change High=1, 2000-2010	-0.13(0.11)	0.15(0.14)	-0.00(0.09)	0.27(0.11)*
Percent Hispanic/Latino, 2000; 2006-2010	-0.92(0.07)***	-1.16(0.12)***	-0.87(0.05)***	-1.08(0.10)***
County Food and Exercise Environment				
Percent No car/access to grocery store, 2010	0.42(0.14)**	-0.01(0.19)	0.54(0.11)***	0.20(0.16)
Fast-food restaurants per 1,000 High =1, 2007; 2011	-0.11(0.11)	-0.30(0.15)	-0.06(0.09)	-0.30(0.12)**
Full-service restaurants per 1,000 High=1, 2007; 2011	-.79(0.13)***	-0.80(0.17)***	-0.92(0.10)***	-1.02(0.13)***
Grocery/supermarkets per 1,000 High=1, 2007; 2011	0.05(0.11)	-0.15(0.15)	-0.04(0.09)	-0.25(0.12)*
Convenience stores per 1,000 High=1, 2007; 2011	0.37(0.11)***	0.24(0.15)	0.40(0.09)***	0.45(0.12)***
Farmers' markets per 1,000 High=1, 2009; 2013	0.06(0.11)	0.11(0.15)	-0.09(0.08)	0.14(0.11)
Recreational facilities per 1,000 High=1, 2007; 2011	-0.16(0.11)	-0.35(0.15)*	-0.25(0.09)**	-0.58(0.12)***
Civic Structure				
Rupasingha and Goetz index High =1, 2005; 2009	-0.09(0.15)	-0.34(0.18)	-0.19(0.11)	-0.40(0.14)**
Ancestry				
Percent American, 2000; 2006-2010	0.03(0.14)	0.05(0.14)	0.35(0.11)***	0.29(0.11)**
Percent English, 2000; 2006-2010	-1.05(0.10)***	-0.98(0.12)***	-0.86(0.08)***	-0.71(0.09)***
Percent German, 2000; 2006-2010	0.47(0.14)***	0.91(0.18)***	0.88(0.11)***	1.41(0.14)***

Table 11. (continued)

Percent Irish, 2000; 2006-2010	-0.52(0.14)***	-0.26(0.14)	-0.62(0.09)***	-0.28(0.11)**
Percent Norwegian, 2000; 2006-2010	-0.36(0.09)***	-0.85(0.11)***	-0.23(0.07)***	-0.74(0.09)***

a Multiple linear regression results for non-metro and all counties nationally. Values are non-standardized coefficients with standard errors in parentheses.

All models are significant at *p<.05; **p<.01; ***p<.001.

Percent of county with obesity (dependent variable) is from 2004 in the first time period, and 2010 for the second time period.

First time period analyses are indicated by the year listed following the independent/control variable name; with the second time period listed second.

Three predictor variables (percent uninsured, percent same residence, and percent housing units with no car/access to grocery store) only had one time period available, and are used again for the second time period.

Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.

High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

Hypothesis 3: This study hypothesized that higher ethnic density will be related to lower obesity compared to the lowest density level. Density appears to be important, but not consistently across ancestries. Given this, this hypothesis is only partially supported. Further, civic structure does not appear to mediate the relationship between ancestry and obesity even at greater densities. Very few if any studies have extended the work of ethnic density to obesity research or European ancestry so these findings are largely exploratory in nature.

Counties with higher population density levels of English and Irish have lower obesity when compared to the lowest density level, and regardless if civic structure was controlled (Table 12). Counties with higher population levels of American and German ancestry have higher obesity when compared to the lowest density level. Lastly, very few differences were observed if civic structure was controlled in the models in non-metro or all counties nationally.

Table 12. Percent of county with obesity, 2004 (Dependent Variable)a with ancestry density categories

	Non-metro Unadjusted	Non-metro Adjusted	All counties Unadjusted	All counties Adjusted
N	1628	1628	2708	2706
Adjusted R^2	.56	.56	.58	.58
County Demographic/Economic Structure				
Educational attainment, 2000	-0.02(0.01)	-0.02(0.01)	-0.03(0.01)**	-0.02(0.01)**
Median Income, 2000	-1.73(0.49)***	-1.72(0.49)***	-1.54(0.36)***	-1.52(0.36)***
Percent unemployed, 2000	0.52(0.19)**	0.51(0.19)**	0.74(0.15)***	0.72(0.15)***
Percent uninsured, 2010	0.03(0.01)*	0.03(0.01)***	0.02(0.01)*	0.02(0.01)*
Percent same residence, 2000	0.06 (0.01)***	0.06 (0.01)***	0.07 (0.01)***	0.07 (0.01)***
Mean travel time to work, 2000	-0.05(0.01)***	-0.05(0.01)***	-0.06(0.01)***	-0.06(0.01)***
Percent 65 years of age or older, 2000	-0.08(0.02)***	-0.08(0.02)***	-0.11(0.01)***	-0.11(0.01)***
Percent female, 2000 High=1	0.35(0.12)**	0.35(0.12)**	0.28(0.09)***	0.29(0.09)***
Percent African-American, 2000 High=1	0.74(0.07)***	0.74(0.07)***	0.74(0.05)***	0.73(0.05)***
Percent married, 2000 High=1	0.14(0.13)	0.14(0.13)	0.28(0.10)**	0.27(0.10)**
Percent Hisp/Lat chng, 2000-10 High=1	-0.09(0.11)	-0.09(0.11)	0.06(0.09)	0.05(0.09)
Percent Hispanic/Latino, 2000	-0.85(0.06)***	0.44(0.14)**	-0.81(0.05)***	-0.81(0.05)***

Table 12. (continued)

County Food/Exercise Environment				
Percent No car/access to store, 2010	0.44(0.14)***	0.44(0.14)**	0.55(0.11)***	0.53(0.11)***
Fast-food rest. per 1,000 High=1 2007	-0.15(0.11)	-0.15(0.11)	-0.06(0.09)	-0.07(0.09)
Full-service rest. per 1,000 High=1 2007	-0.77(0.13)***	-0.77(0.13)***	-0.88(0.10)***	-0.87(0.10)**
Groc./supmrkets per 1,000 High=1 2007	0.03(0.11)***	0.03(0.11)***	-0.06(0.09)	-0.05(0.09)
Convenience stores per 1,000 High=1	0.34(0.11)**	0.34(0.11)**	0.37(0.09)***	0.36(0.09)***
Farmers'markets per 1,000 High=1 2009	0.04(0.11)	0.04(0.11)	-0.10(0.08)	-0.10(0.08)
Recr. facilities per 1,000 High=1 2007	-0.20(0.11)	-0.20(0.11)	-0.29(0.09)***	-0.14(0.11)***
Civic Structure				
Rupasingha/Goetz Index, 2005 High=1		-0.09(0.15)		0.02(0.07)
Ancestry				
American, 2000				
5-10 percent	0.37(0.18)*	0.37(0.18)*	0.74(0.13)***	0.73(0.13)***
10 percent or higher	0.29(0.22)	0.29(0.22)	0.77(0.16)***	0.76(0.16)***
English, 2000				
5-10 percent	-0.55(0.18)**	-0.55(0.18)**	-0.42(0.14)**	-0.43(0.14)**
10-15 percent	-0.97(0.23)***	-0.97(0.23)***	-0.87(0.18)***	-0.87(0.18)***
15 percent or higher	-2.68(0.28)***	-2.69(0.28)***	-2.44(0.22)***	-2.45(0.22)***
German, 2000				
5-10 percent	0.12(0.20)	0.11(0.20)	0.11(0.16)	0.09(0.16)
10-35 percent	0.70(0.25)**	0.71(0.25)**	0.86(0.19)***	0.86(0.19)***
35 percent or higher	0.91 (0.32)**	0.93 (0.32)**	1.28 (0.25)***	1.29 (0.25)***
Irish, 2000				
5-10 percent	-0.37(0.20)	-0.37(0.20)*	-0.42(0.17)**	-0.44(0.17)**
10-15 percent	-0.51(0.23)*	-0.51(0.23)*	-0.40(0.19)**	-0.44(0.17)**
15 percent or higher	-1.61(0.31)*	-1.60(0.31)***	-1.51(0.23)***	-0.41(0.19)*
Norwegian, 2000	-0.14(0.09)	-0.14(0.09)	-0.02(0.07)	-0.02(0.07)

a Multiple linear regression results for non-metro and all counties nationally.
Values are non-standardized coefficients with standard errors in parentheses.
All models are significant at *p<.05; **p<.01; ***p<.001
All models control for health indicators, county demographic/economic structure, county food/ exercise environment, and ancestry.
Models are unadjusted (civic structure not controlled) and adjusted (controlled for civic structure, 2005).
Reference category is 0 to 5 percent for all European ancestries.
County Norwegian ancestry was not made into categories given the overall small density.

Diabetes Diagnoses

The percent of diabetes diagnoses in counties were evaluated across four models. The non-metro models used predictors from two different time periods (2000 and 2006-2010). Likewise, all counties across the nation were also evaluated across the same two time periods. Using the same process outlined for percent county good health and obesity, this section will first outline the three multiple regression steps taken and the change in adjusted R^2 followed by the

ancestry/health results. For more information fully detailing the regression steps, see Tables 5 and 6 of the appendix on pages 159-162.

Demographic/economic structure, food/exercise environment and the individual ancestries significantly adds to the predictive ability of the models; however, less consistency is observed with civic structure. At the national level, county demographic/economic structure and food/exercise measures explained 79 percent of the variance (77 percent in first time period) (Table 5 in appendix). At the non-metro level (first time period) the first model explained 80 percent of variance (76 percent in the second time period) (Table 6 in appendix). In the first time period, civic structure does not explain any variance. However, in the second time period, a significant, but not substantial .001 R^2 change was observed with the addition of civic structure to the model ($p<.001$) at the national level and at the non-metro level ($p<.01$).

Models including ancestry measures explained additional variance, but not substantially. In the first time period, a significant R^2 change of .031 ($p<.001$) was observed with the addition of the ancestry measures at the national level and .029 R^2 change at the non-metro level ($p<.001$). In the second time period, a significant R^2 change of .022 ($p<.001$) was observed at the national level and .023 at the non-metro level ($p<.001$). Taken together, the models explained between 79 to 83 percent of the variance in non-metro counties and 80 to 82 percent in all counties nationally (Table 13). The analysis of variance for all models in both time periods were significant ($p<.001$).

Hypothesis 1: Theory suggests that areas high in civic structure will have lower diabetes (Holtgrave and Crosby 2006). This study adds to existing research by controlling for the food/exercise environment. As such, this study hypothesized that counties rating high in civic structure will have lower county diabetes diagnoses compared to those counties rating low in

civic structure. This hypothesis is partially supported. Although the direction of the regression coefficient suggested that high civic structure counties have lower diabetes diagnoses compared to counties low in civic structure, only the second time period of analysis models were significant ($p<.01$) non-metro counties and ($p<.001$) all counties nationally (Table 5 of appendix).

