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How Ethnic Enclaves Affect Diabetes and Depression Risk Among Older Mexican-origin Latinos in the Southwest

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How Ethnic Enclaves Affect Diabetes and Depression Risk Among Older Mexican-origin Latinos in the Southwest

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of Philosophy in Public Health

by

Eva Maria Durazo

2016

ABSTRACT OF THE DISSERTATION

How Ethnic Enclaves

Affect Diabetes and Depression Risk

Among Older Mexican-origin Latinos in the Southwest

by

Eva Maria Durazo

Doctor of Philosophy in Public Health

University of California, Los Angeles, 2016

Professor Steven P. Wallace, Chair

This dissertation examines the role of ethnic enclaves on diabetes and depression risk for older Latinos of Mexican-origin living in the Southwestern United States. I use the 2004-2005 Hispanic Established Populations for the Epidemiological Studies of the Elderly (Hispanic EPESE) survey, in addition to United States (U.S.) Census data and business data from Infogroup. Using multilevel logistic regression, I examine if ethnic enclaves are associated with diabetes, and explore the possible underlying mechanisms by testing for mediation or moderation by social networks and ethnic ownership of businesses. I follow the same analysis for ethnic enclaves and depression risk.

My findings suggest that ethnic enclaves provide a protective effect for diabetes, even when controlling for neighborhood- and individual-level characteristics. I do not observe mediation or moderation by social networks as measured by a social ties scale and the social cohesion and trust scale. There is also no moderation by the concentration of Latino-owned businesses in a neighborhood. For depression risk, my findings show a protective effect by ethnic enclaves, however the protective effect is only present once I adjust for neighborhood- and individual-level characteristics including having recently moved. Further examining the ethnic enclave and depression risk relationship, I observe some mediation by social ties and social cohesion and trust. However I do not find any impact on the ethnic enclave and depression risk association by concentration of Latino-owned businesses.

Furthermore, results indicate a different health effect by immigrant enclaves on depression risk. Living in a neighborhood with a high immigrant concentration is a risk factor for depression, however this effect appears to be mediated by social networks, measured by social ties and social cohesion and trust. Thus, while ethnic enclaves seem to be protective of health for older Mexican-origin adults, the mechanisms explaining the protective effect may be different for diabetes and depression risk. Also there appears to be differences in the impact of neighborhood characteristics on health, such that an ethnic enclave may be protective while an immigrant neighborhood is a risk factor to health.

This dissertation of Eva Maria Durazo is approved.

Vilma Ortiz

Judith M. Siegel

May-Choo Wang

Steven P. Wallace, Committee Chair

University of California, Los Angeles

2016

Para mi Mamí, quien me enseñó a soñar más alto de lo que podiamos ver.

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Chapter 1: Background and Research Aims

The overall good health of the Latino population defies the expected health patterns of a racial/ethnic minority group with generally low education and income levels. While Latinos as a whole have lower socioeconomic levels, often live in poorer housing, work in physically demanding jobs, and experience limited opportunities, their health patterns do not reflect the same disadvantage, with some notable exceptions. Researchers have called this the Latino health paradox since Latinos have good health outcomes despite the group's overall low socioeconomic status (Abraido-Lanza, Ng-Mak, & Turner, 1999; Dolores Acevedo-Garcia & Bates, 2008; Lara, Gamboa, Kahramanian, Morales, & Bautista, 2005; K.S. Markides & Coreil, 1986; Morales, Lara, Kington, & Valdez, 2002). As a racial minority group, a noteworthy proportion of Latinos are also immigrants, adding another characteristic to be considered in the study of health patterns for the Latino population. Foreign-born Latinos have been shown to have lower mortality and better birth outcomes than native Latinos and non-Latino Whites (Abraido-Lanza et al., 1999; Kandula, Kersey, & Lurie, 2004; Lara et al., 2005; K.S. Markides & Coreil, 1986). However with increasing years in the U.S. or increasing acculturation, the health advantage of Latinos, and more specifically immigrants, begins to deteriorate. Overall Latinos appear to be a healthy group, yet poor health outcomes emerge as researchers examine subgroups within the Latino population or focus on specific health outcomes. Diabetes, for example, disproportionally affects Latinos with a higher prevalence of disease, complications, and mortality rates than the non-Latino white population (CDC, 2004, 2011; Lara et al., 2005). On the other hand, depression has been found to be lower among Latino immigrants, with higher rates among the U.S.-born and/or the more acculturated (Alegria et al., 2007; Lara et al., 2005).

Diabetes is the seventh leading cause of death in the U.S., affecting 25.8 million people of all ages in 2010, 10.9 million of whom are ages 65 and older (CDC, 2011; Murphy, Xu, & Kochanek, 2013). Type 2 diabetes, or non-insulin-dependent diabetes mellitus, accounts for most of the diabetes cases, characterized by high blood glucose levels due to insulin resistance (CDC, 2011). Latinos experience diabetes at higher rates than the overall U.S. population, such that the age-adjusted risk of having diabetes is 66% higher for Latinos when compared to non-Latino Whites (CDC, 2011). There are also differences within Latino subgroups, for example, Mexican Americans and Puerto Ricans have the highest rates of diabetes (CDC, 2011).

The focus of diabetes prevention and management rests in identifying genetic and lifestyle risk factors, in particular family history, obesity, poor diet, or low physical activity levels. Much of diabetes research and prevention focuses on individual characteristics, however there are larger contextual factors that can impact diabetes prevalence and risk. Limited research has addressed the macro-level factors that influence diabetes, such as the role of the social and structural environment on diabetes risk factors and access to care (Bi et al., 2012; Kumari, Head, & Marmot, 2004). Neighborhood effects research considers the role of the social and physical environment on health (Ana V. Diez Roux & Mair, 2010), however few studies examine diabetes specifically, and even fewer consider the Latino population and its distinctive features, such as immigrant selection or acculturation. Ethnic enclave research provides the opportunity to blend neighborhood research and health while considering the distinctive characteristics of the Latino population.

While diabetes is a chronic illness that impacts Latinos at high rates, as a comparison depression is a psychological illness with generally low rates among Latinos. Nationally depression impacts about 5% of the U.S. population over the age of 12, as reported in 2005-2006

(Pratt & Brody, 2008). Among Latinos the rate is 6.3%, statistically similar to non-Hispanic Whites at 4.8% (Pratt & Brody, 2008). However, research has found variation of depression and mental illness among Latino subgroups. Specifically, Latino immigrants have lower rates of mental illness compared to U.S.-born Latinos, and there appears to be an acculturation effect with more acculturated immigrants or those in the U.S. for a longer time period experiencing higher rates (Alegria et al., 2008; Lara et al., 2005; William A. Vega & Rumbaut, 1991). It is hypothesized that immigrants have lower rates of mental illness because of their life experiences in their country of origin, with lower mental illness rates in their home countries (Alegria et al., 2007). U.S.-born Latinos also have a different life experience from immigrants. The native born grow up as racial minorities in the U.S., with prolonged exposure to institutional and individual racism, as well as educational and income inequality, potentially for a longer period of time and in a different context than immigrants.

Studies find that residents living in enclaves have better health and behaviors than those living outside of enclaves (Eschbach, Ostir, Patel, Markides, & Goodwin, 2004; Mair et al., 2010; Patel, Eschbach, Rudkin, Peek, & Markides, 2003; W. A. Vega, Ang, Rodriguez, & Finch, 2011). Ethnic enclaves can be defined as neighborhoods with high concentrations of a specific ethnic group (Eschbach et al., 2004; Patel et al., 2003). Residents of enclaves are believed to have stronger social networks, stemming from a shared culture, language, migration patterns, and/or ethnic identity, which may be protective of health (Eschbach et al., 2004; John R. Logan, Zhang, & Alba, 2002; Patel et al., 2003; A. Portes & Shafer, 2007; Y. Zhou, 1998). However it remains unclear how the pathways within enclaves, such as social networks, function to influence health. There is also little research examining how living in an ethnic enclave may be protective of diabetes, a disease that affects a significant proportion of the Latino population.

Using the Hispanic Established Populations for the Epidemiological Studies of the Elderly (Hispanic EPESE) survey, this study will examine how living in an ethnic enclave effects diabetes and depression risk rates for older Latinos of Mexican-origin in the southwestern United States. Most importantly, I will examine the mechanisms at work within an enclave, focusing on social and institutional factors. While much of the research provides potential explanations as to why living in enclaves provides a protective effect on the health of Latinos, few studies actually test the underlying pathways.

This study focuses on the mechanisms within enclaves, specifically the social and structural[1] characteristics that may provide a protective effect on the health and behaviors of those living in the enclave. Additionally, this study provides a macro-level understanding of diabetes prevalence among Mexican Americans, expanding diabetes research beyond the individual level determinants associated with high diabetes rates. Using multilevel analyses, findings from this study will begin to identify a model for the mechanisms through which ethnic enclaves may be impacting diabetes rates and depression risk for older Mexican Americans. By recognizing social and structural factors that offer health benefits to this population, policies and programs can be designed to support the protective characteristics.

The aims of this study are to: 1) Determine if ethnic enclaves are protective of diabetes and examine the potential underlying mechanisms, in particular social networks and the business environment; and 2) Determine if the same applies to depression risk.

[1] Social pathways are interpreted as the social networks and ties that can provide support and resources for those involved. These social characteristics may occur among individuals, including interpersonal relationships, or at the community level, such as social cohesion. Structural pathways refer to the physical environment and the institutions that are present in the neighborhood, which can influence how the community lives, their access to resources, and their overall stability.

1.1. Background

1.1.1 Diabetes and Depression among Latinos

Diabetes is the seventh leading cause of death in the U.S., affecting 25.8 million people of all ages in 2010, or 8.3% of the population (CDC, 2011). It is a chronic illness that affects all ages at increasing rates and while more common among older adults, the rates of diabetes among younger age groups is growing (CDC, 2011; Trevino et al., 1999). Among adults over age 20, 1.9 million new cases of diabetes were diagnosed in 2010 (CDC, 2011). Estimates find that in 2010 26.9% of the older U.S. population age 65 and over had diagnosed and undiagnosed diabetes, based on NHANES self-report and fasting glucose and hemoglobin A1c levels (CDC, 2011). Type 2 diabetes, or non-insulin-dependent diabetes mellitus, accounts for most of the diabetes cases in the U.S., characterized by high blood glucose levels resulting from insulin resistance (CDC, 2011). Risk factors for diabetes include older age, family history, race/ethnicity, obesity, and physical inactivity (ADA, 2009; CDC, 2011; Diabetes Prevention Program Research, 2002; Haffner, 1998; Mokdad et al., 2003). Age is a risk factor for diabetes across all race/ethnicities (CDC, 2011). Obesity is another important risk factor for diabetes, making diet and physical activity levels central factors for prevention (ADA, 2007; Haffner, 1998; Mokdad et al., 2003).

When examining rates of diabetes two issues need to be considered: those with pre-diabetes and those who are undiagnosed. Pre-diabetes is characterized by higher than normal glucose levels but not yet reaching the diabetes threshold (ADA, 2009). Individuals with pre-diabetes can reduce their risk of diabetes through changes in their diet and weight loss (ADA, 2007, 2009). Based on 2005-2008 data from fasting glucose or hemoglobin A1c levels, more than a third of adults 20 years old older in the U.S. had pre-diabetes (CDC, 2011). Pre-diabetes

rates were higher among the elderly and similar among non-Latino Whites, non-Latino Blacks, and Mexican Americans once adjusting for age (CDC, 2011). Based on self-reports of pre-diabetes from the Behavioral Risk Factor Surveillance System, in 2010 pre-diabetes rates varied across five states in the Southwest, with 8% of California adults age 18 years and over reporting pre-diabetes adjusting for age, 6.4% in Texas, 6.2% in Arizona, and 5.7% in New Mexico and Colorado (CDC, 2013b).

Undiagnosed individuals may not be experiencing symptoms or may not have sought medical care, for a variety of reasons including barriers to access. Estimates find that in 2010, of the 25.8 million people with diabetes in the U.S. seven million were undiagnosed (CDC, 2011). More specifically, among those 65 and over in the U.S., 20% were diagnosed with diabetes and 9% had diabetes but were undiagnosed (CDC, 2013a). The rates are even higher for older adults of Mexican-origin, with 32% diagnosed and an additional 15% undiagnosed (CDC, 2013a). Having a large undiagnosed population can bias the analysis and interpretation of this study, especially with high rates for Mexican and Mexican Americans, because there may be important differences between those who are diagnosed and undiagnosed, such as variations in access to care, health status, or place of residence. While I am unable to assess the level of undiagnosed diabetes in my sample, I can examine the patterns of health care use by enclave level, as well obesity trends, which can be associated with diabetes diagnosis (Gregg et al., 2004). Additionally, research has found comparable agreement between self-reported and medical diagnosis of diabetes (Margolis & Lihong, 2008; Okura, Urban, Mahoney, Jacobsen, & Rodeheffer, 2004).

Diabetes can lead to other morbidities, including heart disease, hypertension, kidney disease, circulatory problems leading to amputations, and blindness (ADA, 2009; CDC, 2011). While diabetes can be controlled with diet, exercise, and/or medications, costs for medical care

and treatment can be high. For example, in 2007, diabetes-related costs amounted to $174 billion in the U.S., attributed to direct medical costs and indirect costs from disability and premature mortality (CDC, 2011). Prevention or delay of diabetes is key to reducing diabetes morbidities, comorbidities, and mortality. Interventions often focus on changes in diet and exercise to prevent or delay diabetes. A longitudinal randomized clinical trial found that education and intensive changes in diet and weight reduced diabetes risk by 58% among those with pre-diabetes, while preventive use of the medication metformin led to a 31% risk reduction of diabetes (Diabetes Prevention Program Research, 1999, 2002, 2009). A similar study in Finland also found reduced risk of diabetes with changes in diet and physical activity (Lindstrom et al., 2006). Diabetes is a significant public health concern in the U.S. as it impacts a significant proportion of the population and can result in severe health problems, but prevention and delay of onset is possible through lifestyle modifications.

In the U.S. diabetes is especially a problem for Latinos and other racial minority groups who are disproportionately afflicted with the chronic disease. Based on national data from 2007-2009 and adjusting for age differences, 12.6% of non-Latino Blacks, 11.8% of Latinos, 8.4% of Asian Americans, and 7.1% of non-Latino Whites had been diagnosed with diabetes (CDC, 2011). There is also great variation in diabetes rates within Latino subgroups, with 13.3% of Mexican Americans having diabetes compared to 13.8% of Puerto Ricans and 7.6% of Cubans and Central and South Americans (CDC, 2011). This means Mexican Americans have an 87% higher risk of diabetes than non-Latino Whites (CDC, 2011). Diabetes is the fifth leading cause of death for Latinos, compared to the seventh for the general U.S. population (CDC, 2004).

In addition to high rates of diabetes, racial/ethnic minorities are more likely to experience complications and death from diabetes than non-Latino Whites (Carter, Pugh, & Monterrosa,

1996). Latinos, for example, have higher rates of diabetes-related complications, such as high rates of amputations and kidney disease (Carter et al., 1996; Karter et al., 2002). Not surprisingly, the high prevalence of diabetes in the Latino population mirrors the high rates of known diabetes risk factors, in particular high obesity rates (Lara et al., 2005; Stern, Gaskill, Hazuda, Gardner, & Haffner, 1983; Trevino et al., 1999). However the rates of diabetes and its risk factors can vary by immigrant-related characteristics, such as acculturation level, time in the U.S., and nativity. For example, U.S. born Latinos as well as more acculturated Latino immigrants are more likely to have unhealthy diets high in fat and low intake of fruits and vegetables (Ayala, Baquero, & Klinger, 2008; Hazuda, Hafner, Stern, & Eifler, 1988; Lara et al., 2005). Diet, physical activity level, and access to care are influenced by acculturation, time in the U.S., and nativity, which are also influenced by where individuals live, especially when the ethnic concentration of the neighborhood is taken into account.

In contrast to the high prevalence of diabetes among Latinos, depression rates for Latinos are similar to the national average. Nationally depression impacts about 5% of the U.S. population over the age of 12, as reported in 2005-2006 (Pratt & Brody, 2008). For Latinos the rate is 6.3%, statistically similar to non-Hispanic Whites at 4.8% (Pratt & Brody, 2008). Depression rates can also vary by age, but older adults generally having lower or similar rates of depression to the national rate. The CDC estimates major depression among adults age 65 and over to vary from 1% to 5% (CDC, 2015). While aging itself does not result in an increased risk for depression, there are several depression risk factors that impact older adults. Depression risk factors include more than one health condition, disability, prior depression, poor health status, social isolation, and bereavement (Beekman et al., 1995; Cole & Dendukuri, 2003; Roberts, Kaplan, Shema, & Strawbridge, 1997). Women are also often at higher risk for depression (Cole

& Dendukuri, 2003). Thus depression risk factors are important to consider for an older population. While the focus of depression risk factors are on the individual, the social context can impact the support that can minimize the effect of depression and its risk factors.

Depression, in particular severe depression, has been linked to other illnesses and even death (Beekman et al., 1995; Blazer, Hybels, & Pieper, 2001; Moussavi et al., 2007). Depression in combination with other illnesses can lead to worsening health or faster progression of the disease. But even minor depression, or depression risk, has been found to result in an increased risk of death for men (Penninx et al., 1999). Thus while depression itself is a mental health illness that can lead to mortality, it can also have a negative impact on health when it is combined with other comorbidities.

Among the Latino population, mental health and depression specifically are generally lower or at the national average (Pratt & Brody, 2008). However, there is variation in depression and mental illness by Latino subgroups. Specifically, Latino immigrants have lower rates of mental illness compared to U.S.-born Latinos, and there appears to be an acculturation effect with more acculturated immigrants or those in the U.S. for a longer time period experiencing higher rates (Alegria et al., 2008; Lara et al., 2005; William A. Vega & Rumbaut, 1991). One possible reason for this immigrant effect is that foreign-born Latinos have different life experiences in their country of origin and the home countries generally have lower rates of mental illness rates compared to the U.S. (Alegria et al., 2007). For U.S.-born Latinos, their life experiences are influenced by their position as a racial minority in the U.S., with prolonged exposure to institutional and individual racism, as well as educational and income inequality, potentially for a longer period of time and in a different context than immigrants. There is also some evidence that depression rates differ by acculturation level and by neighborhood. For

example, English speaking Latinos living in ethnic enclaves have been found to experience better mental health than their counterparts living in mixed or low ethnic neighborhoods (Shell, Peek, & Eschbach, 2013), and these benefits have also been shown to extend to immigrants living in the U.S. longer than 15 years (Vega et al., 2011). Thus while depression rates may not be as high as diabetes rates for the Latino population, there is variation by different subgroups which can inform researchers on who to target for interventions.

1.1.2 Defining Ethnic Enclaves

While there are several variations of the definition of an ethnic enclave, it is generally understood to be a geographic location with a high concentration of ethnic minorities, usually belonging to one ethnic group.[2] The enclave is a neighborhood with a visible presence of the ethnic population that resides there (Portes & Shafer, 2007), providing a "home away from home" for the group. The ethnic shops, restaurants, and grocery stores offer foods and goods customary to the ethnic group, often only available within the enclave. The businesses, churches, and places of recreation allow co-ethnics and immigrants to function in their community with others of the same culture, customs, language, and behaviors (Zhou & Kim, 2006).

Traditionally, ethnic enclaves have formed as a place of initial settlement for newly arrived migrants (Conzen, 1979; Logan et al., 2002). Enclaves are established and replenished by the networks and contacts migrants use on their move to the new home country (Logan et al., 2002). The enclave offers affordable housing and a place to find work, either through the ethnic businesses themselves or through the information shared via the social networks of family, friends, or co-ethnic residents (Logan et al., 2002; Portes & Shafer, 2007). For recent immigrants,

[2] In this paper I will use the term ethnic enclave, although the literature also uses the term immigrant enclave, sometimes interchangeably. Today's immigrants from Latin America must navigate the role of being both foreign-born and part of an ethnic minority group. The use of the term ethnic enclave attempts to maintain the focus on the issue of race and ethnicity as a minority group, although issues of immigration will also intersect. The ethnicity of the group will be the defining factor for the enclave.

the ethnic enclave provides a connection to the home country, but this is often only a temporary neighborhood (Iceland & Scopilliti, 2008; Logan et al., 2002). As individuals learn English, improve their socioeconomic status, become accustomed to U.S. mainstream values and behaviors, or make additional connections outside of the enclave, moving to a new area is often the next step in the integration process, however, this is not always the case (Iceland & Scopilliti, 2008; Logan et al., 2002). Ethnic enclaves also provide a gathering place for long-stay immigrants and the later generations who desire the cultural connection provided through the enclave (Zhou & Bankston, 1994; Zhou & Kim, 2006). Alternatively, long-stay immigrants and the later generations may continue to live in enclaves as a result of social, economic, and educational constraints that impede them from leaving segregated neighborhoods (Telles & Ortiz, 2008). It is unclear if the enclave benefits persist to the same extent for long-stay immigrants and U.S. born Latinos as for new immigrants.

An ethnic enclave, while often being a racially and ethnically isolated neighborhood, is considered to benefit the health of its residents. Enclaves appear to defy the large body of research that finds poor health and social outcomes for those living in segregated neighborhoods (Acevedo-Garcia, Lochner, Osypuk, & Subramanian, 2003; Williams & Collins, 2001). As a type of segregated neighborhood, an ethnic enclave usually embodies the same characteristics of high poverty and limited resources of segregated neighborhoods. However the enclave is considered to have stronger social networks that offset the adversities of a segregated neighborhood. Research on segregated neighborhoods for African Americans, in particular those with extreme segregation, have been found to be detrimental to the health of its residents (Acevedo-Garcia et al., 2003; Williams & Collins, 2001). American Indian reservations, another form of an ethnic community, also experience poor health outcomes (IHS, 2013; Jones, 2006).

The purpose of this study is to distinguish what it may be about a Latino enclave that offers a protective effect despite the low socioeconomic effects of a segregated neighborhood.

1.1.3 Why Enclaves Are Protective of Health

Health research has established a positive association between Latino enclaves and various physical and mental health outcomes. Most research assumes that it is the strength of the social networks that protects the health of those living in the enclave (Eschbach et al., 2004; Osypuk, Diez Roux, Hadley, & Kandula, 2009; Patel et al., 2003), however the presence of ethnic institutions may also play an important role. Several reasons have been theorized to account for the protective nature of enclaves, but few have been explicitly tested.

Enclaves typically have strong social networks, formed and reinforced by the migration process, and strengthened by the shared culture and values of the ethnic or immigrant group (Logan et al., 2002; Qadeer & Kumar, 2006; Zhou, 2004). Social networks can influence health in several different ways. Strong social networks may offer high levels of social support and encourage the sharing of heath information and resources (Kawachi, 2006; Macinko & Starfield, 2001). Individuals living in the enclave may have better access to information and ethnic based resources than those living outside of the enclave. Social networks can also reinforce healthy norms and behaviors that immigrants bring from their home country (Bernosky de Flores, 2010; Lara et al., 2005; Macinko & Starfield, 2001). This is especially important when considering enclaves with an immigrant population since immigrants are thought to be healthier than their native counterparts. Thus, maintaining the traditional behaviors and customs may keep all individuals in the enclave healthier. The social support that results from the strong social networks may also reduce stressors found in the neighborhood, including those from discrimination, acculturation, or from high poverty (Finch & Vega, 2003; Pérez, Fortuna, &

Alegría, 2008; Vega et al., 2011; Viruell-Fuentes, 2007). Theories of social networks and social support are especially appropriate to the study of ethnic enclaves; however few empirical studies have tested concepts from within social network theories.

The presence of ethnic institutions can also provide supports that lead to better health for enclave residents. An ethnic enclave is often characterized by the businesses and organizations that are owned by the ethnic group or provide services specific to the group (Zhou, 2004; Zhou & Kim, 2006; Zhou & Logan, 1989). The ethnic businesses and organizations within the enclave provide resources that can benefit health, either through providing a place of employment, health care services, or programs and supports of health information and care. Although not often applied to the study of enclaves directly, neighborhood effects research has shown that the physical environment can influence ones health through several different pathways, one being the availability of resources such as access to parks or recreational spaces for physical activity, another being the racial/ethnic or economic context of the neighborhood (Browning & Cagney, 2002; Diez Roux & Mair, 2010; Kim, Liu, Colabianchi, & Pate, 2010; Osypuk & Acevedo-Garcia, 2010; Sampson, Morenoff, & Gannon-Rowley, 2002). The institutions and physical resources in an enclave may be one way in which health is protected for enclave residents.

1.1.4 Ethnic Enclaves and Effects on Health

Many studies have found ethnic or immigrant enclaves as protective of health for the Latino population. However recent research presents a more complex understanding of the relationship between enclaves and health, taking into consideration the different facets of an enclave and finding positive and negative effects on various health outcomes (Aguilera & Lopez, 2008; Do et al., 2007; Lee, 2009; Osypuk et al., 2009; Wen & Maloney, 2011). Despite the

variation in their effects in recent research, in general, findings of a protective effect persist for Latino enclaves.

Research finds a protective effect from enclaves across several different physical health outcomes. Latinos living in enclaves have been shown to have better overall self-reported health, lower mortality, and better prenatal health than those outside of enclaves (Eschbach et al., 2004; Mason et al., 2011; Osypuk, Bates, & Acevedo-Garcia, 2010; Patel et al., 2003). For older Mexican Americans living in enclaves, studies have found less frailty and cognitive decline (Aranda, Ray, Snih, Ottenbacher, & Markides, 2011; Sheffield & Peek, 2009). For Latinos living in the enclave, social networks may provide the support and social controls needed for better health and behaviors, resulting in better overall health and lower mortality rates. The enclaves may also encourage maintenance of traditional or healthy behaviors immigrants bring from their country of origin, such as a healthy diet (Ayala et al., 2008; Dubowitz, Subramanian, Acevedo-Garcia, Osypuk, & Peterson, 2008; Guendelman & Abrams, 1995; Osypuk et al., 2009; Reyes-Ortiz, Ju, Eschbach, Kuo, & Goodwin, 2009). Similarly, prenatal health may be best for women in the enclave. Latina women living in the enclave may benefit from shared information and knowledge social networks provide, as well as the encouraged maintenance of low smoking and drinking rates common among immigrant populations (Mason et al., 2011; Osypuk et al., 2010).