The food/exercise environment measures do not appear to matter to the relationships between civic structure and diabetes diagnoses. At the national-level, a significant, but not substantial R^2 change of .006 was observed with the inclusion of the food/exercise environment measures for both time periods of analysis (all, $p<.001$) (Table 9 of appendix). Similar findings could be found in non-metro counties as well. However, the direction of the unstandardized coefficients and statistical significance did not change when the food/exercise environment measures were controlled. But there is a distinction worth noting. If living in the same residence over a five-year period, and mean travel time to work measures are not included with the demographic/economic structure measures, then a negative and significant ($p<.05$) relationship is identified between civic structure and diabetes diagnoses. This statistical relationship is not observed once the food/exercise environment measures are controlled. This is worth noting given that not all research into civic structure and health outcomes control for residential stability and mean travel time to work or food environment and food/exercise environment.

Hypothesis 2: This study hypothesized that counties with higher percentages of residents with German and Norwegian ancestries will have lower diabetes diagnoses compared to those ancestries with lower civic structure. This hypothesis is only partially supported.

Regressions were performed to determine if ancestry and diabetes diagnoses were influenced by food/exercise environment controls or civic structure. There appeared to be no

change in the relationships if the food/exercise environment measures were included in the models. Further, the direction and magnitude of unstandardized coefficients and level of statistical significance did not change whether civic structure was controlled.

Only counties with higher percentages of residents with Norwegian and German ancestries were consistent across both time periods (non-metro and all counties nationally). Counties with higher densities of German and Norwegian ancestry have lower diabetes diagnoses (all, $p<.001$) regardless of what ancestries were included in the models. Given this, the hypothesis can only be partially supported. If the counties with higher percentages of other European ancestries were consistent and always have higher diabetes diagnoses, the hypothesis could be fully confirmed.

Table 13. Percent of county with diabetes diagnoses, 2004; 2010 (Dependent variable)a

	Non-metro 2000-2005	Non-metro 2006-2010	All counties 2000-2005	All counties 2006-2010
N	1946	1934	3101	3085
Adjusted R^2	0.83	0.79	0.82	0.80
Health Indicators				
Percent obesity, 2004; 2010	0.28(0.01)***	0.25(0.01)***	0.26(0.01)***	0.24(0.01)***
County Demographic/Economic Structure				
Educational attainment, 2000; 2006-2010	0.02(0.00)***	0.01(0.01)	0.01(0.00)***	0.01(0.01)
Median household income, 2000; 2006-2010	0.56(0.15)***	0.22(0.21)	0.48(0.12)***	0.41(0.16)**
Percent unemployed, 2000; 2010	0.22(0.06)***	0.65(0.08)***	0.15(0.05)***	0.57(0.07)***
Percent uninsured, 2010	0.02(0.00)***	0.06(0.01)***	0.05(0.00)***	0.06(0.01)***
Percent same residence, 2000	0.02(0.00)***	0.02(0.01)***	0.02(0.00)***	0.02(0.00)***
Mean travel time to work, 2000; 2005-2009	0.01(0.00)***	-0.00(0.01)	0.01(0.00)***	0.00(0.01)
Percent 65 years of age or older	0.11(0.01)***	2.70(0.15)***	0.13(0.01)***	2.66(0.11)***
Percent female High=1, 2000; 2006-2010	0.12(0.04)***	0.05(0.05)	0.09(0.03)**	0.12(0.04)**
Percent Black/African-American, 2000; 2006-2010	0.09(0.02)***	0.17(0.03)***	0.13(0.02)***	0.23(0.02)***
Percent married High=1, 2000; 2006-2010	-0.00(0.04)	0.10(0.06)	0.00(0.03)	0.12(0.05)**
Percent Hispanic/Latino change High=1, 2000-2010	-0.04(0.03)	0.02(0.05)	-0.05(0.03)	-0.01(0.04)
Percent Hispanic/Latino, 2000; 2006-2010	-0.19(0.02)***	-0.39(0.04)***	-0.21(0.02)***	-0.39(0.03)***
County Food and Exercise Environment				
Percent No car/access to grocery store, 2010	0.22(0.04)***	0.43(0.07)***	0.19(0.04)***	0.36(0.06)***
Fast-food restaurants per 1,000 High =1, 2007; 2011	0.05(0.03)	0.16(0.05)**	0.08(0.03)**	0.17(0.04)***
Full-service restaurants per 1,000 High=1, 2007; 2011	0.11(0.04)**	-0.13(0.06)*	0.09(0.03)**	-0.15(0.04)***
Grocery/supermarkets per 1,000 High=1, 2007; 2011	0.06(0.03)	-0.00(0.05)	-0.01(0.03)	-0.07(0.04)
Convenience stores per 1,000 High=1, 2007; 2011	0.07(0.03)*	0.01(0.05)	0.05(0.03)	0.06(0.04)
Farmers' markets per 1,000 High=1, 2009; 2013	0.09(0.03)**	-0.01(0.05)	0.09(0.03)***	-0.09(0.04)*
Recreational facilities per 1,000 High=1, 2007; 2011	0.03(0.03)	-0.05(0.06)	0.04(0.03)	-0.06(0.04)

Table 13. (continued)

Civic Structure				
Rupasingha and Goetz index High =1, 2005; 2009	-0.00(0.05)	-0.08(0.07)	-0.00(0.04)	-0.07(0.05)
Ancestry				
Percent American, 2000; 2006-2010	-0.16(0.05)***	-0.02(0.05)	-0.13(0.03)***	0.08(0.04)*
Percent English, 2000; 2006-2010	0.06(0.03)	-0.09(0.04)*	0.07(0.03)**	-0.10(0.03)**
Percent German, 2000; 2006-2010	-0.33(0.04)***	-0.53(0.06)***	-0.36(0.03)***	-0.53(0.05)***
Percent Irish, 2000; 2006-2010	-0.13(0.04)***	0.02(0.05)	-0.11(0.03)***	0.03(0.04)
Percent Norwegian, 2000; 2006-2010	-0.35(0.03)***	-0.37(0.04)***	-0.37(0.02)***	-0.35(0.03)***

a Multiple linear regression results for non-metro and all counties nationally. Values are non-standardized coefficients with standard errors in parentheses.

All models are significant at *p<.05; **p<.01; ***p<.001

Percent of county with diabetes diagnoses (dependent variable) is from 2004 in the first time period, and 2010 for the second time period.

First time period analyses are indicated by the year listed following the independent/control variable name; with the second time period listed second.

Three predictor variables (percent uninsured, percent same residence, and percent housing units with no car/access to grocery store) only had one time period available, and are used again for the second time period.

Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.

High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

Hypothesis 3: Research into ethnic density has mainly only focused on self-reported health. This study contributes to further research by extending ethnic density research to European ancestries and diabetes at the area-level of focus for both non-metro and all counties nationally. This study hypothesized that ethnic density would be related to lower diabetes diagnoses at the county-level. This hypothesis is only partially supported. Counties with densities of English ancestry equal or greater to 5 percent have higher diabetes diagnoses compared to the lowest density category in non-metro and all counties nationally. However, higher ethnic density was associated with lower diabetes diagnoses for other ancestries. Counties with German and Irish ancestries have lower diabetes diagnoses at greater population density levels when compared to the lowest density category. Counties with densities of American ancestry have lower diabetes diagnoses in non-metro and all counties nationally; however, the level of significance was stronger at a density of 5 to 10 percent when compared to the lowest density category (national level). Lastly, and similar to what was found for county-level obesity, civic structure does not appear to mediate the relationship between county ancestry and county-level diabetes diagnoses in non-metro and all counties nationally.

Table 14. Percent of county with diabetes diagnoses, 2004 (Dependent Variable)a with ancestry density categories

	Non-metro Unadjusted	Non-metro Adjusted	All counties Unadjusted	All counties Adjusted
N	1628	1628	2708	2706
Adjusted R^2	.82	.82	.82	.82
Health Indicators				
Percent obesity, 2004	0.28(0.01)***	0.28(0.01)***	0.26(0.01)***	0.26(0.01)***
County Demographic/Economic Structure				
Educational attainment, 2000	0.01(0.00)***	0.01(0.00)***	0.01(0.00)**	0.01(0.00)**
Median Income, 2000	0.37(0.15)*	0.37(0.15)**	0.33(0.12)**	0.32(0.12)**
Percent unemployed, 2000	0.27(0.06)***	0.26(0.06)***	0.17(0.05)***	0.16(0.05)***
Percent uninsured, 2010	0.05(0.00)***	0.05(0.00)***	0.05(0.00)***	0.05(0.00)***
Percent same residence, 2000	0.02(0.00)***	0.02(0.00)***	0.01(0.00)***	0.02(0.00)***
Mean travel time to work, 2000	0.01(0.00)***	0.01(0.00)***	0.01(0.00)***	0.01(0.00)***
Percent 65 years of age or older, 2000	0.11(0.01)***	0.11(0.01)***	0.12(0.01)***	0.12(0.01)***
Percent female, 2000 High=1	0.15(0.04)***	0.15(0.04)***	0.12(0.03)***	0.12(0.03)***

Table 14. (continued)

Percent African-American, 2000 High=1	0.15(0.02)***	0.15(0.02)***	0.19(0.02)***	0.18(0.02)***
Percent married, 2000 High=1	-0.01(0.04)	-0.01(0.04)	0.00(0.03)	0.03(0.03)
Percent Hisp/Lat chng, 2000-10 High=1	-0.04(0.04)	-0.04(0.04)	-0.05(0.03)	-0.05(0.03)
Percent Hispanic/Latino, 2000	-0.16(0.02)***	-0.16(0.02)***	-0.19(0.02)***	-0.19(0.02)***
County Food/Exercise Environment				
Percent No car/access to store, 2010	0.23(0.04)***	0.23(0.04)***	0.20(0.04)***	0.20(0.04)***
Fast-food rest. per 1,000 High=1 2007	0.05(0.03)	0.05(0.03)	0.08(0.03)**	0.08(0.03)**
Full-service rest. per 1,000 High=1 2007	0.10(0.04)**	0.11(0.04)**	0.08(0.03)**	0.09(0.03)**
Groc./supmrkets per 1,000 High=1 2007	0.07(0.03)*	0.08(0.03)	0.00(0.03)	0.00(0.03)
Convenience stores per 1,000 High=1	0.09(0.03)**	0.09(0.03)**	0.08(0.03)**	0.08(0.03)**
Farmers'markets per 1,000 High=1 2009	0.08(0.03)**	0.08(0.03)*	0.08(0.03)**	0.08(0.03)**
Recr. facilities per 1,000 High=1 2007	0.02(0.03)	0.03(0.03)	0.03(0.03)	0.03(0.03)
Civic Structure				
Rupasingha/Goetz index, 2005 High=1		-0.04(0.05)		-0.05(0.04)
Ancestry				
American, 2000				
5-10 percent	-0.18(0.06)**	-0.18(0.06)**	-0.16(0.04)***	-0.16(0.04)***
10 percent or higher	-0.21(0.07)***	-0.21(0.07)***	-0.18(0.05)***	-0.17(0.05)***
English, 2000				
5-10 percent	0.10(0.06)	0.10(0.06)	0.10(0.05)*	0.10(0.05)*
10-15 percent	0.14(0.07)*	0.14(0.07)*	0.21(0.06)***	0.21(0.06)***
15 percent or higher	0.22(0.09)**	0.22(0.09)**	0.26(0.07)***	0.26(0.07)***
German, 2000				
5-10 percent	0.01(0.06)	0.01(0.06)	-0.02(0.05)	-0.02(0.05)
10-35 percent	-0.14(0.08)	-0.14(0.08)	-0.13(0.06)*	-0.13(0.06)*
35 percent or higher	-0.32(0.10)***	-0.31(0.10)**	-0.38(0.08)***	-0.38(0.08)***
Irish, 2000				
5-10 percent	-0.27(0.06)***	-0.27(0.06)***	-0.27(0.05)***	-0.27(0.05)***
10-15 percent	-0.31(0.07)***	-0.31(0.07)***	-0.32(0.06)***	-0.32(0.06)***
15 percent or higher	-0.42(0.10)***	-0.42(0.10)***	-0.40(0.08)***	-0.40(0.08)***
Norwegian, 2000	-0.35(0.03)***	-0.35(0.03)***	-0.36(0.02)***	-0.40(0.08)***

a Multiple linear regression results for non-metro and all counties nationally.
Values are non-standardized coefficients with standard errors in parentheses.
All models are significant at *p<.05; **p<.01; ***p<.001
All models control for health indicators, county socioeconomic characteristics, food environment, and ancestry.
Models are unadjusted (civic structure not controlled) and adjusted (controlled for civic structure, 2005).
Reference category is 0 to 5 percent for all European ancestries.
County Norwegian ancestry was not made into categories given the overall small density.