In addition to the protective effects of enclaves on physical health, research has found similar patterns for mental health. Various studies have found better mental health outcomes for Latinos living within an enclave than for those living outside (Brown et al., 2009; Gerst et al., 2011; Mair et al., 2010; Vega et al., 2011). The process of migrating and acculturating can place a great amount of stress on an individual, but living in an enclave with other immigrants may provide support from family and the larger community that counteract some or all of the negative

effects. Living in enclaves may also reduce stressors, such as discrimination, by limiting interactions in social or work spheres with others of different racial or socioeconomic groups (Brown et al., 2009; Vega et al., 2011; Viruell-Fuentes, 2007). There are, however, variations in the effects of enclaves on mental health outcomes, with one study finding increased mental health problems for Mexican Americans living in ethnically isolated neighborhoods (Lee, 2009) and another finding that less established enclaves result in less use of mental health services (Aguilera & Lopez, 2008).

Living in an enclave may be overall beneficial to the physical and mental health of residents, but few studies have specifically examined the effect on diabetes. However, several studies have considered the relationship between enclaves and diabetes risk factors, such as diet, physical activity, and obesity. Research shows that Latinos living in ethnic or immigrant enclaves are more likely to have better diets, with high fruit and vegetable intake and lower consumption of fats and processed foods (Dubowitz et al., 2008; Osypuk et al., 2009; Reyes-Ortiz et al., 2009). Research examining physical activity (PA) among Latinos has resulted in inconsistent findings, with some finding lower levels of PA for immigrants than for their native born counterparts (Kandula et al., 2004; Osypuk et al., 2009), for the less acculturated (Ham, Yore, Kruger, Moeti, & Heath, 2007; Lara et al., 2005), but Latinos, in particular recent immigrants, report higher levels of PA related to occupation and transportation activities (Ham et al., 2007). For immigrants, then, it is possible that an enclave effect might be present but more as a selection rather than a causal effect. Few studies examine the link between residence in an enclave and PA levels for Latinos. A recent study found Latinos living in immigrant enclaves have lower physical activity levels and report poorer walking environments than those living outside of immigrant enclaves (Osypuk et al., 2009). While Latino enclaves have shown to be

protective of dietary behaviors, the effect on PA is inconclusive and more research is needed to determine how PA levels of Latinos and immigrants vary by place of residence.

Studies have found mixed results of the effect of ethnic enclaves on obesity. While some studies find that Latinos living in ethnic or immigrant enclaves have lower rates of body mass index than those living outside of enclaves (Nobari et al., 2013; Park, Neckerman, Quinn, Weiss, & Rundle, 2008; Wen & Kowaleski-Jones, 2012), other studies find the opposite effect (Do et al., 2007; Wen & Maloney, 2011). Some studies have demonstrated the protective health effects of enclaves for obesity, however the studies use a variety of measures and populations, making it difficult to establish which group benefits from living in the enclave and what additional factors may be important to consider.

In general ethnic enclaves are protective and result in better health for its residents, although there are specific outcomes such as physical activity and obesity in which more research is needed. There is even less research on the reasons why enclaves are protective and few studies test the underlying mechanisms of an ethnic neighborhood. Additionally, an important limitation shared across all ethnic enclave research is that of selection and causality. Individuals are not randomly selected into neighborhoods and characteristics such as race/ethnicity, community of origin, or health status at migration, can be a source of bias, which cannot always be resolved through statistical methods. Enclave research is also limited in determining causality on health effects because of social selection and confounding variables.

1.1.5 Diabetes, Depression, and Enclaves

To identify factors for diabetes prevention, research often focuses on diabetes predictors and risk-factors that impact individuals by specific racial and/or ethnic group. In addition to examining differences by race and ethnicity, studies have also considered individual behaviors,

such as diet or physical activity levels. Social determinants can also contribute to diabetes risk factors and management, such as poverty or access to healthy foods (Brown et al., 2004; Chaufan, Davis, & Constantino, 2011; Horowitz, Colson, Hebert, & Lancaster, 2004), however few studies consider the direct association between neighborhoods and diabetes. The lack of research may be due to the difficulty in establishing a relationship between neighborhood effects and diabetes, especially since diabetes often occurs later in life. Even fewer neighborhood studies have integrated the role of immigration on diabetes prevalence.

Three recent studies examine the association of diabetes and neighborhoods. Two similar analyses from Auchincloss et al. (Auchincloss, Diez Roux, Brown, Erdmann, & Bertoni, 2008; Auchincloss et al., 2009) find that neighborhoods with access to physical activity facilities and healthy foods are associated with lower levels of insulin resistance and diabetes prevalence. While the studies do not specifically consider ethnic enclaves, we can hypothesize that if an enclave has less access to parks and recreational facilities, their risk for insulin resistance and diabetes may be higher. This hypothesis is especially applicable for ethnic enclaves in urban areas with high poverty levels as they may have less access to resources. One of the only randomized neighborhood studies, the Moving To Opportunity study, finds that neighborhood poverty can influence the obesity and diabetes risk of residents (Ludwig et al., 2011). About a third of individuals in each group identified as Hispanic of any race and about two-thirds identified as African-American. The intervention group received vouchers and counseling on housing with the condition of moving to a census tract with less than a 10% poverty rate. The traditional group received vouchers with no other assistance, and the control group received no assistance of any kind. Ten years after randomization, women who moved to a census tract with a low poverty rate were at less risk of obesity and diabetes compared to the control group

(Ludwig et al., 2011). While the diabetes rates were not statistically significant different between the intervention and the traditional group, diabetes prevalence was lower for the intervention group who moved to a lower poverty neighborhood (Ludwig et al., 2011). High poverty neighborhoods, such as many of the Latino enclaves, may be at greater risk for obesity and diabetes. However, it is theorized that the social networks of ethnic enclaves can overcome the harmful effects of poverty and limited resources, which could result in a protective effect from diabetes.

While few studies have examined ethnic enclaves and diabetes specifically, several have examined depression or mental health. As with physical health outcomes, Latinos living in ethnic enclaves have better mental health than those not living in an enclave (Ostir, 2003; Mair 2010). However research has found that those benefits impact some groups more than others. A study using the Hispanic EPESE found living in an ethnic enclave to be protective of depression for men, but not for women (Gerst et al., 2011). Another depression and enclave study from Texas found the protective enclave effect to be true only for English-speaking Latinos living in the high ethnic neighborhood (Shell et al., 2013). They also examined several different mediators and moderators, finding that Spanish language, social support, discrimination, and stress explained the ethnic enclave and depression relationship (Shell et al., 2013). Similarly, Vega and co-authors (2011) found that language isolation, as a measure of neighborhood ethnic concentration, had a negative association with depression, which was greater for Latino immigrants in the U.S. longer than 15 years. Thus for depression it is not only neighborhood ethnic concentration that is important, but also the nativity and/or length of stay of the resident living in the enclave. Ethnic enclaves are generally protective of mental health, but they are more beneficial to some Latino subgroups than others.

1.2. Theoretical Framework and Conceptual Model:

1.2.1 Overview of Theories – The Social and Physical Environment

This study incorporates several well-researched theories to understand the mechanisms in which ethnic enclaves may be protective of diabetes. The main hypothesis for the protective effect is ascribed to the social networks within an enclave (Eschbach et al., 2004; Patel et al., 2003). Thus, applying social network theory to enclaves allows me to investigate if elements associated with social networks are operating within enclave as protective factors. In addition to networks, enclaves are also defined by the physical environment and institutions, providing a physical and social space for the residents (Logan et al., 2002; Zhou & Kim, 2006). Drawing from neighborhood effects research, I can incorporate factors related to the structural environment and institutions to the study of ethnic enclaves. This study will examine the mechanism by which ethnic enclaves influence diabetes and depression risk using a framework guided by social network theory and neighborhood research.

Social network theory

Social network theory has long been studied to understand how ties based on family, friends, neighbors, or social class can affect social behaviors and access to resources (Berkman, Glass, Brissette, & Seeman, 2000). Social networks can influence behavior and attitudes by establishing norms and determining access to information and resources. The characteristics of social networks can vary, such as in their size, reach, and homogeneity (Berkman et al., 2000), which can determine the quantity or direction of its influence (positive or negative). Berkman and authors present a comprehensive framework that includes the social and structural conditions that can shape social networks, as well as detail the specific mechanisms that can operate within

a social network to eventually influence health and health behavior. More specifically, the impact of social networks on health can occur through several potential pathways: social support, social influence, social engagement, person-to-person contact, and access to resources and material goods (Berkman et al., 2000).

Social networks can occur through several different pathways, with each type representing a different aspect of social life. Social support is an important concept that has been positively associated with better health and behaviors (Broadhead et al., 1983; Kawachi, 2006). Support can be provided in several ways, such as emotional, instrumental, appraisal, and informational (Berkman et al., 2000), resulting in less stress or a higher sense of efficacy in the recipient (Berkman et al., 2000). Social networks can also be considered as the everyday contact between individuals or groups, increasing familiarity and integration. Social ties are easily cultivated in enclaves because of the shared values and experiences between residents based on race/ethnicity, language, or migration. Social networks can also provide support in maintaining norms and behaviors, with the ability of neighbors and residents to influence each other. In the case of ethnic enclaves, social influence can lead to maintenance of culture and the healthy behaviors immigrants bring with them, or it can lead to risky or unhealthy behaviors.

An important aspect of social networks is the resulting social capital. There is a vast literature within sociology and public health on social capital (Forrest & Kearns, 2001; Kawachi, 2006; Portes, 2000; Sampson et al., 2002), and there are important links between social networks and social capital pertinent to immigrant and ethnic enclaves. A community with strong social networks can benefit from the collective effort of individuals in order to achieve a larger collective goal, resulting in social capital for the neighborhood (Macinko & Starfield, 2001). Social capital can also be interpreted as the individual benefits attained from social networks, for

example when a job is obtained through the individual's social ties (Portes, 2000). Furthermore, social capital can be described as a form of social norms, where more social capital in a community results in increased community trust, neighbors helping each other, increased neighborhood safety, and control of negative behaviors that can lead to social disorganization (Macinko & Starfield, 2001; Portes, 2000). Also, social networks and social capital can have both positive and negative effects, depending on the type of influence and support provided (Portes, 2000).

While there are many definitions and variations in the use of the social networks and social capital, what is important for this study is the assumption that processes associated with social networks operate within Latino enclaves, which then result in economic, social, or health benefits for the enclave residents. Social networks may be formed or sustained with greater ease within Latino enclaves because of the shared culture, values, and experiences, more so than in other neighborhoods, thus leading to the health benefits.

This study will apply social network theory, specifically Berkman et al's model, to the research of enclaves. For example, social support can provide emotional comfort and minimize stress to new immigrants as they begin adapting to a new country. Social support can also provide a basis for sharing knowledge and information, which can be critical for immigrants with no immediate family, and can range from information about jobs to where to shop, to how to access health care or other social services. Networks in an ethnic enclave also function through social influence by maintaining cultural norms and influencing behavior and attitudes, especially around healthy behaviors that is often prominent among Latinos immigrants, such as limited smoking and excessive alcohol consumption (Lara et al., 2005).

Also key is that benefits from social networks and social capital may buffer negative determinants of health associated with neighborhoods, such as high poverty and structural disadvantage (Eschbach et al., 2004; Patel et al., 2003). Living in an enclave and having strong networks can serve to provide immigrants and native-born Latinos with a source of social support, access to shared information, protection from discrimination encountered in other more integrated locations (Mason et al., 2011; Viruell-Fuentes, 2007), or prevention of stressors from acculturation (Finch & Vega, 2003). Whether by choice or by circumstance, immigrants and co-ethnics living together in an enclave build and strengthen the social networks that can provide a place to share information as well as provide support. It is these social ties that strengthen the enclave and serve to define the community itself (Qadeer & Kumar, 2006). Combined, all of the advantages of having strong social networks from living in an ethnic enclave can result in better health outcomes for residents.

Neighborhood Research

Neighborhood effects research examines how the physical and social environments of a community impact the social and health outcomes of its residents. While neighborhood effects research does not usually address issues of immigration, the research can be applied to our understanding of how Latino enclaves function, especially as we determine their positive and harmful effects. Researchers have provided several possible pathways in which a neighborhood can impact the health and behaviors of its residents (Diez Roux & Mair, 2010; Sampson et al., 2002). Generally, these pathways fall under the larger categories of the physical environment and the social environment. Diez Roux and Mair identify the physical environment as encompassing environmental exposures (e.g. air pollution, noise, and other risks), the built environment (e.g. street design, transportation systems, and physical decay), access to food through grocery stores

and restaurants, recreational resources like parks, the availability of social and medical services, and the quality of housing (Diez Roux & Mair, 2010). The social environment of a neighborhood encompasses: norms, social networks, safety and crime, and social capital (Diez Roux & Mair, 2010; Sampson et al., 2002).

The physical environment can impact the health of residents in various forms. For example, proximity to environmental exposures, such as exhaust particles from diesel trucks and busses, or hazardous materials emissions from businesses and factories, can result in poorer health. The built environment can affect the level of physical activity of residents or the availability of resources, which can impact the behaviors and stressors of residents. In another example, Sampson and authors detail how the location of schools, availability of public transportation, and the placement of commercial space all impact the daily routines of residents, which has an effect on the behaviors and availability of resources (Sampson et al., 2002).

The social environment in a neighborhood is greatly influenced by the social networks and ties the residents have with each other and the community. As previously discussed, social networks can provide support and facilitate transfer of knowledge and information. A strong social network can bolster the social capital of individuals as well as for the neighborhood, and can help establish the norms and values of a community. Intersecting with these social pathways are concepts from social disorganization theory. Social disorganization theory contends that neighborhoods with high poverty, residential instability, ethnic heterogeneity, and family instability can create atmospheres of distrust and fear, reducing social cohesion and social norms (Kubrin & Weitzer, 2003; Sampson & Groves, 1989; Sampson et al., 2002). Crime and violence can flourish in these neighborhoods, resulting in poor social, economic, and health outcomes for residents (Sampson & Groves, 1989; Sampson et al., 2002).

One aspect that ethnic enclave research does not address is the potential social disorganization of an enclave. The ethnic enclave is assumed to have strong social ties and is mostly ethnically homogenous, thus social disorganization should be minimal. Nevertheless there are some aspects, especially poverty or family and residential instability, which may destabilize social networks in an enclave. Gangs and drug abuse that lead to street crime, for example, are more common in low-income than middle-income neighborhoods, regardless of whether they are enclaves or not (Sampson, Raudenbush, & Earls, 1997). Incorporating a neighborhood effects lens allows for the consideration of negative health effects within enclaves, as well as provides a framework to incorporate both structural and social characteristics. Accordingly the physical and structural environment of an enclave should be considered when examining the effect on health.

A component of the structural environment in a neighborhood includes the neighborhood economy. Within the sociological literature the ethnic businesses and the enclave economy, and their socioeconomic effects on residents, has been a focus of the enclave research (Light, Sabagh, Bozorgmehr, & Der-Martirosian, 1994; Portes & Shafer, 2007; Waldinger, 1993). The ethnic enclave economy, which is an alternative labor market built by co-ethnics or immigrants as entrepreneurs and labor, is "bounded by co-ethnicity and location" (Portes & Shafer, 2007; Zhou, 2004). The enclave economy offers an alternative labor market to integrate new immigrants, reducing any language, cultural, and resource barriers that may be encountered in the mainstream labor market (Wilson & Portes, 1980). In addition to providing jobs to the enclave, the ethnic enclave economy is a source of services and businesses specific to the immigrant and ethnic group. These may include ethnic grocery stores, restaurants, and specialty shops that are dominated by the enclave entrepreneurs and draw to the enclave immigrant residents and outside

co-ethnics. The services cater to the group's culture, language, and customs. They may also provide opportunities and services not available to them in mainstream society, such as banks, real estate, and educational or health services (Zhou & Kim, 2006; Zhou & Lee, 2011). Understanding the businesses and economy of the enclave, which may be a source of work and income to enclave residents, is an important aspect of enclave research. The businesses and resources within the enclave can also determine the amount and availability of support, services, and goods for the enclave residents, all of which can influence health care and behaviors.

Strengths and Limitations of Social Network and Neighborhood Research

There are several strengths in applying social network theory and neighborhood research to the study of ethnic enclaves. Social network theory provides a variety of pathways that allows for the inclusion of characteristics distinct in ethnic and immigrant enclaves, such as the benefits of a shared culture, language, or values. Also, if using a conceptual model like that of Berkman et al., researchers can include the influence of social context, such as the migration experience, when considering how social networks function. This is key when studying ethnic enclaves because the immigration experience, as well as the human capital and resources that immigrants may or may not bring with them, is key to the enclave and the cultivation of the networks within the enclave.

However, social networks theories can be too focused on individual level aspects of the enclave. Alternatively, the neighborhood effects perspective allows for the examination of enclaves at the macro-level, observing the social and structural mechanisms at work within neighborhoods. Neighborhood effects literature also allows for the inclusion of a disadvantage aspect, one that the enclave literature often lacks. Incorporating Berkman et al.'s (2000) conceptual model of social networks and Diez Roux and Mair's (2010) framework of

neighborhood effects, I can begin to identify the pathways in which an ethnic enclave may be associated with diabetes. Empirical and theoretical conceptualizations of social capital, enclaves, and health, will also be considered in the conceptual model.

1.2.2 Conceptual Models

Social determinants of Health

Much of health research focuses on the individual characteristics and behaviors that cause or increase the risk of illness. The conceptual model in Figure 1.1 begins with demographic characteristics that are based at the individual level, then expands the focus to include contextual factors, such as the physical and social environment, that can also influence the onset of diabetes or depression. Health status and behaviors are also critical in understanding the direct impact individuals have on their health, specifically for diabetes and depression. For the Latino population, these risk factors and health behaviors may also be influenced by the experiences of immigration and being a racial minority.

Proximate risk factors for diabetes and depression risk include demographic characteristics such as age, gender, race/ethnicity, and socioeconomic status. Older age is a significant risk factor for diabetes, across all races and ethnicities (CDC, 2011; Mokdad et al., 2003). The onset of diabetes can also be influenced by family history, with many researchers pointing to genetics as one reason for the high rates of diabetes among Latinos, especially those of Mexican descent (Markides & Coreil, 1986; Stern et al., 1983). Diabetes rates vary disproportionally by race/ethnicity, with Latinos, African Americans, and Native Americans having higher rates of diabetes compared to whites, even when adjusting for age (CDC, 2011; Singh & Miller, 2004). These demographic risk factors can be directly associated with diabetes or they can influence the contextual factors and health behaviors that could then result in

diabetes. For depression, females often have higher rates of mental health illness, but it is not clear if women are at greater risk or are diagnosed at higher rates in comparison to men (Cole & Dendukuri, 2003; Hirschfeld & Weissman, 2002). Age is not a direct risk factor for depression, however many of the risk factors for depression intersect with older age, such as illness and disability (Roberts et al., 1997). Thus age and gender may be important factors to consider when studying depression risk. Additional risk factors for major depression include trauma, major life events, or stress (Hirschfeld & Weissman, 2002), important factors to consider when examining depression among Latinos who have migrated in their lifetime or experienced varying levels of the acculturation process.

Risk factors for diabetes and depression also include health behaviors and health status. These are often the focus of interventions because they are lifestyle behaviors that can be modified. Obesity has been shown to be an important risk factor for diabetes, with obesity and/or high body mass index (BMI) associated with an increasing likelihood of diabetes (ADA, 2009; Do et al., 2007; Mokdad et al., 2003; Stern et al., 1983). Related to obesity are diet and physical activity. To reduce the risk of diabetes the American Diabetes Association recommends a diet low in fats and calories and high in fiber and whole grain along with physical activity levels of 150 minutes per week (ADA, 2007). Overall Latinos in the U.S. have been shown to have high rates of obesity and irregular levels of physical activity (Lara et al., 2005; Osypuk et al., 2009). Dietary patterns vary among Latinos, in particular between recent immigrants and more acculturated or U.S. born Latinos. For example, Latino immigrants and less acculturated Latinos have been shown to have healthier diets low in fats and sugar and high in fruits and vegetables (Ayala et al., 2008; Guendelman & Abrams, 1995; Neuhouser, Thompson, Coronado, & Solomon, 2004), which can help to prevent obesity and diabetes. While health behaviors, such as

diet and physical activity, can have a direct impact on diabetes risk and may be regulated by the individual (Diabetes Prevention Program Research, 2009), these health behaviors are also influenced by environmental factors.

Health risk factors for depression are very different from the risk factors for diabetes. For depression, health status can be a risk factor. More specifically, among older adults having a disability, new illness, chronic disease, or poor self-rated health can result in higher depression risk (Cole & Dendukuri, 2003). Individuals with a recent disease diagnosis are at risk for depression as they face the changes in their health, but those with a disability or a chronic illness are also at risk for depression as they may encounter challenges in managing their health. Other risk factors among older adults includes female gender, prior depression, and bereavement (Cole & Dendukuri, 2003). As with diabetes, the risk factors that can result in depression can also be influenced by larger factors in the physical and social environment.

Contextual risk factors are more difficult to link to diabetes or depression because of their potentially distant association. The physical or psychosocial environment may directly impact diabetes, but there is usually an underlying mechanism that intersects with the demographic or behavioral factors as well. The physical environment, for example, can influence the health behaviors of an individual through the neighborhood characteristics. Place of residence and the resources available may determine access to parks and recreation centers, which can then impact physical activity levels, along with the "walkability" of neighborhoods (Foster & Giles-Corti, 2008; Wen, Kandula, & Lauderdale, 2007). The neighborhood will also determine the availability of fresh foods, which impacts dietary behaviors (Horowitz et al., 2004). The institutions available in a neighborhood can be important to depression, such that the availability and influence of churches, schools, and businesses can create an environment that reduces social

isolation or provides support for other health and social related risk factors. The physical environment can influence diabetes and depression through its association with other distal factors, such as the social environment and neighborhood socioeconomic status, and through its association with proximate factors that they may moderate or influence. The ethnic enclave serves as a geographic location for the study of neighborhood factors and race/ethnicity at the neighborhood and individual level.

The social environment affects diabetes and depression by fostering social networks, which can provide information as well as support specifically related to diabetes or depression. Social networks can also provide support in reducing stress and increasing access to services, which can have overall health benefits (Broadhead et al., 1983; Kawachi, 2006). However social networks also have the potential to increase stress or influence unhealthy behaviors. The following section discusses environmental risk factors, both social and physical, in greater detail.

There are several risk factors that can impact the onset of diabetes and depression. These risk factors occur at the individual level, as well as larger macro levels, all of which can be interrelated to one another. Diabetes and depression are often studied at the individual level, identifying risk factors and interventions that impact individuals. However there are other factors, such as the social and physical environment, that can influence these illnesses and their risk factors, which I discuss in more detail below.

Ethnic Enclaves, Diabetes, and Depression Risk

Whiles there are several risk factors for diabetes and depression risk, the conceptual models driving this study detail the hypothesized pathways in which ethnic enclaves are associated with diabetes, Figure 1.2, and depression risk, Figure 1.3. The focal relationship is the relationship between ethnic enclaves and diabetes or depression risk. I am using similar models

that highlight two possible pathways explaining the focal relationship. Based on empirical findings in the enclave and health literature, I hypothesize that enclaves with a higher ethnic concentration, specifically of Mexican-origin, will have a protective effect, resulting in decreased rates of diabetes and depression for the enclave residents. The focal relationship establishes a link between the main concept of interest and the disease. Diabetes often occurs much later in life and can take years for the disease to develop and be diagnosed. It is a distal outcome for which several pathways can lead to its development. Depression, on the other hand, can occur closer to the exposure, but there can still be several mechanisms that link the neighborhood effect to depression risk. For this study I concentrate on two potential pathways: the social and the physical environment.

One way in which ethnic enclaves may be functioning to affect health is through the social networks that create the enclave and are sustained within it. The social networks and ties within an enclave are presumed to provide a protective effect for the health of its residents.[3] As previously reviewed, social networks can operate through several pathways to impact health (Berkman et al., 2000). Considering the characteristics of an ethnic enclave and its possible influence on diabetes or depression risk, I focus on two types of social pathways: social ties and social cohesion and trust. These are also measures available in the Hispanic EPESE.

Social ties consider the interpersonal networks of individuals, such as family, friends, and neighbors. Social ties can be assessed as personal contact through the number of ties individuals have and with whom, or by the function of the relationship, i.e. ties that offer emotional, instrumental, or informational support (Almeida, Kawachi, Molnar, & Subramanian, 2009; Lin, 1999). Social ties are networks that individuals can access either in person or from a distance and

[3] Social networks can also be harmful and promote unhealthy behaviors, however in terms of enclaves the social cohesion and social ties are assumed to be protective.

are a potential source of support. An example of informational support is an individual notifying his/her friends of new exercise classes at the local community center. The friends demonstrate emotional support by encouraging each other to attend the classes. However, ties can also be a source of stress, such that the individual may not benefit from the relationship (Kawachi, 2006; Portes, 2000). Social ties can influence health behaviors, such as diet, physical activity, all of which are important for diabetes risk, but as mentioned these influences can have positive or negative health effects. Social ties can translate into a greater number of social contacts or a greater perception of support, which can reduce depression risk by creating a sense of support and combat social isolation. Ethnic enclaves serve to cultivate and maintain interpersonal social ties, which can then influence health behaviors and resources, ultimately affecting diabetes risk factors and diabetes prevalence, as well as depression risk.

Unlike social ties, which are based on interpersonal networks, social cohesion and trust is based on macro level connections. Social cohesion encompasses the support and trust individuals receive and share within their community (Forrest & Kearns, 2001; Sampson et al., 1997). Social cohesion can be considered an interpretation of social capital, providing the neighborhood with a sense of belonging through commonalities, and a sense of power or ability to influence their surroundings (Forrest & Kearns, 2001; Kawachi, 2006).[4] An aspect of social cohesion is social controls, in which community members reinforce norms and behaviors accepted by the group (Forrest & Kearns, 2001). In the case of enclaves, strong social cohesion can encourage and support healthy behaviors often identified within Latino populations, such as low smoking and drinking patterns, and healthier diets (Lara et al., 2005). Social cohesion can also take the form

[4] This study uses the term social cohesion, as opposed to social capital, since it reflects the social cohesion and trust scale available in the dataset. The social cohesion and trust scale was used by Sampson et al (1997) in order to measure a dimension of collective efficacy, which is associated with low neighborhood violence.

of the commitment an individual feels for others, even without personal contact (Berkman et al., 2000). For example, enclaves with high social cohesion may feel responsible for others living in the enclave and be concerned with creating a safe and healthy environment for everyone.