County-Level Smoking

As stated previously when discussing the conceptual model on page 9, counties with higher percentages of residents who currently smoke or have ever smoked 100 cigarettes in their lifetime (here forward referred to as percent county smoking) will be evaluated to ensure that the relationships identified thus far are not changed due to not controlling for percent county smoking. Research finds that smoking can have adverse health effects (Bamia et al. 2004;

Chiolero et al. 2008; Houston et al. 2006; John et al. 2005). However, this study did not initially control for percent county smoking for a few reasons. First, health research that has examined mortality, obesity or diabetes have not been consistent in using smoking as a control. Another complication is that several national-level databases with county-level smoking statistics have a large number of missing data and to use these statistics as a control would have dramatically reduced the overall county sample-size of this study. To ensure that county-level smoking does not change the relationships between ancestries, civic structure and health outcomes, two models at the national level were created. Model 1 excludes percent county smoking and model 2 includes percent county smoking. Both models exclude the counties with percent county smoking missing data so that the sample sizes are the same for both models. Although both time periods were evaluated (2000 and 2006-2010), models for only the first time period of analysis are shown below in tables (Table 15).

In general, the ancestry results for percent county good health, obesity and diabetes diagnoses appear relatively similar whether percent county smoking is controlled or not; however, a few differences were observed in the second time period. In the first time period of analysis, the ancestry variables all show the same coefficient direction and roughly the same levels of statistical significance with regard to county-level good health. The magnitude of statistical significance for counties with higher percentages of residents with Irish and English ancestries weakened, but remained positive and significant. Even with the reduced sample due to filtering out missing data, the results are roughly the same as presented previously where all counties are included in the analysis. In the second time period of analysis, a few differences were identified. The direction of the unstandardized coefficients for counties with higher percentages of residents with American and English ancestries remained the same whether or not

smoking was controlled; however, statistical significance went away when smoking was controlled in the model (not shown). Therefore, smoking does have some influence, but not enough to change the direction of the coefficients.

Table 15. Percent of county with self-reported good health (age-adjusted), 2006-2012 and percent county smoking (Dependent Variable)a

	All counties Model 1	All counties Model 2
N	2573	2573
Adjusted R^2	0.67	0.69
Health Indicators		
Percent smoking, 2006-2012		-0.17(0.01)***
Percent obesity, 2004	-0.08(0.04)*	-0.04(0.04)
Percent diabetes, 2004	-0.17(0.09)*	-0.10(0.09)
County Demographic/Economic Structure		
Educational attainment, 2000	0.24(0.02)***	0.22(0.02)***
Median household income, 2000	4.54(0.62)***	3.66(0.61)***
Percent unemployed, 2000	-2.91(0.28)***	-2.65(0.27)***
Percent uninsured, 2010	0.00(0.02)	-0.01(0.03)
Percent same residence, 2000	0.05(0.02)***	0.04(0.02)**
Mean travel time to work, 2000	-0.04(0.02)*	-0.03(0.02)
Percent female High=1, 2000	-0.19(0.16)	-0.33(0.16)
Percent Black/African-American, 2000	0.38(0.10)***	0.19(0.10)*
Percent married High=1, 2000	-0.07(0.24)	-0.16(0.17)
Percent Hispanic/Latino change High=1, 2000	0.26(0.16)	0.28(0.15)
Percent Hispanic/Latino, 2000	-0.22(0.15)*	-0.24(0.11)*
County Food and Exercise Environment		
Percent No car/access to grocery store, 2010	0.22(0.22)	0.37(0.22)
Fast-food restaurants per 1,000 High =1, 2007	-0.16(0.16)	-0.16(0.16)
Full-service restaurants per 1,000 High=1, 2007	0.39(0.18)*	0.31(0.18)
Grocery/supermarkets per 1,000 High=1, 2007	0.23(0.16)	0.16(0.15)
Convenience stores per 1,000 High=1, 2007	0.27(0.16)*	0.25(0.16)
Farmers' markets per 1,000 High=1, 2009	-0.02(0.21)	-0.03(0.14)
Recreational facilities per 1,000 High=1, 2007	0.11(0.16)	0.15(0.15)
Civic Structure		
Rupasingha and Goetz index High =1, 2005; 2009	0.44(0.20)*	0.25(0.20)
Ancestry		
Percent American, 2000	-1.45(0.19)***	-1.04(0.20)***
Percent English, 2000	0.60(0.15)***	0.37(0.15)**
Percent German, 2000	0.80(0.19)***	0.91(0.19)***

Table 15. (continued)

Percent Irish, 2000	-0.71(0.29)***	-0.34(0.17)*
Percent Norwegian, 2000	0.55(0.14)***	0.43(0.13)***

a Multiple linear regression results for counties nationally, excluding missing data for percent smoking 2006-2012. Values are non-standardized coefficients with standard errors in parentheses. All models are significant at *p<.05; **p<.01; ***p<.001
Model 1 excludes percent county smokers; model 2 includes percent of county with smokers
Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.
High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

The results for percent county obesity whether county smoking was controlled or not appear roughly the same. In the first time period, the magnitude of statistical significance reduced some for counties with higher populations of American and Irish ancestries when percent county smoking was controlled, but significance remains as does the direction of the coefficients. The results also for the most part mirror results discussed previously, despite the reduced sample size. The only exception unique with regard to controlling or not for smoking is that counties with higher percentages of residents with Norwegian ancestry lost statistical significance when smoking was controlled, but just barely (p<.057). This lack of statistical significance for when smoking was controlled was not observed in the second time period of analysis. In general, the second time period of analysis has the same results whether or not smoking is controlled in the models with the exception of counties with higher populations of American ancestry, which lost statistical significance when smoking was controlled.

Table 16. Percent of county with obesity with percent county smoking (Dependent Variable)a

	All counties Model 1	All counties Model 2
N	2674	2674
Adjusted $\boldsymbol{R^2}$	0.60	0.61
Health Indicators		
Percent smoking, 2006-2012		0.07(0.01)***
County Demographic/Economic Structure		
Educational attainment, 2000	0.00(0.01)	0.01(0.01)
Median household income, 2000	-1.86(0.40)***	-1.43(0.40)***
Percent unemployed, 2000	0.95(0.16)***	0.82(0.16)***
Percent uninsured, 2010	0.04(0.01)**	0.04(0.01)***
Percent same residence, 2000	0.05(0.01)***	0.06(0.01)***
Mean travel time to work, 2000	-0.06(0.01)***	-0.07(0.01)***
Percent 65 years of age and older, 2000	-0.09(0.02)***	-0.09(0.02)***
Percent female High=1, 2000	0.29(0.10)**	0.32(0.10)***
Percent Black/African-American, 2000	0.78(0.06)***	0.82(0.06)***
Percent married High=1, 2000	0.29(0.11)**	0.36(0.11)***
Percent Hispanic/Latino change High=1, 2000	0.02(0.09)	-0.02(0.09)
Percent Hispanic/Latino, 2000	-0.93(0.06)***	-0.90(0.06)***
County Food and Exercise Environment		
Percent No car/access to grocery store, 2010	0.57(0.13)***	0.49(0.13)***
Fast-food restaurants per 1,000 High =1, 2007	-0.04(0.10)	-0.03(0.09)
Full-service restaurants per 1,000 High=1, 2007	-1.05(0.11)***	-1.00(0.11)***
Grocery/supermarkets per 1,000 High=1, 2007	-0.06(0.09)	-0.03(0.09)
Convenience stores per 1,000 High=1, 2007	0.36(0.10)***	0.35(0.09)***
Farmers' markets per 1,000 High=1, 2009	-0.12(0.09)	-0.12(0.09)
Recreational facilities per 1,000 High=1, 2007	-0.30(0.09)***	-0.30(0.09)***
Civic Structure		
Rupasingha and Goetz index High =1, 2005; 2009	-0.26(0.12)*	-0.18(0.12)
Ancestry		
Percent American, 2000	0.40(0.12)***	0.24(0.12)*
Percent English, 2000	-0.80(0.09)***	-0.71(0.09)***
Percent German, 2000	1.05(0.12)***	0.96(0.12)***
Percent Irish, 2000	-0.64(0.10)***	-0.77(0.10)***
Percent Norwegian, 2000	-0.20(0.08)**	-0.15(0.08)

a Multiple linear regression results for counties nationally, excluding missing data from percent smoking 2006-2012. Values are non-standardized coefficients with standard errors in parentheses. All models are significant at *p<.05; **p<.01; ***p<.001

Model 1 excludes the variable percent of county with smokers; model 2 includes percent of county with smokers

High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

The results for percent county diabetes diagnoses appeared virtually the same whether percent smoking was controlled or not. The second time period results appeared the same whether or not smoking is controlled except for counties with higher percentages of residents with Irish ancestry. Counties with a higher population of Irish ancestry changed direction (positive to negative), but remained not significant.