Both social cohesion and social ties influence behaviors, access to services, sharing of information, and social supports, all of which can influence diabetes and depression. Social cohesion and social ties contribute to the environment in which individuals may experience, promote, or constrain diabetes risk factors. For example, strong social ties with family or friends who have maintained a healthy diet rooted in cultural characteristics will encourage the individual to also continue a healthy diet. A neighborhood with high social cohesion will be able to enforce a healthy (or unhealthy) diet through the types of food available in the area, providing a supportive environment, and encouraging norms for health behaviors. Strong social ties and social cohesion can thus provide a positive and supportive environment that encourages the maintenance of healthy behaviors that many immigrants bring with them, as well as sharing information and access to resources, all of which can reduce diabetes risk factors and diabetes itself. Additionally, social ties can create an environment of support and assistance for individuals with disabilities or a chronic illness, preventing the onset of depression. A larger sense of social cohesion and trust can also provide the perception of a supportive community, providing individuals with a sense of belonging, reducing isolation, especially for those living alone, a risk factor for depression. Social ties and social cohesion and trust can be developed and strengthened through social organizations within the enclave. Organizations such as churches, schools, community groups, or certain businesses can bring people together and allow the neighborhood to build strong support for the individuals and the neighborhood as a whole. These groups may especially be important in influencing depression risk. These organizations that

facilitate the social support and bonds of the enclave residents are part of the physical environment of the ethnic enclave

The physical and structural environment may be one of the mechanisms operating within ethnic enclaves that can function to influence diabetes and depression risk. An enclave can be defined by its geographic location and its ethnic or immigrant concentration (Logan et al., 2002; Zhou & Logan, 1989). Structurally, the ethnic enclave can be identified by the congregation of ethnic businesses and services, as well as its institutions, such as churches, schools, or hospitals (Zhou & Kim, 2006). It is these ethnic services, shops, and institutions that visually distinguish the enclave, provide the unique goods and services not available to the ethnic group in other mainstream locations, and ultimately reinforce social support and social cohesion for the residents. The enclave economy has the potential to provide jobs for newcomers and financial support to the community. It also serves to physically establish the enclave by creating a place that offers businesses, services, and institutions unique to the ethnic group. Currently, public health research focuses on the social networks of the ethnic enclave, and to a lesser extent neighborhood demographics such as neighborhood socioeconomic status. Neighborhood effects research has shown the impact of the physical environment on health, including neighborhood poverty, neighborhood safety, walkability, and the availability of resources such as parks and health food outlets. These neighborhood characteristics can especially impact diabetes risk factors, and depression risk to a lesser extent. However other factors may be important in assessing the strength of an enclave and the economic state of the neighborhood, such as the level of entrepreneurship and the types of businesses available.

The strength of an enclave, or the level at which the ethnic group is integrated into the neighborhood, can vary. Some groups may have a stronger presence and more capital in the

enclave compared to other enclaves (Logan, 2001). Enclaves with a significant number of businesses owned by the ethnic group, organizations focusing on the needs of the group, and availability of institutions to provide resources and support for the group may provide a better context for social networks and cohesion to thrive. The institutional embeddedness of the group may result in a stronger enclave, having a direct effect on diabetes and depression and an indirect effect through its influence on the social environment.

Through the physical and structural characteristics, an enclave can impact the health behaviors, access to services and information, and provide support. As with the social environment, the physical environment can form a health promoting atmosphere where healthy foods are sold, businesses offer financial stability, and support and resources are available through churches and ethnic organizations. Together these benefits can limit and reduce diabetes/depression risk factors and ultimately the onset of diabetes/depression.

1.3. Specific Aims and Research Questions:

In order to understand the relationship and mechanisms between ethnic enclaves and diabetes and depression I address two overall aims with detailed research questions and hypotheses, described below:

Aim 1: Determine if ethnic enclaves are protective of diabetes for older Mexican-origin adults and examine the underlying social and structural mechanisms.

I began by establishing the association between ethnic enclaves and diabetes for older Mexican Americans in five Southwestern states. Using the 2004-2005 Hispanic Established Populations for the Epidemiological Studies of the Elderly (HEPESE) merged with 2000 Census data, I first determined if there was an association between the concentration of Mexican-origin

individuals in a neighborhood and the prevalence of diabetes. The research question and hypothesis addressing Aim 1 are detailed as follows:

1.1: Do older Mexican and Mexican-Americans living in ethnic enclaves have lower odds of diabetes?

$H_{1.1}$: Older Mexican and Mexican Americans living in high ethnic concentrated neighborhoods will be less likely to have diabetes than those living in neighborhoods with lower ethnic concentrations, controlling for individual and neighborhood level characteristics.

In research question 1.1 I first identified any variation in diabetes prevalence by neighborhood ethnic concentration and established whether it has a protective effect. In this study a higher ethnic concentration corresponds to a higher concentration of Mexican-origin individuals in a census tract. Based on enclave research for other health outcomes, I predicted that living in an ethnic enclave will be protective of diabetes for older Mexican and Mexican Americans compared to those not living in ethnic enclaves, net of other known diabetes predictors at the individual level and neighborhood level characteristics. With the first research question I established the focal relationship between ethnic enclaves and diabetes. Research questions 2 and 3 explored the possible social and structural mechanisms associated with the focal relationship.

The second research question examined the pathways in which an ethnic enclave can affect diabetes. Social networks within an enclave have been hypothesized to be protective of health (Eschbach et al., 2004; Patel et al., 2003), thus I examined the social characteristics found within an enclave. Research question 1.2 asked what role social ties play in the ethnic enclave and diabetes relationship and research question 1.3 focused on the broader social networks of individuals, social cohesion and trust.

1.2: How are social ties and social cohesion associated with ethnic enclaves and diabetes?

$H_{1.2.1}$: Neighborhoods with higher Mexican-origin concentrations will result in more social ties for individuals in the neighborhood, controlling for individual and neighborhood level characteristics.

$H_{1.2.2}$: Social ties will mediate the association between ethnic enclaves and diabetes, controlling for other diabetes risk factors at the individual and neighborhood level.

$H_{1.2.3}$: Neighborhoods with higher concentrations of Mexican-origin individuals will be associated with higher levels of social cohesion.

$H_{1.2.4}$: Social cohesion will mediate the association between ethnic enclaves and diabetes, controlling for other diabetes risk factors at the individual and neighborhood level.

The main goal of the second research question is to determine whether social networks play a mediating or moderating role in the ethnic enclave and diabetes relationship. A mediating variable is determined by the addition of the variable in question to the model and observing the change in the coefficient for the original relationship, in this case how neighborhood ethnic concentration predicts diabetes. Also an import part of the mediation test is examining the relationships between the predictor and the mediation variable, then the mediation variable and the outcome. Appendix A presents the bivariate regression model of ethnic enclaves and social ties and the bivariate logistic regression model of the social ties scale and diabetes.

With hypothesis 1.2.1, I establish the relationship between ethnic enclaves and social ties, predicting that neighborhoods with higher ethnic concentrations will lead to stronger social ties

in the enclave. I then explored the role of social ties and hypothesized that neighborhood social ties will serve as a mediator in the association between ethnic enclaves and diabetes. I also test for moderation by social ties, which would indicate that increasing social ties has an effect on the ethnic enclave and diabetes relationship, such as strengthening that association with the presence of higher social ties. While the literature usually refers to social networks as a mediating effect, it could also serve as a moderator. Thus I will examine both possibilities.

Having explored social ties, which captured the interpersonal social relationships, I then examined the role of broader social networks with the social cohesion and trust scale. I began by first examining the relationship between ethnic enclaves and social cohesion, hypothesizing that increased ethnic concentration of a neighborhood resulted in higher social cohesion. Next I hypothesized that the social cohesion measure mediated the ethnic enclave and diabetes relationship. I also tested for moderation as with the social ties scale above (see Appendix A). Research question 1.2 examined the role of social networks at the interpersonal level with the social ties measure and the role of social relationships within a community with the social cohesion measure. While these measures may overlap, there may also be differences that impact the enclave and diabetes relationship differently. Looking at two different types of measures allowed me to better understand the mechanisms at work in the protective effect of ethnic enclaves.

The third research question focused on the impact of the structural environment. I examined how the institutional embeddedness of respondents within the enclave impacted the relationship between the ethnic enclave and diabetes using business data by census tract from Infogroup.

1.3: Does the level of institutional embeddedness[5] of the Mexican-origin community influence the relationship between ethnic enclaves and diabetes prevalence?

$H_{3.1.1}$: Neighborhoods with higher ethnic concentrations will be associated with a higher presence of Latino-owned businesses per census tract.

$H_{3.1.2}$: Latino-owned businesses will moderate the association between ethnic enclaves and diabetes.

I expected that ethnic enclaves, or neighborhoods with higher concentration of Mexican-origin individuals, would result in stronger institutional embeddedness within the neighborhood as measured by a higher rate of Latino-owned businesses, compared to neighborhoods with lower concentrations of Mexican-origin individuals. I also hypothesized that the level of Latino-owned businesses would operate as a moderator in the relationship between ethnic enclaves and diabetes. Ethnic groups that are institutionally embedded within the enclave should have a stronger ethnic economy or an increased availability of resources and support for the group. Enclaves with a significant structural influence from the ethnic group would be able to foster a community with healthy behaviors and norms, reducing the risk of diabetes. I explored the role businesses, both the proportion of Latino-owned businesses and the type of business, played in the ethnic enclave and diabetes relationship, which could serve to moderate the relationship. The presence of Latino-owned businesses may strengthen the protective effect of ethnic enclave on diabetes; however mediation may also be possible. I will test for mediation; however there is less literature on the potential of Latino-owned businesses having a direct effect on diabetes, which would be needed for mediation to be observed.

[5] Institutional embeddedness will be operationalized as the number and type of businesses owned by Latinos at the census tract level. Conceptually I intend to capture a neighborhood in which the businesses and type of resources create a supportive and thriving community.

Aim 2 followed a similar format as with Aim 1, but with a focus on depression risk. Aim 1 explored the effects of ethnic enclaves on a physiological health outcome while Aim 2 looked at a psychosocial health outcome, depression risk.

Aim 2: Determine if ethnic enclaves are protective of depression risk for older Mexican-origin adults and examine the underlying social and structural mechanisms.

I began by establishing the association between ethnic enclaves and depression risk for older Mexican Americans in five Southwestern states. Using the 2004-2005 Hispanic Established Populations for the Epidemiological Studies of the Elderly (HEPESE) merged with 2000 Census data, I first determined if there was an association between the concentration of Mexican-origin individuals in a neighborhood and the prevalence of depression risk. Research question 2.1 asks:

2.1: Do older Mexican and Mexican-Americans living in ethnic enclaves have lower odds of depression risk?

$H_{1.1}$: Older Mexican and Mexican Americans living in high ethnic concentrated neighborhoods will be at lower risk of depression compared to those living in neighborhoods with lower ethnic concentrations, controlling for individual and neighborhood level characteristics.

I expected an increasing ethnic concentration of the neighborhood to result in a decreased risk of depression. Past research has examined the effect of enclaves on depression with many studies finding a protective effect (Gerst et al., 2011; Mair et al., 2010; Ostir, Eschbach, Markides, & Goodwin, 2003). But few studies examined what might explain the protective enclave effect, thus in the following research questions I examined the role of social networks and businesses on the enclave and depression relationship. Since the immigrant concentration of a neighborhood was a significant predictor for the depression analysis I also examined the immigrant enclave and

depression relationship. While this was not one of the main focuses at the beginning of the study, it became apparent that I would also need to examine the immigrant enclave in the analysis of the social and structural pathways.

2.2: How are social ties and social cohesion associated with ethnic enclaves and depression risk?

$H_{2.2.1}$: Social ties will mediate the association between ethnic enclaves and depression, controlling for other risk factors at the individual and neighborhood level.

$H_{2.2.2}$: Social cohesion will mediate the association between ethnic enclaves and depression, controlling for other risk factors at the individual and neighborhood level.

$H_{2.2.3}$: Neighborhoods with higher immigrant concentrations will result in more social ties for individuals in the neighborhood, controlling for individual and neighborhood level characteristics.

$H_{2.2.4}$: Social ties will mediate the association between immigrant enclaves and depression, controlling for other risk factors at the individual and neighborhood level.

$H_{2.2.5}$: Neighborhoods with higher immigrant concentrations will result in higher social cohesion for individuals in the neighborhood, controlling for individual and neighborhood level characteristics.

$H_{2.2.6}$: Social cohesion will mediate the association between immigrant enclaves and depression, controlling for other risk factors at the individual and neighborhood level.

Once I established the enclave and depression relationship, I next explored the potential mediating effect of social networks as measured by social ties and social cohesion. As I previously examined the association between the ethnic enclave and social ties and social cohesion, in Aim 1, for Aim 2 I focused on the mediation effect of the social network measures and the ethnic enclave and depression risk relationship. In hypotheses $H_{2.2.1}$ and $H_{2.2.2}$ I predicted that social ties and social cohesion, respectively, would mediate the ethnic enclave and depression association. As with diabetes in Aim 1, I also test for a moderating effect for ethnic enclaves and depression risk. Since immigrant enclaves were consistent predictors of depression risk, I also examined if higher immigrant concentrations in neighborhoods results in more social ties and higher social cohesion and if social ties and social cohesion mediated or moderated the relationship between immigrant enclaves and depression.

Lastly I focused on the business environment and its potential impact on enclaves and depression risk.

2.3: Does the level of institutional embeddedness of the Mexican-origin community influence the relationship between ethnic enclaves and depression risk?

$H_{2.3.1}$: Latino-owned businesses will moderate the association between ethnic enclaves and depression risk.

$H_{2.3.2}$: Neighborhoods with higher immigrant concentrations will be associated with a higher presence of Latino-owned businesses per census tract.

$H_{2.3.3}$: Latino-owned businesses will moderate the association between immigrant enclaves and depression risk.

I first tested the moderating effect of Latino-owned businesses on the ethnic enclave and depression relationship. I then focused on the immigrant enclave and predicted that a higher ratio

of Latino-owned neighborhoods would influence the effect of higher immigrant neighborhoods on depression, thus moderating the relationship. However ethnic enclaves and high immigrant neighborhoods may be associated with a higher ratio of Latino-owned businesses, in which case Latino-owned businesses may serve as mediators.

1.4 Figures

Figure 1.1. Conceptual Model: Risk Factors for Diabetes and Depression Risk

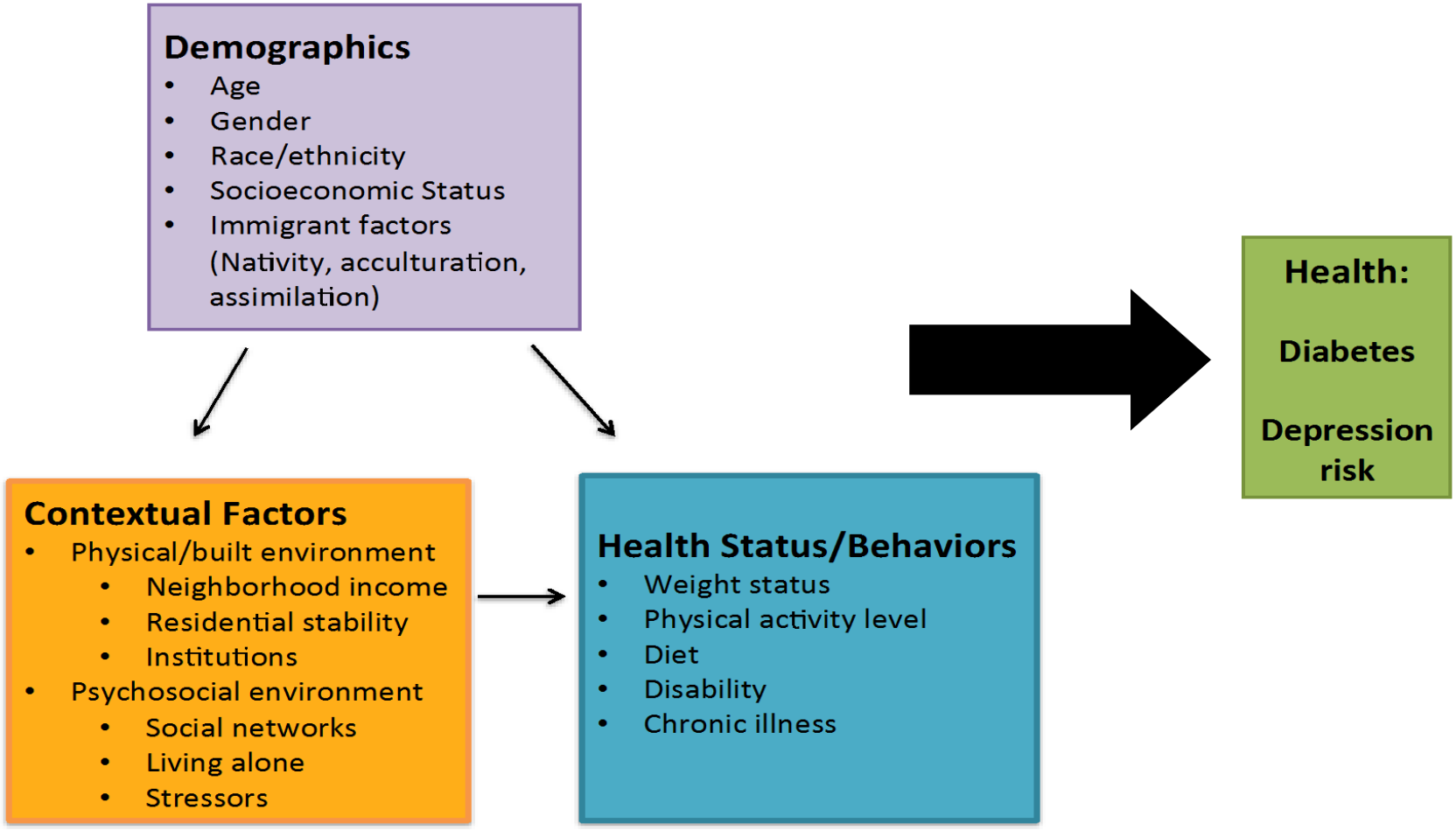
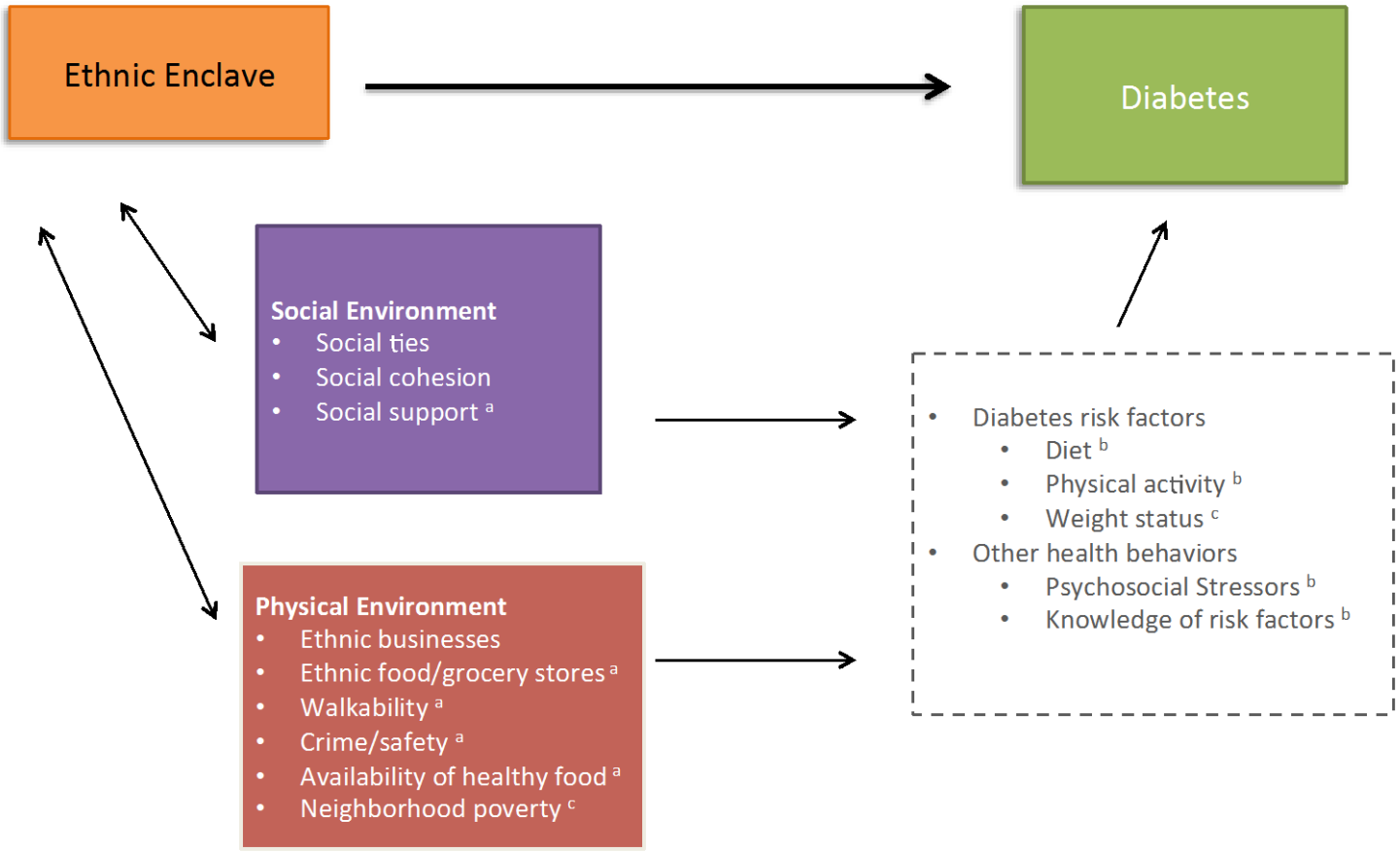
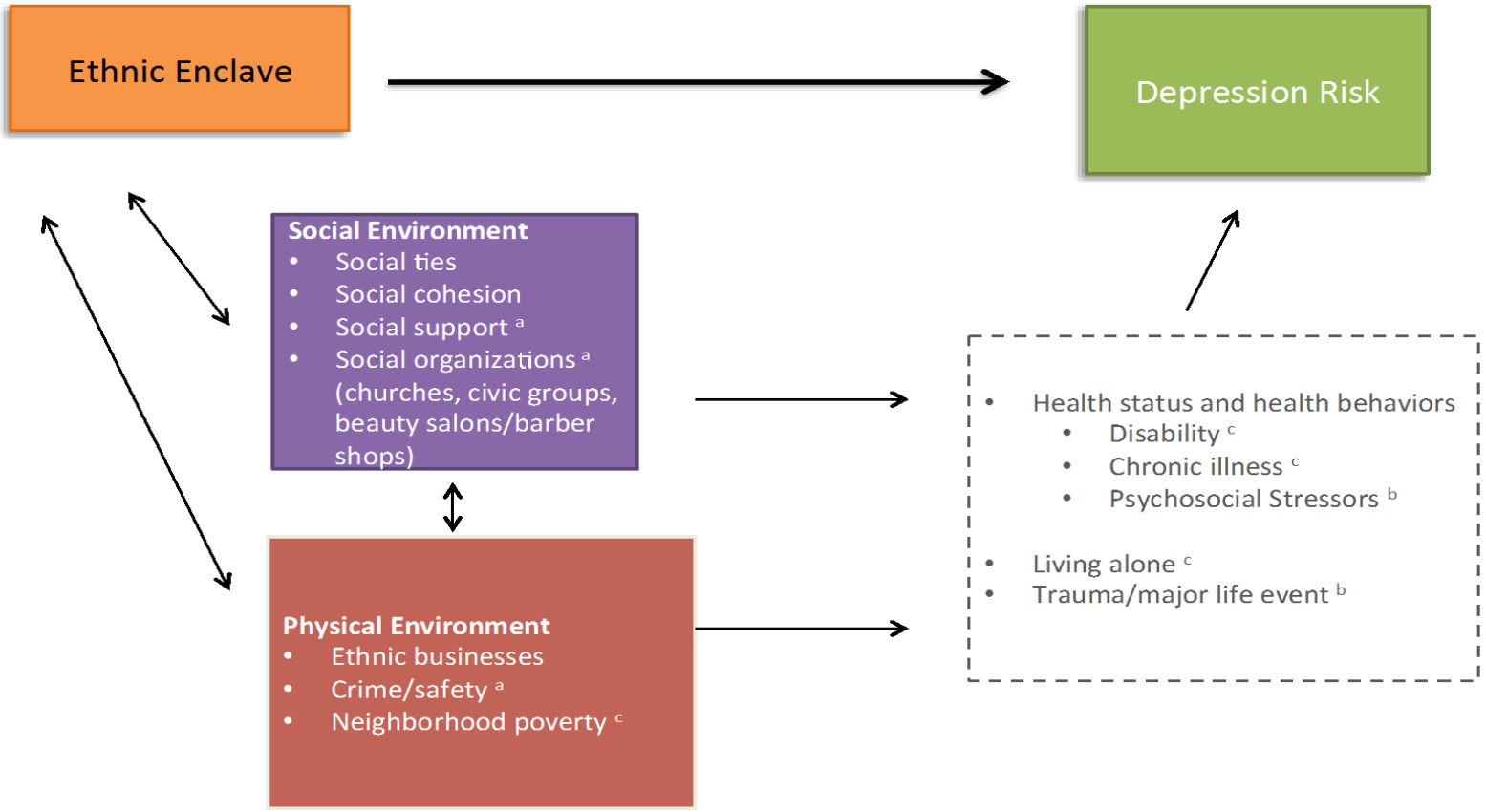


Figure 1.2: Ethnic Enclaves and Diabetes



[a] Contextual factors potentially impacting diabetes, but not included in analysis because measure is unavailable.
[b] Denotes variable is part of the diabetes risk factors but not included in the analysis because measure is unavailable in the Hispanic EPESE.
[C] Control for Neighborhood poverty and individual BMI in analysis.

Figure 1.3: Ethnic Enclaves and Depression Risk



[a] Contextual factors potentially impacting depression, but not included in analysis because measure is unavailable.
[b] Denotes variable is part of depression risk factors but not included in the analysis because measure is unavailable in the Hispanic EPESE.
[C] Control for neighborhood poverty, disability, chronic illness, and living alone in analysis.

Chapter 2: Data and Methods

This section details the publicly available data sources used in the study, as well as the measures and variables important to addressing the research questions. I also review how the data was prepared for analysis and describe the analysis plan.

2.1 Data Sources

2.1.1 The Hispanic EPESE

The Hispanic Established Populations for the Epidemiological Studies of the Elderly (HEPESE) began in 1993-1994 and was created to address the lack of data available on the growing elder Latino population (Markides, Ray, Angel, & Espino, 2009). The HEPESE was fashioned after the 1981-1993 Established Populations for the Epidemiologic Studies of the Elderly, a study of the elderly population in the U.S. The HEPESE surveys Mexican-origin adults ages 65 and older across five Southwestern states: Texas, California, Arizona, Colorado, and New Mexico. Additional waves have been conducted approximately every two to three years, with the most recent publically available data, Wave 6, collected in 2006-2007.