Table 17. Percent of county with diabetes diagnoses with percent county smoking (Dependent Variable)a

	All counties Model 1	All counties Model 2
N	2674	2674
Adjusted $\boldsymbol{R^2}$	0.83	0.83
Health Indicators		
Percent smoking, 2006-2012		0.01(0.00)***
Percent obesity, 2004	0.25(0.01)***	0.25(0.01)***
County Demographic/Economic Structure		
Educational attainment, 2000	0.02(0.00)***	0.02(0.00)***
Median household income, 2000	0.50(0.13)***	0.57(0.13)***
Percent unemployed, 2000	0.25(0.05)***	0.23(0.05)***
Percent uninsured, 2010	0.05(0.00)***	0.05(0.00)***
Percent same residence, 2000	0.01(0.00)***	0.01(0.00)***
Mean travel time to work, 2000	0.01(0.00)**	0.01(0.00)**
Percent 65 years of age and older, 2000	0.13(0.01)***	0.13(0.01)***
Percent female High=1, 2000	0.11(0.03)***	0.11(0.03)***
Percent Black/African-American, 2000	0.13(0.02)***	0.14(0.02)***
Percent married High=1, 2000	0.01(0.03)	0.03(0.03)
Percent Hispanic/Latino change High=1, 2000	-0.04(0.03)	-0.05(0.03)
Percent Hispanic/Latino, 2000	-0.24(0.02)***	-0.24(0.02)***
County Food and Exercise Environment		
Percent No car/access to grocery store, 2010	0.24(0.04)***	0.23(0.04)***
Fast-food restaurants per 1,000 High =1, 2007	0.07(0.03)*	0.08(0.03)**
Full-service restaurants per 1,000 High=1, 2007	0.07(0.04)*	0.08(0.04)*
Grocery/supermarkets per 1,000 High=1, 2007	-0.03(0.03)	-0.03(0.03)
Convenience stores per 1,000 High=1, 2007	0.03(0.03)	0.03(0.03)
Farmers' markets per 1,000 High=1, 2009	0.10(0.03)***	0.10(0.03)***
Recreational facilities per 1,000 High=1, 2007	0.05(0.03)	0.04(0.03)
Civic Structure		
Rupasingha and Goetz index High =1, 2005; 2009	-0.03(0.04)	-0.02(0.04)

Table 17. (continued)

Ancestry		
Percent American, 2000	-0.13(0.04)***	-0.16(0.04)***
Percent English, 2000	0.04(0.03)	0.05(0.03)
Percent German, 2000	-0.32(0.04)***	-0.34(0.04)***
Percent Irish, 2000	-0.16(0.03)***	-0.18(0.03)***
Percent Norwegian, 2000	-0.37(0.03)***	-0.36(0.03)***

a Multiple linear regression results for counties nationally, excluding missing data from percent smoking 2006-2012. Values are non-standardized coefficients with standard errors in parentheses. All models are significant at *p<.05; **p<.01; ***p<.001

Model 1 excludes the variable percent of county with smokers; model 2 includes percent of county with smokers

High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

CHAPTER 7

DISCUSSION

This study attempted to combine three separate streams of literature in an effort to answer questions that have both cultural and geographic implications: Do counties with a higher percentage of residents with a particular ancestry (Norwegian and German) have greater civic structure and consequently better health outcomes? Is higher ethnic density associated with better health outcomes? This research finds that given the great variation across county ancestry density and health outcomes that a single answer is not possible. Several findings were identified that deserve further discussion.

This study tested three hypotheses for each of the dependent variables. First, regressions were performed to determine if counties with high civic structure have lower self-reported good health, and lower prevalence of obesity and diabetes diagnoses compared to counties that rated low in civic structure (hypothesis 1). Secondly, counties with higher percentages of residents with German and Norwegian ancestries were tested to see if they have higher self-reported good health, lower prevalence of obesity, and lower levels of diabetes diagnoses (hypothesis 2). Lastly, ancestries were developed into density categories to determine if higher density levels of a particular ancestry have higher civic structure and self-reported good health, and lower obesity prevalence and diabetes diagnoses when compared to the lowest density category (hypothesis 3).

This study suggests that county self-reported ancestry does matter given different health outcomes were observed across counties with higher and differing percentages of residents of European ancestries. Counties with high civic structure have higher levels of self-reported good health compared to those counties low in civic structure. However, these relationships were not substantial given all models showed very little variance explained by adding civic structure.

Relationships between civic structure and obesity, diabetes diagnoses either did not exist or were less consistent. Norwegian and German ancestries were associated with higher civic structure, but were not always related to better health outcomes. Ethnic density was not always associated with better health outcomes. In general, civic structure and health outcomes varied very little across non-metro counties and all counties nationally.

Health and Civic Structure Trends

This study evaluated health and civic structure outcomes from two different time periods covering mostly the years of 2000 to 2005, and 2006-2010. County-level obesity increased roughly 6 percentage points (25 to 31 percent) and diabetes diagnoses increased almost 3 percentage points (8 to 11 percent) from 2004 to 2010 for both non-metro and all counties nationally and is consistent with past research tracking obesity or diabetes (HHS 2010). County-level self-reported good health was lower in non-metro counties compared to all counties nationally (82 percent compared to 83 percent, respectively) during the time period available (2006-2012). Civic structure increased in non-metro counties (.21 to .26), but decreased across all counties nationally (-.01 to -.02) (2005 to 2009). In general, self-reported ancestry for the top four ancestries in the United States slightly increased in population across the two time periods evaluated, except for county-level American ancestry, which decreased by roughly two percentage points (12 to 10 percent) in non-metro and all counties nationally.

Hypothesis 1

Tests were performed to determine if high civic structure counties have higher self-reported good health, and lower prevalence of obesity and diabetes diagnoses compared to counties that rated low in civic structure. In general, high civic structure counties have higher

self-reported good health compared to low civic structure counties. Civic structure was not related to, or not consistently related to obesity or diabetes diagnoses.

Consistent with past research, counties high in civic structure have better self-reported health compared to those counties low in civic structure (both non-metro and all counties nationally) during both time periods evaluated and regardless of whether or not the food environment and food/exercise access measures were included. This lends support to past research that have found positive associations between self-reported health and civic structure (Kawachi et al. 1999; Kim and Kawachi 2006; Mellor and Milyo 2005; Veenstra et al. 2005). Despite this, it is worth noting that civic structure contributed very little additional explained variance to the models.

Civic structure for the most part was not associated with obesity, and findings were sensitive to whether or not the food/exercise environment measures were included in the models as discussed previously. For the most part, adding civic structure to the models did not provide additional explained variance, except for the second time period when food measures are not controlled. For analysis on the first time period, no unstandardized coefficients were statistically significant in any of the models, regardless if food measures were included or not. These findings appear to support and also conflict with past research showing associations between civic structure and obesity. For example, Holtgrave and Crosby (2006) found that higher civic structure was related to lower state-level obesity ($p<.001$), but their study only controlled for two income/poverty related measures. Yoon and Brown (2011) noted that civic structure in counties was negatively related to obesity, but not statistically significant. Their research controlled for a fewer number of socioeconomic factors than this study and only one food/exercise environment measure, restaurants per 100,000 persons in a county. Kim et al. (2006) found that counties

above the median on their social capital scale have lower obesity, but not significantly. Their study did not evaluate the food/exercise environment. More research is needed to determine if civic structure can assist in managing the obesity epidemic and other potential mediators. This study finds potential aid from civic structure during the second time period in both non-metro and all counties nationally, but only when the food/exercise environment measures are not controlled. This research adds to the literature by demonstrating how sensitive obesity outcomes can be depending on how controls are used.

Associations were found between civic structure and diabetes diagnoses, but further explanation is needed. For the first time period evaluated, civic structure did not provide additional explained variance to the models. Although the direction of the unstandardized coefficients were negative, suggesting that civic structure was negatively related to county-level diabetes diagnoses, the values were not statistically significant. For the second time period evaluated, civic structure provided minimal, but significant explained variance to the non-metro ($p<.01$) and national models ($p<.001$). Therefore, in the second time period, counties high in civic structure have lower county-level diabetes diagnoses compared to those counties low in civic structure for both models (non-metro and all counties nationally).

Hypothesis 2

The second hypothesis evaluated whether counties with higher percentages of residents with Norwegian or German ancestries have higher self-reported good health, and lower prevalence of obesity and diabetes diagnoses. The following paragraphs will first evaluate civic structure and ancestry in relation to past studies, followed by a discussion on the relationship between civically-inclined ancestries and health outcomes.

Research shows that areas with higher percentages of residents with particular European ancestries differ in civic structure when compared to each other (Besser 2011; Greeley and McCready 1974; Putnam 2000; Rice and Ling 2002), which is also confirmed in this study. Four European ancestries and American ancestry were evaluated for civic structure. Only counties with higher population densities of Norwegian and German ancestries have higher civic structure. These findings were fairly consistent across models; non-metro and all counties nationally. Counties with higher percentages of residents from other ancestries have lower civic structure.

The results depart from previous research, however. Past research into civic structure and ancestry would suggest that civic structure would be roughly similar for areas with higher population densities of German, English and Irish ancestries (Greeley and McCready 1974; Rice and Feldman 1997; Rice and Ling 2002). Additionally, studies would suggest that areas with higher percentages of residents with Norwegian ancestry would be expected to rate the highest in civic structure compared to areas with higher densities of other ancestries. Instead, this study finds that nationally, counties with higher population densities of German ancestry rates the highest in civic structure compared to all others. Counties with higher population densities of Norwegian ancestry rates second in terms of civic structure. Counties with higher population densities of English and American ancestries had roughly similar levels of civic structure. Counties with higher percentages of residents with Irish ancestry had the lowest levels of civic structure when compared to others.

The differences in results identified from this study and past research could be due to the unit of analysis and the overall measure of civic structure itself. Studies into civic structure and ancestry have mostly used trust, or have used it in combination with other civic-related measures

(Rice and Feldman 1997; Rice and Ling 2002; Uslaner 2008). Greeley and McCready (1974) used political participation and voting. This study, however, uses the Rupasingha and Goetz index, which includes county-level census response rate, voting, and aggregated county-level voluntary associations, groups and religious organizations. Measured in this way at the county-level might be a more accurate portrait of civic structure and ancestry in the United States. Further, past studies have relied on the General Social Survey (Rice and Feldman 1997; Rice and Ling 2002; Uslaner 2008), which does not catch all counties nationally.

Patterns could be observed between counties with higher civic structure and counties with higher percentages of residents with German or Norwegian ancestries. Two possible scenarios could explain these relationships; the staying power of ancestry, and homogeneity. As it relates to Nordic exceptionalism, some researchers suspect the higher levels of civic structure is due in part to ethnic homogeneity (Besser 2011; Delhey and Newton 2005). Diversity has been described as having negative relationships with civic structure (Alesina and Ferrara 2000; Rupasingha et al. 2006). A diversity index confirms that county heterogeneity is signficant and negatively related to civic structure in all models (both time periods; non-metro and all counties nationally) (all, $p<.001$). Mapping reveals that German and Norwegian ancestries live mostly in racially and ethnicially homogoenous non-metro counties. Further, mapping also shows that although several generations have past, German and Norwegian ancestries are still heavily concentrated in the Upper Midwest region of the United States. Historical research notes that German and Norwegian ancestries were more inclined to move to rural areas in order to farm (Dinnerstein and Reimers 2009; Lichter 2012; Walch 1994) and once there were less likely to move compared to other ancestries, such as the Irish or English (Gutmann and Pullum 1999). Another interesting historical clue is that German and Norwegian ancestries were more heavily

interested in preserving their cultures through schools that provided education in native languages, going so far as to champion laws requiring it when their populations reached a certain size. This native language instruction existed until WWII and in some cases even later (Dinnerstein and Reimers 2009).

In contrast to German and Norwegian ancestries, other ancestries live in more diverse parts of the United States. Mapping and past research shows that the Irish and English are more spread out across the United States (Greeley and McCready 1974), which may help provide some explanation to why counties with higher densities of these ancestries have lower civic structure. Counties with higher population densities of American ancestry also have lower civic structure. Research has found that low socioeconomic status or county instability to be associated with lower levels of civic structure (Kawachi et al. 1997). Further, American ancestry has been found to be related to low socioeconomic status and other inequalities (Lieberson 1985; Waters 1990).