Several physical and mental health indicators are included in the survey, with the intention to establish trends for the older Mexican-origin population, as well as compare to other racial groups. With the objective of collecting data generalizable to approximately 500,000 older adults, the baseline HEPESE survey sampled from the southwestern U.S., where about 85% of the older Mexican and Mexican American population resided at the time (Markides et al., 2009).

The final 1993-94 baseline sample consists of 3,050 respondents. The HEPESE used an area probability sampling design. Sample selection began with a list of all counties in Texas, California, Arizona, Colorado, and New Mexico. The counties were placed in order by the number of Mexican-origin individuals and those counties above the 90% cut-off point were

included in the sampling pool. From the remaining counties, those with at least 30% Mexican-origin adults were also included. Within the selected counties, census tracts were ordered by the number of Mexican and Mexican American elderly in each tract. Three hundred census tracts were selected with probabilities proportional to the number of Mexican-origin older adults and marked as the primary sampling units (PSU's). Blocks in each track were then identified and a block was randomly selected from each census tract. Between 260 and 360 housing units for each block within the PSU were identified and up to 175 households were screened. In each household, up to four members of Mexican-origin and age 65 and over were interviewed.

In the first wave a sample of 3,050 older adults were interviewed in their homes, resulting in a response rate of 83%. Respondents were interviewed and basic physical assessments were conducted including: physical functioning, blood pressure, height and weight, hip and waist, vision, and medication use.

All follow up interviews were conducted in person. The present study used Wave 5 data, collected between 2004 and 2005. From the baseline cohort, 1,167 respondents completed the fifth follow up interview. The principal investigators also added a new sample to the HEPESE in Wave 5. This new sample of 902 Mexican-origin adults are age 75 and over. The new sample also has higher average education and income levels compared to the baseline sample (Markides et al., 2009). The researchers wanted to include a sample with a higher socioeconomic level to compare their health with the baseline cohort, which had low education and income levels. The final sample for Wave 5 is 2,069 older adults of Mexican-origin.

The HEPESE collected information on health across several outcomes, including chronic conditions, activities of daily living, disability, mental health, utilization of health services, and quality of life such as stressors and social support. The survey also captured direct measures of

mobility, height, weight, and HbA1c for those with diabetes. In addition to the physical and mental health questions asked at each wave of the HEPESE, the 2004-2005 Wave 5 included several questions not asked in previous years, such as social and neighborhood related questions. These questions are critical to my study, thus the study is cross-sectional and limited to data from the 2004-2005 Wave 5 interviews.

2.1.2 The U.S. Census

Census tract data for several demographic characteristics are available through the U.S. Census. In order to address all three aims and operationalize a Latino ethnic enclave, I used racial and ethnic concentration data for census tracts in the five southwestern states that correspond to the HEPESE Wave 5 data. Since the HEPESE Wave 5 was collected in 2004 and 2005, I used census tract data collected in the 2000 U.S. Census. Use of the 2000 U.S. Census data is consistent with the survey authors, as they also used 2000 Census data in creating the weights for the HEPESE Wave 5.

Data for ethnic concentration by census tract can be found in Summary File 1 (SF1). SF1 tables were created by the Census using data from all people and housing units. Within the SF1, I use table QT-P9 "Hispanic or Latino by Type: 2000" from American Factfinder (Census, 2000b) to determine the number of individuals who self identify as Latino of Mexican-origin for each census tract for the five HEPESE states. Census tracts of Mexican-origin ethnic concentration include both foreign born and U.S.-born individuals. The ethnic enclave variable, a ratio of the number of individuals who identify as Mexican over the total number of individuals for each census tract, is merged with the HEPESE data using the unique census tract number as the common variable. The 2000 Census also provides data for the neighborhood level controls,

specifically neighborhood poverty level and neighborhood foreign-born concentration. The 2,069 respondents in the HEPESE live across 415 census tracts in the five southwestern states.

2.1.3 Business Data

Data of businesses within the U.S. was purchased from Infogroup, a business data and marketing company. The data is also publicly available through the Los Angeles Public Library via the ReferenceUSA Business Database, however the database is not set up to access large numbers of data at one time. Purchasing the data from Infogroup was advantageous logistically because it allowed me to use Census Tract identifiers from the 2000 Census and it saved time. Infogroup has a database of 14 million businesses in the U.S. The data is compiled from public sources and confirmed through phone calls. Various information is available in the database, including company name, address and phone number, executive's ethnicity, employee size, sales volume, North American Industry Classification System (NAICS) codes, and census tract. For this study I will use data from businesses with owners who identify as Hispanic or Latino.

As of December 2013 when the ReferenceUSA Business data was initially reviewed, there were a total of 699,568 (4.3%) Latino owned businesses in the U.S. out of 16,215,882. In California there were 172,853 (9.3%) Latino owned businesses, 115,471 (9.9%) in Texas, 20,765 (6.8%) in Arizona, 18,020 (16.7%) in New Mexico, and 13,591 (4.3%) in Colorado. Infogroup provided data on the number of Latino owned businesses for the 415 census tracts that correspond with the Hispanic EPESE. Using the census tract identifiers I linked data from Infogroup to the HEPESE Wave 5. I focus on the number of Latino business owners by census tract, but also include the type of businesses. I identified types of businesses using NAICS codes that are conducive of social networks, such as hair salons, barbershops, and churches, and those that may influence diet, such as food stores and restaurants.

My sample includes a total of 2,069 respondents and 415 census tracts. Among the final merged sample there is an average of 26% of Latino-owned businesses, for California it is 20%, Texas 31%, Arizona, 12%, Colorado 13%, and New Mexico 10%.

2.2 Measures

2.2.1 Dependent Variables

Diabetes variable:

Diabetes is one of two main outcomes of interest in this study. The Wave 5 HEPESE asks respondents to self-report diabetes with the question: "Have you ever been told by a doctor that you have diabetes, sugar in your urine, or high blood sugar?" The possible responses are yes, no, don't know, or refuse. I recoded the variable to a dichotomous yes/no, combining the "no", "don't know" and "refuse" responses as respondents reporting no diabetes. The diabetes variable is collected and used in the analysis at the individual level. About a third of the sample, 690 respondents, report having diabetes.

Depression risk variable:

Depression risk is asked in the Wave 5 HEPESE. The measure originates from the Center for Epidemiological Studies-Depression (CES-D) scale, a 20-item scale with an established cut-off score of 16 or greater indicating depression risk (CES-D, Accessed April 2016).[f] The questions are scored on a 4-item Likert scale asking about sleep, appetite, loneliness, and feelings of sadness, depression, happiness, and hopefulness, among other similar topics. The 20 questions were summed and a dichotomous variable was created with those with a score of 16 or above being at risk for depression. The depression risk variable is collected and used in the

[f] http://www.apa.org/pi/about/publications/caregivers/practice-settings/assessment/tools/depression-scale.aspx

analysis at the individual level. Less than 20% of the sample, 391 respondents, are at risk for depression and 167 have missing data on depression.

2.2.2 Independent Variables

Ethnic Enclave variable:

In this study the enclave variable is a neighborhood level variable that provides the ethnic concentration for the census tract using data from the 2000 Census. The ethnic enclave variable was measured as the ratio of individuals within a census tract who identified ethnically as Latinos of Mexican-origin compared to the total population for the same census tract. In the enclave literature there is no consensus on the precise way to measure an enclave. Some studies have used a continuous variable, including several studies of the HEPESE data, such that the enclave is an increasing percentage of Mexican-origin individuals living in a neighborhood (Eschbach et al., 2004; Gerst et al., 2011; Mair et al., 2010; Patel et al., 2003; Wen & Maloney, 2011). Other studies measure enclaves using specific cut-offs, such as quartiles or halves of the ethnic distribution, or a combination of ethnic concentration, language used in the home, and/or immigrant concentration (Almeida et al., 2009; Aranda et al., 2011; Denton, Shaffer, Alcantara, Clemow, & Brondolo, 2015; Kandula, Wen, Jacobs, & Lauderdale, 2009; Mair et al., 2010; Mason et al., 2011; Nobari et al., 2013; Osypuk et al., 2010; Osypuk et al., 2009). Because there is no agreement on the most effective way to measure an enclave, I examined the data using a categorical version. I measured a Mexican-origin ethnic enclave by using categories that cut the sample into three equal groups based on the neighborhood distribution.

In this study the ethnic enclave categorical variable divided the population into tertiles with cut-off points at 60% and 76%. Thus an ethnic enclave is defined as a census tract with a concentration of Mexican-origin individuals at 77% and above. A neighborhood with a range of

61-76% Mexican-origin concentration is a mid-level ethnic neighborhood and one with 60% or less is a low-level ethnic neighborhood.

Immigrant Enclave variable:

Using the 2000 Census data I created a measure of the concentration of foreign-born individuals in a census tract divided by the total population in the census tract. I created a dichotomous variable with a cut-off at approximately the median. A low immigrant neighborhood was defined as a census tract with 30% or less of foreign-born residents and a high immigrant neighborhood at greater than 30% foreign-born concentration.

Social ties scale:

The social ties scale is the sum of two questions from the HEPESE that ask about the amount of family and friends in the respondents' neighborhood with responses: none, a few, many, or most. This measure attempts to capture the immediate relationships respondents have in their neighborhood. These relationships represent social ties that can provide direct assistance if necessary, as well as companionship and a general sense of community as recognizable faces in the respondent's neighborhood. The social ties scale was recoded so that a value of 2 represents no family or friends in the neighborhood and a value of 6 represents the highest possible value of many or most family and friends in the neighborhood. The social ties variable serves to examine the presence of direct social networks at the individual level within ethnic enclaves and their effects on diabetes and depression.

While ties with family and friends may be different in their intensity or value in providing support, past studies have conceptualized social ties as a combination of connections with family and friends, thus I combined the scores of both variables creating an average score of family and friend ties for each individual (Almeida et al., 2009). While the reliability of the

combined variables may not be high, Cronbach's alpha of 0.43, theoretically the social ties of both family and friends at the individual level may be complementary and provide similar support.

Social cohesion and trust scale:

Sampson and co-authors pioneered the use of the social cohesion and trust scale, among other neighborhood measures, in order to capture the level of collective efficacy in neighborhoods (Sampson et al., 1997). Neighborhoods with high levels of social cohesion are better situated to exhibit social controls, which can minimize neighborhood disorganization, e.g. violence and crime (Sampson et al., 1997). The social cohesion and trust scale is a sum of five questions. Each question has a 5-point Likert response of: strongly agree, agree, neutral, disagree, and strongly disagree. The questions ask respondents to rate characteristics of their neighborhood, including if it is close-knit, whether people are willing to help each other, if they get along, if they share the same values, and if they trust others in the neighborhood.

The social cohesion and trust scale is collected at the individual level in Wave 5 of the HEPESE and is based on the individual's perception of social cohesion. To create the scale, three of the questions were reverse-coded so that a score of five corresponds to high social cohesion and a score of one corresponds with low social cohesion. The five questions were summed for each respondent, resulting in a maximum score of 25 for the highest level of social cohesion possible.

There are also several missing, refusals, and "don't know" responses, which will impact the sum of the five questions for the individual level variable and have a decreasing effect on the mean score for the neighborhood level variable. Following Sampson et al, "don't know" responses are recoded to a neutral response (Sampson et al., 1997). This leaves 142 respondents

with missing or refusal responses. Almost all of these cases, 132 or 6.4% of the total sample, are missing all five social cohesion questions. For the analysis of social networks I will use listwise deletion and drop all cases that have a non-response (i.e. missing or refusal) to any of the five social cohesion questions, leaving a sample of 1,927 cases. Since most cases with missing data are missing all five questions, imputation would introduce biases. Several studies that use the social cohesion scale, including its creator, have also dropped cases with missing responses (Almeida et al., 2009; Osypuk et al., 2009; Sampson et al., 1997).

The social cohesion and trust scale is used at the individual level since it was collected at that level. While conceptually the scale asks about neighborhood characteristics, creating a level 2 variable may be problematic. I would need to take an average of the social cohesion score per census tract to create a neighborhood level variable, however there are 162 out of 415 census tracts with only one respondent and thus unable to produce a mean score at the neighborhood level. For many respondents I would be using their individual score as opposed to the mean score for the census tract if they are the only respondent in that census tract. While this large number of singletons may be acceptable considering the large number of total census tracts at level 2 (Bell, Morgan, Kromrey, & Ferron, 2010), I will keep the social cohesion scale as an individual level variable.

Latino-Owned Businesses:

The data from Infogroup provided the number of Latino-owned businesses per census tract using the 2000 Census tract identifiers. They were also able to provide the number of Latino-owned businesses and total number of businesses per census tract using the 2010 Census tract identifiers. I used this data to create several variations of the Latino-owned variables, see Appendix B. Since all versions of the variable provided similar results, in the final tables I used

the ratio of Latino-owned business over total business version for ease of discussion, detailed below. One limitation of the business data was that there was no distinction between a zero value and missing. Thus, no data for a census tract could represent no Latino-owned businesses for the tract, no businesses at all for the tract, or missing data.

Ratio of Latino-owned Businesses

Using the business data from Infogroup I created a ratio of Latino-owned businesses by census tract, creating a neighborhood level variable. This variable is constructed from the number of businesses owned by Latinos divided by the total number of businesses within a census tract. In order to create the ratio of Latino-owned businesses I used total business data per census tract based on the 2010 Census tract identifiers, along with the count of Latino-owned businesses based on the 2010 Census tract identifiers. While the business data based on the 2000 Census tract identifiers is most relevant to the HEPESE because of closer collection dates, unfortunately InfoGroup was not able to give me the number of total businesses to create a ratio of Latino-owned businesses that would be based on the 2000 Census tract identifiers. Thus I will use the count of Latino-owned businesses as well as the ratio of Latino-owned businesses to compare if there is a difference since each is based on different census tract identifiers.