Aside from ethnic cohesion/homogeneity that may be related to civic structure (Gutmann and Pullum 1999), another explanation is that people maintain civic-related qualities of their ancestries, even generations later (Alba 1990; Cross et al. 2000; Greeley 1974; Greeley and McCready 1974; Rothenberg and Licht 1982; Waters 1990). To be sure, Rice and Ling (2002) find differences in civic structure among European nations and note that these differences remain roughly the same for these ancestries in the United States even generations later. This could provide some evidence to why counties with higher percentages of residents with Norwegian and German ancestries have higher civic structure.

Given the different historical backgrounds of Norwegian and German ancestries compared to others, and the finding that counties with higher population densities of these

ancestries have higher civic structure compared to others might suggest that they also should exhibit better health outcomes. Counties with higher population densities of Norwegian and German ancestries have higher self-reported good health and lower diabetes diagnoses. However distinctions are worth noting and such relationships were not consistent with obesity. German ancestry is associated with higher county-level good health in all models (all, $p<.001$). Norwegian ancestry is related to higher good health during the first time period evaluated. A much different picture was observed for county-level obesity. Counties with higher densities of German ancestry have higher obesity in all models ($p<.001$), regardless if food/exercise measures or civic structure were controlled. Only counties with higher densities of one other ancestry have a positive relationship with obesity, which was American ancestry, and past research discussed previously helps validate this outcome. Norwegian ancestry was negatively related to obesity in all models.

Since counties with higher percentages of residents with Norwegian ancestry have better health outcomes in almost all models, it could suggest another example of what some researchers have noted as Nordic exceptionalism (Besser 2011; Delhey and Newton 2005). Although it is worth noting that the ancestry measures provide very little explained variance, minimizing the potential conclusion that exceptionalism is at play. Counties with higher percentages of residents with civically-inclined ancestries do not consistently have better health outcomes. Further, ancestries not related to civic structure still have positive associations with health outcomes. This is evidenced by the fact that English ancestry, which was found to be negatively related to civic structure, actually have significant associations with higher county-level good health in three of the four models and lower county-level obesity in all models. Irish ancestry was related to decreasing obesity and diabetes diagnoses in most models as well.

Hypothesis 3

This study hypothesized that higher ethnic density of a particular ancestry will be associated with higher civic structure and self-reported good health, and lower obesity prevalence and diabetes diagnoses when compared to the lowest density level. Ethnic density research suggests better mental or physical health outcomes with higher densities (Fang et al. 1998; Franzini and Spears 2003; Halpern 1993; Neeleman and Wessely 1999). This study adds county-level obesity and diabetes diagnoses to this growing area of research at the area-level of focus. Past studies have used measures of social capital that included how people feel about crime and related issues, not measures related to civic structure as implemented in this study (Becares 2013). This study also attempts to bridge this theoretical focus beyond minority populations by looking at European ancestries as well.

Consistent with past research on minority ethnicities (Becares et al. 2009), variation was found among counties with higher densities of particular ancestries across the three health outcomes. Also consistent with past research is that higher density is not always related to better health outcomes (Karlsen et al. 2002). Higher population density of different ancestries were associated with better health outcomes compared to the lowest density level in some models, but not consistently.

Results were not consistent across counties with higher density levels of European ancestries compared to the lowest density level. In terms of county-level good health, higher density of German ancestry was associated with higher self-reported good health compared to the lowest density category. However, for other ancestries, higher density either was not significant or showed that higher density was associated with lower self-reported good health. This lack of consistency across ancestries could also be found with obesity and diabetes

diagnoses. English and Irish ancestral density was related to lower obesity when comparing to the lowest density level. In some models, ancestries with higher densities were associated with worse health outcomes. Higher German ancestry density was associated with obesity when compared to the lowest density category, and civic structure did not appear to mediate the relationship. Counties with higher density levels of American ancestry density have lower self-reported good health and higher obesity. This may suggest that geography or economic deprived areas plays a more influential role for health outcomes (Karlsen et al. 2002), especially for counties with higher density levels of particular ancestries (American ancestry) (Lieberson and Waters 1986). Although it should be noted that higher density levels of American ancestry was related to lower diabetes diagnoses compared to lower density categories.

The lack of consistent conformity among the results may be due to several factors. For example, mental health outcomes may benefit more from ethnic density than other physical-related health outcomes. To be sure, Karlsen et al. (2002) notes that health outcomes may vary from ethnic density depending on the health indicators included in the study. Further, evaluating counties with higher population levels of European ancestries may yield different outcomes when compared to minority populated areas. As a whole, higher ethnic density was associated with better health outcomes in some models, but the lack of consistent results suggest that more research is needed.

Non-metro and All Counties Nationally

Past research suggests that health outcomes can be worse in non-metro counties when compared to metro and other areas. As noted previously in the literature review, rural areas have lower socioeconomic status, higher poverty, lower rates of health insurance (Eberhardt et al. 2001; Yang et al. 2011); shortage of health care providers (Bennett 2008); high proportions of

the elderly and people with low levels of education, less diversified economies and have lower tax revenues when compared to urban areas (Morton 2004). Health outcomes in rural areas are also worse compared to urban areas. Rural areas have a higher prevalence of obesity (Beaudoin and Thorson 2004; Liu et al. 2008; Patterson et al. 2004; Ramsey and Glenn 2002) and lower self-rated health (Monnat and Beeler Pickett 2011).

Given the differences that can be observed in non-metro counties, comparisons were made of non-metro counties to all counties nationally. Although remote counties were reviewed as a part of this study, the dramatically reduced sample size made it difficult to make direct comparisons. As such, a discussion of remote counties are not included here.

In general, multiple regression analysis for health outcomes across ancestries whether in non-metro counties or all counties nationally seemed similar. The direction and magnitude of the unstandardized coefficients and level of statistical significance did not fluctuate greatly in non-metro counties compared to all other counties. Although direct comparisons to past research related to health outcomes and ancestry are not readily available, this study appears to contradict past rural studies that have found health differences when comparing non-metro counties to other areas. However, research into the food/exercise environment have found that health outcomes were relatively similar when comparing non-metro counties to all counties nationally (Ahern et al. 2011).

Food/Exercise Environment

Growing research shows that relationships exist between civic structure and health outcomes (Holtgrave and Crosby 2006; Kawachi et al. 1999; Kim and Kawachi 2006; Kim et al. 2006; Mellor and Milyo 2005; Yoon and Brown 2011). However, very little of this literature is

dedicated to obesity and diabetes diagnoses at the county or area level of analysis, despite the growing obesity epidemic. Another shortcoming is that health and civic structure studies do not take the food/exercise environment into account. This study improves upon past research by evaluating civic structure, obesity and diabetes diagnoses at the county-level of analysis while controlling for the food/exercise environment. Counties high in civic structure may influence the food/exercise environment and overall access to healthy food or places to exercise. Both time periods showed a statistically significant increase in explained variance when food/exercise measures were included in the models for the three dependent variables, but not substantially. Although differences in the direction of coefficient signs and statistical significance (whether food/exercise environment measures were controlled) were not identified for self-reported good health and diabetes diagnoses, however, it did make a difference for county-level obesity. For the first time period, if county-level demographic/economic structure were the only measures controlled, counties high in civic structure have with less obesity compared to low civic structure counties (not significant). Although not significant in the first time period of analysis, it is worth noting that when the food/exercise environment measures were included in the models, the sign flipped positive (but remained not significant). In the second time period of analysis, counties high in civic structure have lower obesity compared to those counties low in civic structure ($p<.001$). This statistical significance went away once the food/exercise measures were included in the models. This suggests that at least for county-level obesity in the second time period, civic structure may serve an important role in lowering obesity through the food environment and food/exercise access, but this mediator is not as important when evaluating self-reported health and diabetes diagnoses. This finding lends support to researchers on food security (Morton et al. 2005; Smith and Miller 2011; Smith and Morton 2009) where food accessibility may play an

important role in combating hunger, but more research is needed to tease out which food access measures are the most beneficial/harmful as it relates to civic structure and obesity.

County-Level Smoking

Research shows that health outcomes are made worse by smoking. Although there is some debate about whether people gain weight due to the cessation of smoking, there appears to be some agreement that smoking ultimately can lead to increased body mass index or diabetes (Bamia et al. 2004; Chiolero et al. 2008; Houston et al. 2006; John et al. 2005). Despite this, there does not appear to be consistency to using smoking as a control in civic structure and health, obesity or diabetes studies. Some studies into civic structure and self-reported health or mortality used smoking as a control (Kawachi et al. 1999; Subramanian et al. 2001), while others have not (Kawachi et al. 1997; Kim et al. 2011; Kim and Kawachi 2006; Lochner et al. 2003). Civic structure and obesity/diabetes research is also mixed with some using smoking as a control (Yoon and Brown 2011), but not others (Holtgrave and Crosby 2006; Kim et al. 2006; Long et al. 2010). Evaluating studies on the food environment and obesity found that some research included smoking as a control (Ahern et al. 2011), while others did not (Jilcott et al. 2011; Roth et al. 2014; Salois 2012). Research into ethnic density reviewed for this study did not appear to use smoking as a covariate (Becares et al. 2013; Becares et al. 2009; Fang et al. 1998; Franzini and Spears 2003; Karlsen et al. 2002). Given this, it is not entirely clear whether county-level smoking can impact health associations with ancestry or not or if controlling for socioeconomic status is sufficient. County-level smoking data is not publically available for all counties nationally. The Centers for Disease Control and Prevention has state-level data currently available (Centers for Disease Control and Prevention 2014c). The University of Wisconsin's County Health Rankings website (Catlin et al. 2013) have two county-level smoking datasets for

more recent years, but both lack having all counties. To overcome this obstacle and to ensure that smoking does not impact the results, two models were created with one using smoking as a control and the other model without. Both models exclude counties that had missing smoking data, which were heavily concentrated in Illinois and Texas, with the rest evenly scattered across the country. In general, the direction of coefficients and statistical significance of health outcomes across ancestries varied little whether smoking as a control was included in the models or not. The results from these two models also differed very little compared to the full models that did not filter out those counties that were missing smoking data. Although research fully shows that smoking is related to negative health outcomes, at least from an ancestry perspective, it does not appear to make a tremendous difference.

Conclusions

This study makes several contributions to existing literature on health outcomes. In particular, this study combined three separate, but parallel areas of literature to better understand how self-identified ancestral background is associated with self-reported good health, obesity and diabetes diagnoses during two different periods in time in both non-metro and all counties nationally. This research also builds on the very limited number of studies that have evaluated if civic structure is related to lowering obesity and diabetes health risks.

This study tested three hypotheses. First, tests were performed to determine if counties with high civic structure have higher self-reported good health, lower prevalence of obesity and diabetes diagnoses compared to counties that rated low in civic structure (hypothesis 1). Secondly, counties with higher percentages of residents with Norwegian and German ancestries were tested to see if they have higher self-reported good health, lower prevalence of obesity and diabetes diagnoses (hypothesis 2). Lastly, ethnic density was evaluated to determine if higher

ethnic density is associated with higher civic structure, self-reported good health, and lower obesity prevalence and diabetes diagnoses when compared to the lowest density category (hypothesis 3).

The results show that the three dependent variables do not function in the same way. Although self-reported good health, obesity and diabetes diagnoses in counties have characteristics in common, they behaved differently. Support was found for hypothesis 1 testing for whether counties high in civic structure have higher self-reported good health compared to low civic structure counties. However, no support was found for obesity, and only partial support for diabetes diagnoses given it was only significant during the second time period. The plentiful number of past studies and findings relating to self-reported health and civic structure may not necessarily transfer to county-level obesity and diabetes diagnoses and suggests more work is needed in this area. Although it would be reasonable to conclude that people in general can have a positive outlook on their health or life in general, but still be conflicted with specific diseases, such as obesity and diabetes. Another important observation is that civic structure added very little explained variance to the self-reported health models, and little to no explained variance to the obesity and diabetes models. There appears to be more important predictors in explaining health outcomes than civic structure.

The results from hypothesis 2 reveal that Norwegian and German ancestries were not consistently related to better health outcomes. Partial support for hypothesis 2 was found with self-reported good health and diabetes diagnoses, but no support was found for obesity. Norwegian ancestry was related to higher self-rated good health, lower obesity and diabetes diagnoses. However, other ancestries that were not related to civic structure were also shown to be associated with higher self-reported good health, lower obesity and diabetes diagnoses.

German ancestry was related to higher civic structure, yet was associated with higher county-level obesity. Another important finding is that the ancestry measures provided very little additional explained variance to the models suggesting there are other more important predictors.

The findings from hypothesis 3 suggest that higher ethnic density is sometimes associated with better health outcomes, but the results were not consistent across ancestries. Higher ethnic density also does not appear to be associated with civic structure. Partial support for hypothesis 3 was found with obesity and diabetes diagnoses, but not self-reported good health. German ancestry was the best example showing that higher density categories are associated with higher self-reported good health; however, other ancestries did not necessarily benefit at higher densities. More support for hypothesis 3 was found with obesity and diabetes diagnoses. Higher English and Irish ancestral density was associated with lower obesity compared to the lowest density category. But similar findings were not observed with other ancestries. Higher German and Irish ancestral density was associated with lower diabetes when compared to the lowest density category. But similar findings were not observed with other ancestries. In all models, civic structure was not associated with better health outcomes at higher density levels.

This study finds that county-level self-reported ancestry does influence the type of health outcomes that occur in the United States. But this finding is also tempered by the fact that only a small level of additional explained variance was provided by the ancestry measures. Despite this, this study does provide a glimpse into the social environment and its relationship with health outcomes. Although it is not the intention of this author to target specific ancestry groups with health campaigns or to suggest that one ancestral background it better than another, this study is an important first step in evaluating how culture may influence health via ancestral

density. Further research could delineate how self-reported ancestry is related to cultural activities in geographical areas, which may have health implications.

Limitations

The use of ancestry as a measure does have a number of limitations. A big factor is that the Census Bureau's question on ancestry does not assess strength of ethnic identification (Uslaner 2008; Waters 1990). As such, it is not clear whether the respondent was closely aligned with an ancestry, or only loosely associates with it. Research has also found that respondents change their answers over the course of the life cycle, or simply answers to one ancestry when parents may have multiple ancestries (Lieberson and Waters 1986; Lieberson and Waters 1993; Waters 1990).

Another limitation is that religion was not used in the analyses in order to maintain a manageable scope and due to time considerations. The relationship between ancestry and civic structure can be enhanced by religion (Besser 2011). Further, any given ancestry may not have the same religion. For example, Irish ancestry is made up of both Protestant and Catholic religious backgrounds and research finds that Irish Catholics are more civically inclined than Irish Protestants (Greeley and McCready 1974). Despite this, ethnicity has been found to be "a more powerful predictor of attitudes and behavior than religion" (1974:319).

This study is cross-sectional so reverse causality is possible. In other words, bad health outcomes may be related to lower civic structure (Kim et al. 2006). Fisher (2007:72) found some support to show that people sort themselves into non-metro counties that have "personal attributes associated with human impoverishment." Further, healthy more socially active people may want to live near each other (Kim et al. 2006). Research might find that this self-sorting

among people may be related to ancestral characteristics. Despite these limitations, this study had a large sample size and measures are evaluated across two different points in time and in non-metro and all counties nationally. Generally, results appeared consistent across both time periods in non-metro and all counties nationally.

This study was a community to community-level of focus. Given this, it was not possible to fully understand what people of an ancestry thought at the individual –level of focus about civic structure or gain information on their health status. The use of controls at the individual-level could have gained important insight into whether people of a particular ancestry had certain health outcomes and how these outcomes differed by geography. Despite these limitations, this study had a large number of controls to manage potential intervening affects between ancestry and health outcomes. Further research could apply multi-level statistical methods to gain both individual and community-level affects from ancestry on health outcomes, including the types of health/culture related activities people in these groups participate in.

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APPENDIX

CHANGE IN ADJUSTED R-SQUARE BY MODEL

Table 1. Percent of county with self-reported good health in all counties nationally (age-adjusted), 2006-2012 (Dependent Variable)a

	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
		First Time Period			Second Time Period	
N	2705	2705	2705	2695	2695	2695
Adjusted R^2	0.62	0.62	0.65	0.63	0.63	0.65
Health Indicators						
Percent obesity, 2004; 2010	-0.02	-0.02	-0.09*	-0.05*	-0.05	-0.10***
Percent diabetes, 2004; 2010	-0.39***	-0.40***	-0.20*	-0.45***	-0.44***	-0.30***
County Characteristics						
Educational attainment, 2000; 2006-2010	0.33***	0.32***	0.24***	0.34***	0.32***	0.30***
Median household income, 2000; 2006-2010	3.70***	3.96***	4.33***	5.01***	5.39***	5.40***
Percent unemployed, 2000; 2010	-2.71***	-2.63***	-2.93***	-2.02***	-1.96***	-1.83***
Percent uninsured, 2010	-0.04	-0.03	0.01	-0.03	-0.03	-0.02
Percent same residence, 2000	0.11***	0.10***	0.07***	0.07***	0.06***	0.04**
Mean travel time to work, 2000; 2006-2010	-0.12***	-0.11***	-0.05**	-0.11***	-0.11***	-0.06**
Percent female High=1, 2000; 2005-2009	-0.69***	-0.72***	-0.33*	-0.55***	-0.57***	-0.27
Percent Black/African-American, 2000; 2006-2010	0.22**	0.26**	0.43***	0.44***	0.43***	0.51***
Percent married High=1, 2000; 2006-2010	-0.13	-0.13	0.10	0.47**	0.42*	0.35
Percent Hispanic/Latino change High=1, 2000-2010	0.17	0.19	0.20	0.23	0.27	0.32*
Percent Hispanic/Latino, 2000; 2006-2010	-0.03	0.01	-0.28**	-0.11	-0.07	-0.31*
Food and Exercise Availability/Access						
Percent No car/access to grocery store, 2010	-0.29	-0.25	-0.05	0.01	0.02	0.08
Fast-food restaurants per 1,000 High =1, 2007; 2011	-0.28	-0.30	-0.13	-0.21	-0.18	-0.12
Full-service restaurants per 1,000 High=1, 2007;2011	.092***	0.86***	0.52**	0.96***	0.87***	0.86***
Grocery/supermarkets per 1,000 High=1, 2007; 2011	0.32*	0.28	0.20	-0.03	-0.09	-0.13
Convenience stores per 1,000 High=1, 2007; 2011	0.15	0.18	0.25	0.02	0.01	0.06

Table 1. (continued)

Farmers' markets per 1,000 High=1, 2009; 2013	-0.20	-0.21	-0.11	0.22	0.18	0.26
Recreational facilities per 1,000 High=1, 2007; 2011	0.13	0.08	0.08	-0.11	-0.15	0.11
Civic Structure						
Rupasingha and Goetz index High =1, 2005; 2009		0.80***	0.54**		0.69***	0.30
Ancestry						
Percent American, 2000; 2006-2010			-1.41***			-0.46**
Percent English, 2000; 2006-2010			0.67***			0.31**
Percent German, 2000; 2006-2010			0.79***			1.06***
Percent Irish, 2000; 2006-2010			-0.75***			-1.13***
Percent Norwegian, 2000; 2006-2010			0.47***			0.18

a Multiple linear regression results for all counties nationally. Values are non-standardized coefficients.
All models are significant at *p<.05; **p<.01; ***p<.001
First period analyses are indicated by the year listed following the independent/control variable name; with the second time period listed second.
Three predictor variables (percent uninsured, percent same residence, and percent housing units with no car/access to grocery store) only had one time period available, and are used again for the second time period.
Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.
Percent of county with good health (dependent variable) was only available for one time period and is used in both the first and second time periods.
High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

Table 2. Percent of county with self-reported good health in non-metro counties (age-adjusted), 2006-2012 (Dependent Variable)a

	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
		First Time Period			Second Time Period	
N	1627	1627	1627	1620	1620	1620
Adjusted R^2	0.60	0.60	0.63	0.61	0.61	0.62
Health Indicators						
Percent obesity, 2004; 2010	0.01	0.00	-0.08	-0.06	-0.05	-0.11**
Percent diabetes, 2004; 2010	-0.44***	-0.45***	-0.26	-0.42***	-0.41***	-0.29***
County Demographic/Economic Structure						
Educational attainment, 2000; 2006-2010	0.32***	0.30***	0.20***	0.32***	0.30***	0.29***
Median household income, 2000; 2006-2010	4.00***	4.17***	4.71***	5.34***	5.49***	5.26***
Percent unemployed, 2000; 2010	-2.58***	-2.43***	-2.78***	-2.18***	-2.12***	-1.97***
Percent uninsured, 2010	-0.01	0.00	0.04	-0.02	-0.02	0.01
Percent same residence, 2000	0.14***	0.13***	0.07***	0.10***	0.09***	0.04
Mean travel time to work, 2000; 2006-2010	-0.18***	-0.16***	-0.08**	-0.15***	-0.15***	-0.08**
Percent female High=1, 2000; 2005-2009	-0.87***	-0.93***	-0.39	-0.83***	-0.88***	-0.56**
Percent Black/African-American, 2000; 2006-2010	0.12	0.17	0.43**	0.35**	0.33**	0.40**
Percent married High=1, 2000; 2006-2010	-0.29	-0.29	-0.09	0.18	0.13	0.03
Percent Hispanic/Latino change High=1, 2000-2010	-0.05	0.03	-0.04	0.08	0.14	0.18
Percent Hispanic/Latino, 2000; 2006-2010	-0.12	-0.08	-0.33*	-0.15	0.11	-0.47**
County Food and Exercise Environment						
Percent No car/access to grocery store, 2010	-0.27	-0.20	-0.11	0.08	0.11	-0.03
Fast-food restaurants per 1,000 High =1, 2007; 2011	-0.21	-0.21	-0.04	-0.12	-0.11	-0.09
Full-service restaurants per 1,000 High=1, 2007; 2011	0.86***	0.76**	0.34	1.13***	1.01***	1.02***
Grocery/supermarkets per 1,000 High=1, 2007; 2011	0.34	0.32	0.29	-0.12	-0.18	-0.20
Convenience stores per 1,000 High=1, 2007; 2011	0.32	0.36	0.40	0.04	0.02	0.10
Farmers' markets per 1,000 High=1, 2009; 2013	0.03	0.06	0.14	0.31	0.29	0.34
Recreational facilities per 1,000 High=1, 2007; 2011	0.29	0.22	0.19	0.21	0.15	0.25

Table 2. (continued)

Civic Structure				
Rupasingha and Goetz index High =1, 2005; 2009	1.08***	0.90**	0.80**	0.46
Ancestry				
Percent American, 2000; 2006-2010		-1.66***		-0.50*
Percent English, 2000; 2006-2010		0.77***		0.29
Percent German, 2000; 2006-2010		0.97***		1.11***
Percent Irish, 2000; 2006-2010		-0.88***		-1.50***
Percent Norwegian, 2000; 2006-2010		0.39*		0.07

a Multiple linear regression results for non-metro counties. Values are non-standardized coefficients.
All models are significant at *p<.05; **p<.01; ***p<.001
The first time period indicated by the year listed following the independent/control variable name; with the second time period listed second.
Three predictor variables (percent uninsured, percent same residence, and percent housing units with no car/access to grocery store) only had one time period available, and are used again for the second time period.
Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.
Percent of county with good health (dependent variable) was only available for one time period and is used in both the first and second time periods.
High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

Table 3. Percent of county with obesity in all counties nationally, 2004; 2010 (Dependent Variable)a

	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
		First Time Period			Second Time Period	
N	3101	3101	3101	3085	3085	3085
Adjusted R^2	0.53	0.53	0.57	0.48	0.48	0.52
County Demographic/Economic Structure						
Educational attainment, 2000; 2006-2010	-0.05***	-0.47***	-0.00	-0.05***	-0.05***	-0.02
Median household income, 2000; 2006-2010	-1.81***	-1.81***	-1.67***	-6.18***	-6.22***	-5.74***
Percent unemployed, 2000; 2010	0.50***	0.51***	0.80***	-0.52*	-0.55**	-0.22
Percent uninsured, 2010	-0.02*	-0.02*	0.03**	-0.01	-0.01***	0.02
Percent same residence, 2000	0.07***	0.07***	0.04***	0.11***	0.11***	0.10***
Mean travel time to work, 2000; 2006-2010	-0.08***	-0.08***	-0.05***	-0.03*	-0.03*	-0.03**
Percent 65 years of age or older, 2000; 2006-2010	-0.10***	-0.10***	-0.08***	-3.38***	-3.29***	-3.24***
Percent female High=1, 2000; 2005-2009	0.20*	0.20*	0.29***	0.06	0.06	0.05
Percent Black/African-American, 2000; 2006-2010	0.78***	0.82***	0.73***	0.83***	0.83***	0.91***
Percent married High=1, 2000; 2006-2010	0.43***	0.43***	0.30**	0.82***	0.83***	0.71***
Percent Hispanic/Latino change High=1, 2000-2010	0.01	0.02	0.00	0.32**	0.31***	0.27*
Percent Hispanic/Latino, 2000; 2006-2010	-0.87***	-0.87***	-0.87***	-1.06***	-1.06***	-1.08***
County Food and Exercise Environment						
Percent No car/access to grocery store, 2010	0.47***	0.85***	0.54***	0.10	0.09**	0.20
Fast-food restaurants per 1,000 High =1, 2007; 2011	-0.17	-0.19*	-0.06	-0.34**	-0.35**	-0.30**
Full-service restaurants per 1,000 High=1, 2007; 2011	-1.14***	-1.20***	-0.92***	-1.11***	-1.08***	-1.02***
Grocery/supermarkets per 1,000 High=1, 2007; 2011	-0.16	-0.13	-0.04	-0.48***	-0.45***	-0.25*
Convenience stores per 1,000 High=1, 2007; 2011	0.31***	0.40***	0.40***	0.24**	0.25**	0.45***
Farmers' markets per 1,000 High=1, 2009; 2013	-0.19*	-0.17*	-0.09	0.00	0.11	0.14
Recreational facilities per 1,000 High=1, 2007; 2011	-0.30***	-0.24**	-0.25**	-0.40**	-0.39**	-0.58***
Civic Structure						
Rupasingha and Goetz index High =1, 2005; 2009		0.05	-0.19		-0.24	-0.40**

Table 3. (continued)

Ancestry		
Percent American, 2000; 2006-2010	0.36***	0.30**
Percent English, 2000; 2006-2010	-0.86***	-0.72***
Percent German, 2000; 2006-2010	0.88***	1.41***
Percent Irish, 2000; 2006-2010	-0.62***	-0.29**
Percent Norwegian, 2000; 2006-2010	-0.24***	-0.75***

a Multiple linear regression results for all counties nationally. Values are non-standardized coefficients.
All models are significant at *p<.05; **p<.01; ***p<.001
First time period analyses are indicated by the year listed following the independent/control variable name; with time period listed second.
Three predictor variables (percent uninsured, percent same residence, and percent housing units with no car/access to grocery store) only had one time period available, and are used again for the second time period.
Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.
High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

Table 4. Percent of county with obesity in non-metro counties, 2004; 2010 (Dependent Variable)a

	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
		First Time Period			Second Time Period	
N	1946	1946	1946	1934	1934	1934
Adjusted R^2	0.51	0.51	0.56	0.44	0.44	0.49
County Demographic/Economic Structure						
Educational attainment, 2000; 2006-2010	-0.05***	-0.06***	0.00	-0.08***	-0.07***	-0.03
Median household income, 2000; 2006-2010	-1.83***	-1.83***	-1.57***	-5.10***	-5.09***	-4.56***
Percent unemployed, 2000; 2010	0.29	0.30	0.57**	-0.92***	-0.92***	-0.64**
Percent uninsured, 2010	-0.01	-0.01	0.03*	-0.04*	-0.04**	0.00
Percent same residence, 2000	0.07***	0.07***	0.04***	0.09***	0.09***	0.07***
Mean travel time to work, 2000; 2006-2010	-0.08**	-0.08*	-0.05***	0.01	-0.01	-0.01
Percent 65 years of age or older, 2000; 2006-2010	-0.06***	-0.06***	-0.05**	-3.32***	-3.25***	-2.84***
Percent female High=1, 2000; 2005-2009	0.32***	0.32***	0.34**	0.30*	0.31**	0.21
Percent Black/African-American, 2000; 2006-2010	0.80***	0.80***	0.68***	0.92***	0.92***	0.91***
Percent married High=1, 2000; 2006-2010	0.23	0.23	0.19	0.63***	0.63***	0.58***
Percent Hispanic/Latino change High=1, 2000-2010	0.12	0.12	-0.13	0.11	0.10	0.15
Percent Hispanic/Latino, 2000; 2006-2010	-0.83***	-0.83***	-0.92***	-0.02***	-1.02***	-1.16***
County Food and Exercise Environment						
Percent No car/access to grocery store, 2010	0.51***	0.51***	0.42**	0.25	0.03	-0.01
Fast-food restaurants per 1,000 High =1, 2007; 2011	-0.23	-0.23	-0.11	-0.32*	-0.32*	-0.30
Full-service restaurants per 1,000 High=1, 2007; 2011	-1.01***	-1.02**	-0.79***	-0.87***	-0.84***	-0.80***
Grocery/supermarkets per 1,000 High=1, 2007; 2011	-0.13	-0.13	0.05	-0.29	-0.35*	-0.15
Convenience stores per 1,000 High=1, 2007; 2011	0.30**	-0.30**	0.37***	0.36	0.10	0.24
Farmers' markets per 1,000 High=1, 2009; 2013	-0.03	0.03	0.06	-0.02	-0.02	0.11
Recreational facilities per 1,000 High=1, 2007; 2011	-0.23*	-0.23*	-0.16	-0.40*	-0.35*	-0.35*
Civic Structure						
Rupasingha and Goetz index High =1, 2005; 2009		0.11	-0.09		-0.16	-0.35

Table 4. (continued)

Ancestry		
Percent American, 2000; 2006-2010	0.03	0.05
Percent English, 2000; 2006-2010	-1.05***	-0.98***
Percent German, 2000; 2006-2010	0.47***	0.91***
Percent Irish, 2000; 2006-2010	-0.52***	-0.27
Percent Norwegian, 2000; 2006-2010	-0.36***	-0.86***

a Multiple linear regression results for non-metro counties. Values are non-standardized coefficients.
All models are significant at *p<.05; **p<.01; ***p<.001
First time period analyses are indicated by the year listed following the independent/control variable name; with the second time period listed second.
Three predictor variables (percent uninsured, percent same residence, and percent housing units with no car/access to grocery store) only had one time period available, and are used again for the second time period.
Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.
High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

Table 5. Percent of county with diabetes diagnoses in all counties nationally, 2004; 2010 (Dependent Variable)a

	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
		First Time Period			Second Time Period	
N	3101	3101	3101	3085	3085	3085
Adjusted R^2	0.79	0.79	0.82	0.78	0.78	0.80
Health Indicator						
Obesity, 2004; 2010	0.25***	0.25***	0.26***	0.24***	0.24***	0.24***
County Demographic/Economic Structure						
Educational attainment, 2000; 2006-2010	-0.00	0.00	0.01***	-0.02***	-0.02***	0.01***
Median household income, 2000; 2006-2010	0.28*	-0.28*	0.48***	0.43**	-0.39*	0.41**
Percent unemployed, 2000; 2010	0.17***	0.16***	0.15***	0.84***	0.82***	0.57***
Percent uninsured, 2010	0.06***	0.06***	0.05***	0.07***	0.07***	0.06***
Percent same residence, 2000	0.02***	0.02***	0.01***	0.02***	0.02***	0.02***
Mean travel time to work, 2000; 2006-2010	0.03***	0.03***	0.01***	0.02***	0.02***	0.00
Percent 65 years of age or older, 2000; 2006-2010	0.10***	0.10***	0.13***	2.35***	2.41***	2.66***
Percent female High=1, 2000; 2005-2009	0.27***	0.28***	0.09**	0.31***	0.32***	0.12*
Percent Black/African-American, 2000; 2006-2010	0.26***	0.26***	0.12***	0.38***	0.38***	0.23***
Percent married High=1, 2000; 2006-2010	0.02	0.02	0.00	0.09	0.10*	0.12**
Percent Hispanic/Latino change High=1, 2000-2010	-0.05	-0.05*	-0.05	0.01	0.00	-0.01
Percent Hispanic/Latino, 2000; 2006-2010	-0.17***	-0.17***	-0.21***	-0.39***	-0.39***	-0.39***
County Food and Exercise Environment						
Percent No car/access to grocery store, 2010	0.27***	0.26***	0.19***	0.40***	0.39***	0.36***
Fast-food restaurants per 1,000 High =1, 2007; 2011	0.12***	0.13***	0.08**	0.24***	0.23***	0.17***
Full-service restaurants per 1,000 High=1, 2007; 2011	0.03	0.04	0.08**	-0.20***	-0.18***	-0.14***
Grocery/supermarkets per 1,000 High=1, 2007; 2011	0.00	0.01	-0.01	-0.08	-0.06	-0.06
Convenience stores per 1,000 High=1, 2007; 2011	0.08**	0.08**	0.05	0.10*	0.11**	0.05
Farmers' markets per 1,000 High=1, 2009; 2013	0.10***	0.10***	0.09***	-0.11**	-0.10*	-0.09*
Recreational facilities per 1,000 High=1, 2007; 2011	0.01	0.02	0.04	-0.08	-0.07	-0.06*

Table 5. (continued)

Civic Structure				
Rupasingha and Goetz index High =1, 2005; 2009	-0.08*	0.00	-0.19***	-0.07
Ancestry				
Percent American, 2000; 2006-2010		-0.13***		0.08*
Percent English, 2000; 2006-2010		0.07**		-0.10**
Percent German, 2000; 2006-2010		-0.36***		-0.53***
Percent Irish, 2000; 2006-2010		-0.11***		0.03
Percent Norwegian, 2000; 2006-2010		-0.37***		-0.36***

a Multiple linear regression results for all counties nationally. Values are non-standardized coefficients.
All models are significant at *p<.05; **p<.01; ***p<.001
First time period analyses are indicated by the year listed following the independent/control variable name; with the second time period listed second.
Three predictor variables (percent uninsured, percent same residence, and percent housing units with no car/access to grocery store) only had one time period available, and are used again for the second time period
Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.
High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

Table 6. Percent of county with diabetes diagnoses in non-metro counties, 2004; 2010 (Dependent Variable)a

	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
		First Time Period			Second Time Period	
N	1946	1946	1946	1934	1934	1934
Adjusted R^2	0.80	0.80	0.83	0.76	0.76	0.78
Health Indicator						
Obesity, 2004; 2010	0.28***	0.28***	0.28***	0.26***	0.26***	0.25***
County Demographic/Economic Structure						
Educational attainment, 2000; 2006-2010	0.00	0.01	0.01***	-0.01	-0.01	0.01
Median household income, 2000; 2006-2010	0.27	0.28	0.56***	-0.03	-0.01	0.22
Percent unemployed, 2000; 2010	0.25***	0.24***	0.22***	0.96***	0.95***	0.65***
Percent uninsured, 2010	0.06***	0.06***	0.05***	0.08***	0.08***	0.06***
Percent same residence, 2000	0.02***	0.02***	0.02***	0.02***	0.03***	0.02***
Mean travel time to work, 2000; 2006-2010	0.03***	0.03***	0.01***	0.03***	0.02***	0.00
Percent 65 years of age or older, 2000; 2006-2010	0.09***	0.09***	0.12***	2.22***	2.30***	2.67***
Percent female High=1, 2000; 2005-2009	0.30***	0.29***	0.12***	0.25***	0.26***	0.05
Percent Black/African-American, 2000; 2006-2010	0.22***	0.22***	0.09***	0.32***	0.32***	0.17***
Percent married High=1, 2000; 2006-2010	0.01	0.01	0.00	0.06	0.06	0.10
Percent Hispanic/Latino change High=1, 2000-2010	0.03	0.03	-0.04	0.04	0.03	0.02
Percent Hispanic/Latino, 2000; 2006-2010	-0.12***	-0.12***	-0.19***	-0.33***	-0.33***	-0.39***
County Food and Exercise Environment						
Percent No car/access to grocery store, 2010	0.28***	0.27***	0.22***	0.46***	0.45***	0.43***
Fast-food restaurants per 1,000 High =1, 2007; 2011	0.08*	0.09*	0.05	0.20***	0.20***	0.16**
Full-service restaurants per 1,000 High=1, 2007; 2011	0.06	0.06	0.11**	-0.18**	-0.15*	-0.13
Grocery/supermarkets per 1,000 High=1, 2007; 2011	0.08**	0.08*	0.06	-0.01	0.01	0.01
Convenience stores per 1,000 High=1, 2007; 2011	0.10**	0.09**	0.07*	0.03	0.03	0.00
Farmers' markets per 1,000 High=1, 2009; 2013	0.09**	0.09**	0.09**	-0.03	-0.03	0.00
Recreational facilities per 1,000 High=1, 2007; 2011	0.00	0.00	0.03	-0.08	-0.07	-0.05
Civic Structure						
Rupasingha and Goetz index High =1, 2005; 2009		-0.07	0.00		-0.19**	-0.08

Table 6. (continued)

Ancestry		
Percent American, 2000; 2006-2010	-0.16***	0.02
Percent English, 2000; 2006-2010	0.05	-0.09*
Percent German, 2000; 2006-2010	-0.33***	-0.53***
Percent Irish, 2000; 2006-2010	-0.13***	0.02
Percent Norwegian, 2000; 2006-2010	-0.35***	-0.37***

a Multiple linear regression results for non-metro counties. Values are non-standardized coefficients. All models are significant at *p<.05; **p<.01; ***p<.001

First time period analyses are indicated by the year listed following the independent/control variable name; with the second time period listed second.

Three predictor variables (percent uninsured, percent same residence, and percent housing units with no car/access to grocery store) only had one time period available, and are used again for the second time period.

Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.

High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median code 0.

Table 7. Percent of county with self-reported good health nationally and food environment (age-adjusted), 2006-2012 (Dependent Variable)a

	Model 1	Model 2	Model 3
N	2715	2715	2715
Adjusted R^2	0.62	0.62	0.62
Health Indicators			
Percent obesity, 2004	-0.08*	-0.02	-0.02
Percent diabetes, 2004	-0.36***	-0.40***	-0.40***
County Demographic/Economic Structure			
Educational attainment, 2000	0.35***	0.33***	0.32***
Median household income, 2000	3.28***	3.70***	3.86***
Percent unemployed, 2000	-2.80***	-2.71***	-2.63***
Percent uninsured, 2010	-0.03	-0.04	-0.02***
Percent same residence, 2000	0.13***	0.11***	0.10
Mean travel time to work, 2000	-0.14***	-0.12***	-0.11***
Percent female High=1, 2000	-0.76***	-0.69***	-0.72***
Percent Black/African-American, 2000	0.18*	0.22*	0.26**
Percent married High=1, 2000	-0.08	-0.13	-0.13
Percent Hispanic/Latino change High=1, 2000-2010	0.17	0.17	0.19
Percent Hispanic/Latino, 2000	-0.05	-0.03	0.01
County Food and Exercise Environment			
Percent No car/access to grocery store, 2010		-0.29	-0.25
Fast-food restaurants per 1,000 High =1, 2007		-0.28	-0.30
Full-service restaurants per 1,000 High=1, 2007		0.92***	0.85***
Grocery/supermarkets per 1,000 High=1, 2007		0.32*	0.28
Convenience stores per 1,000 High=1, 2007		0.15	0.18
Farmers' markets per 1,000 High=1, 2009		-0.20	-0.21
Recreational facilities per 1,000 High=1, 2007		0.13	0.08
Civic Structure			
Rupasingha and Goetz index High =1, 2005			0.80***

a Multiple linear regression results for all counties nationally. Values are non-standardized coefficients.

All models are significant at *p<.05; **p<.01; ***p<.001

Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.

High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

Table 8. Percent of county with obesity nationally (Dependent variable) and food environment, 2004.

	Model 1	Model 2	Model 3
N	3101	3101	3101
Adjusted $\boldsymbol{R^2}$	0.50	0.53	0.53
County Demographic/Economic Structure			
Educational attainment, 2000	-0.06***	-0.05***	-0.05***
Median household income, 2000	-2.66***	-1.81***	-1.81***
Percent unemployed, 2000	0.44**	0.50***	0.51***
Percent uninsured, 2010	0.03**	0.02*	0.02*
Percent same residence, 2000	0.08***	0.07***	0.07***
Mean travel time to work, 2000	-0.06***	-0.08***	-0.08***
Percent 65 years of age and older, 2000	-0.14***	-0.09***	-0.09***
Percent female High=1, 2000	0.19*	0.20*	0.20*
Percent Black/African-American, 2000	0.91***	0.78***	0.79***
Percent married High=1, 2000	0.59***	0.43***	0.43***
Percent Hispanic/Latino change High=1, 2000-2010	0.01	0.01	0.02
Percent Hispanic/Latino, 2000	-0.92***	-0.87***	-0.87***
County Food and Exercise Environment			
Percent No car/access to grocery store, 2010		0.47***	0.48***
Fast-food restaurants per 1,000 High =1, 2007		-0.17	-0.17
Full-service restaurants per 1,000 High=1, 2007		-1.14***	-1.14***
Grocery/supermarkets per 1,000 High=1, 2007		-0.16	-0.16
Convenience stores per 1,000 High=1, 2007		0.31***	0.31***
Farmers' markets per 1,000 High=1, 2009		-0.19*	-0.19*
Recreational facilities per 1,000 High=1, 2007		-0.30***	-0.30***
Civic Structure			
Rupasingha and Goetz index High =1, 2005			0.05

a Multiple linear regression results for all counties nationally. Values are non-standardized coefficients. All models are significant at *p<.05; **p<.01; ***p<.001

Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.

High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.

Table 9. Percent of county with diabetes diagnoses (dependent variable) nationally and food environment; 2004.

	Model 1	Model 2	Model 3
N	3101	3101	3101
Adjusted $\boldsymbol{R^2}$	0.79	0.79	0.79
Health Indicators			
Percent obesity, 2004	0.25***	0.25***	0.25***
County Demographic/Economic Structure			
Educational attainment, 2000	0.00	0.00	0.00
Median household income, 2000	0.14	0.28*	0.28*
Percent unemployed, 2000	0.20***	0.17***	0.16***
Percent uninsured, 2010	0.06***	0.06***	0.06***
Percent same residence, 2000	0.02***	0.02***	0.02***
Mean travel time to work, 2000	0.03***	0.03***	0.03***
Percent 65 years of age and older, 2000	0.10***	0.10***	0.10***
Percent female High=1, 2000	0.29***	0.27***	0.28***
Percent Black/African-American, 2000	0.27***	0.26***	0.26***
Percent married High=1, 2000	-0.03	0.02	0.02
Percent Hispanic/Latino change High=1, 2000-2010	-0.06	-0.05	-0.05
Percent Hispanic/Latino, 2000	-0.20***	-0.17***	-0.17***
County Food and Exercise Environment			
Percent No car/access to grocery store, 2010		0.27***	0.26***
Fast-food restaurants per 1,000 High =1, 2007		0.12***	0.13***
Full-service restaurants per 1,000 High=1, 2007		0.03	0.04
Grocery/supermarkets per 1,000 High=1, 2007		0.00	0.01
Convenience stores per 1,000 High=1, 2007		0.08**	0.08**
Farmers' markets per 1,000 High=1, 2009		0.10***	0.10***
Recreational facilities per 1,000 High=1, 2007		0.01	0.02
Civic Structure			
Rupasingha and Goetz index High =1, 2005			-0.08*

a Multiple linear regression results for all counties nationally. Values are non-standardized coefficients. All models are significant at *p<.05; **p<.01; ***p<.001

Percent Hispanic/Latino change reflects the proportional percent change in county population from 2000 to 2010.

High=1 indicates that the variable was recoded with everything above the median coded 1 and all else below the median coded 0.