Type of Latino-owned Businesses:

Using the 2002 North American Industry Classification System (NAICS) I identified types of businesses that were most relevant to the research questions. The NAICS is used by federal agencies to categorize businesses and are grouped into 20 sectors identified by two-digit codes. These are then defined in more detail with additional digits identifying more specific types of businesses. First I identified 2002 NAICS codes of business types that could affect diabetes risk factors, depression risk, or social networks. I then created variables that captured

each type of businesses in broad categories: *retail food stores* codes 4451=grocery stores and 4452=specialty food stores (i.e. groceries, specialty foods/markets); *food services* codes 722=food services and drinking places (i.e. restaurants, small eateries, non-alcoholic drinking places); *social businesses or services* codes 81=other services, except public administration (hair salons, barber shops, personal care, religious, civic organizations); and *recreational* businesses codes 71=arts, entertainment, and recreation (performing art groups, entertainment, spectator sports, museums, amusement parks).[g] Once the NAICS codes were identified for each category I created a count by census tract. Using the type of businesses allowed me to examine if certain types of businesses with Latino owners are more influential in the prevalence of diabetes or depression.

Covariates:

I controlled for several demographic characteristics at the individual level, including age, education, household income, nativity, and language of interview. I controlled for age because diabetes generally afflicts and is diagnosed at older ages (CDC, 2011). Old age may also be a factor in depression risk, especially when depression risk factors include onset of illness, disability, or bereavement (Roberts et al., 1997). Age is measured as a continuous variable. Neighborhoods with a smaller Mexican-origin ethnic concentration often have a higher socioeconomic status, indicated by higher education and income levels. In order to adjust for potential socioeconomic differences among individuals I controlled for education and household income of respondents. Education is measured as a categorical variable with four categories: no education, six years or less, greater than six years but no high school degree, and high school

[g] For comparison, other NAICS categories not used in this analysis include agriculture, utilities, wholesale trade, finance and insurance, health care and social assistance, public administration, etc. A complete list of the business sectors for 2002 can be found here: http://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2002.

degree or higher. Household income is operationalized as a categorical variable of respondents with household incomes less than $10,000, between $10,000 – 19,000 and $20,000 and above.

I also controlled for nativity, U.S. born or Mexican born. Nativity is an important control because diabetes rates have been found to differ by place of birth (Singh & Miller, 2004) and neighborhoods can vary in the concentration of immigrants, with ethnic enclaves potentially having more foreign-born residents (Logan et al., 2002). Additionally, I controlled for language of interview, English or Spanish, because it may serve as a proxy for level of acculturation with those who speak Spanish being less acculturated and thus retaining more of their dietary behaviors that can impact diabetes (Lara et al., 2005). Ethnic enclaves can also facilitate the retention of language and diet through their networks and environment, thus there may be differences in language preference by the degree of ethnic concentration in the neighborhood. Other controls included living alone, BMI for the diabetes models, and needing assistance with at least one activity of daily living (ADL) and at least one health condition (for the depression models.

Additionally, I included a variable to control for years since moved into home. The variable identifies those who moved within the last three to four years and those that have lived in their homes longer. Approximately 15% of the sample had recently moved within the last three to four years. The amount of time a respondent has lived in their neighborhood could potentially impact their level of social embeddedness within the neighborhood, which could affect social networks. Those with less time in their home may have fewer social networks established in their neighborhood, as well as less familiarity with available services. Therefore, those living in a new neighborhood may experience more isolation and less familiarity with

resources, including social events or services. On the other hand, those that have recently moved may have moved to be closer to family, thus increasing their immediate social ties.

At the neighborhood level I include two important controls. First I controlled for socioeconomic status at the neighborhood level because there can be large differences between enclaves and non-enclaves. Controlling for neighborhood poverty helps to ensure that any association found between ethnic enclaves and diabetes are attributable to the ethnic concentration of the neighborhood and not the economic conditions. Several studies control for neighborhood income or poverty when examining the association between ethnic enclaves and health (Almeida et al., 2009; Eschbach et al., 2004; Osypuk et al., 2009). The neighborhood poverty variable[h] measured concentration of poverty below 20% or at 20% and higher. I also controlled for immigrant concentration at the neighborhood level to further distinguish the ethnic enclave effect from a possible immigrant effect. Ethnic enclaves are often also high immigrant populations by nature; however these can also be very distinct neighborhoods with unique characteristics. Distinguishing between high ethnic and high immigrant neighborhoods allowed me to better understand their differences and their possible varying effects on health.

2.3 Analysis Plan

2.3.1 Data Preparation

I began with the publicly available Hispanic Established Populations for the Epidemiological Studies of the Elderly (HEPESE) Wave 5, with a total sample of 2,069 respondents. The HEPESE includes the census tract number of residence for each respondent. Using the census tract number as the common identifier, I merged data from the 2000 Census with the 2004-2005 Wave 5 HEPESE. Data from the 2000 Census provided demographic data at

[h] Poverty is defined as 100% of the Federal Poverty Level.

the census tract level, or neighborhood level, for each HEPESE respondent. The main neighborhood variable of interest was the ethnic enclave variable, in this case the percentage identifying as Latino of Mexican-origin in a census tract (previously defined in section *2.2.2 Independent Variables)*.

The combined dataset included five states and 415 census tracts. Each state had a varying number of census tracts represented, although most respondents reside in Texas and California (see table 3.2). Arizona has 19 census tracts represented in the data, California has 164, Colorado has 8, New Mexico has 16, and Texas has 208. The number of HEPESE cases in each census tract varies with a range of one through 43. More detailed data by census tract is presented in the following descriptives chapter, Chapter 3.

The number of observations per census tract is important for the multilevel analysis of the data. About half of the census tracts have one or two respondents: 162 census tracts have one respondent and 63 census tracts have two respondents. The low number of cases within a census tract is a limitation to consider when interpreting the analyses (Moineddin, Matheson, & Glazier, 2007). However the data does have a large number of census tracts in the total sample, especially for the states of California and Texas, which has been shown to be suitable for proper random effects estimates even with a large number of singletons (Bell et al., 2010; Snijders, 2005). In testing the effect at level-2, the sample size of level-2 is important (Snijders, 2005), thus in analyzing the effects of enclave neighborhoods in this study the large sample size of census tracts is valuable.

Missing data was especially evident in the social cohesion and social ties questions as well as the depression risk outcome. Decisions about coding the "don't know" and refusal responses is detailed for each variable above in section *2.2.2 Independent Variables.* I examined

the remaining missing data and choose to use listwise deletion to drop cases with missing values for the social cohesion and social ties questions bringing the sample to 1,927 respondents within 394 census tracts for models with the social network measures. Models for depression risk are also limited by the sample size of the depression variable, 1,902 respondents within 392 census tracts.

The business data is provided from InfoGroup for the 415 census tracts in the HEPESE based on census tracts established from the 2000 Census.[i] I combined the business data with the HEPESE and Census data using census tracts as the common identifier. InfoGroup provided data on a total of 13,297 businesses owned by Latinos including the names of the owners, business address, NAICS code, census tract number, employment size, and sales volume. Once the business data was merged to the HEPESE and Census data, the sample of Latino owned businesses per census tract ranged from zero to 505 businesses, with a mean of 31.6 and standard deviation of 35.3.

2.3.2 Analytic Plan

I began the analysis with descriptive statistics, with particular attention to the main predictor variable, the ethnic enclave variable, see Chapter 3. For all variables used in the analysis I examined the frequencies and obtained mean and range or percent when appropriate. The descriptive statistics provided a larger understanding of the dataset and the demographics of the respondents. For the ethnic enclave variable, the concentration of Mexican-origin Latinos in

[i] Using business data based on the 2000 Census tract identifiers I was able to create a count of Latino-owned businesses by census tract. In order to create the ratio of Latino-owned businesses I had to use business data per census tract based on the 2010 Census tract identifiers. While the business data based on the 2000 Census tract identifiers is most relevant to the HEPESE because of closer collection dates, unfortunately InfoGroup was not able to give me the number of total businesses to create a ratio of Latino-owned businesses that would be based on the 2000 Census tract identifiers. In a sensitivity analysis I will compare the effect on the enclave and diabetes/depression relationship by the variations of the business variables.

a census tract, I examined a categorical version. I reviewed scatterplots, histograms, means, ranges, and/or percentages for each version. With the categorical ethnic enclave variable I examined the demographic characteristics of the three neighborhood levels in order to identify differences between the enclave types. I did the same for the immigrant enclave variable. Multivariate and multilevel analyses were used to address the research questions detailed in Aims one and two. STATA version 14 was used for all analyses.

Multilevel analysis was necessary to understand the role of the neighborhood on diabetes and depression rates. Multilevel logistic regression allowed me to determine if differences in the odds of having diabetes were due to the individual characteristics of residents within neighborhoods, a compositional effect, or due to differences between neighborhoods of varying ethnic composition, a contextual effect. A similar analysis was used for the depression risk outcome. Below I detail the analysis and general models used for diabetes, with the same models used for depression risk.

Using the notation by Raudenbush and Bryk (Raudenbush & Bryk, 2002), the general individual level model, also referred to as level 1, was:

$$\eta_{ij} = \beta_{0j} + \beta_{pj} X_{pij}$$

where η is the log odds of success for individual *i* within neighborhood *j,* in this case the odds of having diabetes or depression risk. The β_0 coefficient is the intercept, or the log odds of the outcome when all other predictors equal zero. β_p is the coefficient for predictor X_{ij} at the individual level. This level 1 model corresponded to the "within-neighborhood" effects of individual level predictors on diabetes or depression. The general neighborhood level model, also referred to as level 2, was:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} x_j + u_{0j}, \quad u_{0j} \sim N(0, \tau_{00})$$

$$\beta_{pj} = \gamma_{p0} \quad \text{for } p > 0$$

where β_0 is the intercept at level 1 and β_{pj} is a level 1 coefficient for neighborhood j. γ_{00} and γ_{p0} represent the intercepts, γ_{01} the coefficient for the neighborhood level predictor $x_{j,}$ and u_{0j} is the neighborhood level error. The neighborhood level error is assumed to have a normal distribution with a variance between neighborhoods represented by $\tau_{00.}$ The level 2 model corresponded to the "between-neighborhood" effects of group level predictors on diabetes or depression. The neighborhood level error, μ_{0j}, represented the random effects of the models.

These general multilevel logistic regression equations were the starting points for the models used in Aims one and two for diabetes and depression. For all multilevel models I used a random intercept and one random coefficient, in most cases for the ethnic enclave variable. For the depression models I also ran the models with the immigrant neighborhood variable as the random coefficient.[j] Below I detail the analysis plan for Aim 1 focusing on diabetes.

Aim 1: Determine if ethnic enclaves are protective of diabetes for older Mexican-origin adults and examine the underlying social and structural mechanisms.

1.1: Do older Mexican and Mexican-Americans living in ethnic enclaves have lower odds of diabetes?

Initial bivariate analyses between the main predictor variable and the dependent variable provided some preliminary patterns of association. I examined correlations as well as crosstabs and a chi-square test to review emerging associations between diabetes rates by ethnic enclave

[j] I included the immigrant neighborhood variable as a random coefficient for the depression models only as it was a statistically significant predictor of depression. Since the immigrant concentration did not vary for diabetes, I did not include it as a random effect. Also, I only used one random coefficient at a time because the models lacked the sample size to use two neighborhood level random effects at once.

level. A bivariate multilevel model served as the initial model and was then followed by individual and neighborhood level controls.

Model 0 was the empty multilevel logistic regression equation, which examines variation in diabetes status (yes/no) among individuals and between neighborhoods. The equations below include the level 1 and level 2 equations with no predictors or controls:

[Model 0]

$$\eta_{ij\ (\text{diabetes})} = \beta_{0j}$$

$$\beta_{0j} = \gamma_{00} + u_{0j} \qquad u_{0\text{j}} \sim \text{N}(0, \tau_{00})$$

η_{ij} is the log odds of having diabetes for individual i in neighborhood j, γ_{00} is the average log-odds of diabetes across all neighborhoods, and u_{0j} is the random effect. Using the variance, $\tau_{00,}$ of the random effect I calculated the intraclass correlation coefficient (ICC), which provides the variance in the odds of diabetes attributable to neighborhood differences. In other words, the ICC indicates what proportion of diabetes differences is due to the neighborhood effect.

Next I tested the main focal relationship between the ethnic enclave variable and diabetes. In Model 1 the ethnic enclave predictor variable was measured at the neighborhood level and the outcome variable, diabetes, at the individual level. The level 1 and 2 equations are:

[Model 1]

$$\eta_{ij\ (\text{diabetes})} = \beta_{0j}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} x_{j\ (\text{Mexican-origin concentration})} + u_{0j}$$

Here η_{ij} is the odds of having diabetes for individual i in neighborhood j. γ_{00} is the average odds of diabetes across all neighborhoods, γ_{01} is the coefficient of the ethnic enclave predictor, x_j, at the neighborhood level. u_{0j} is the neighborhood specific effect.

Next I added the neighborhood level controls to Model 1, which already included the neighborhood ethnic enclave variable. Thus Model 2 includes all of the neighborhood level variables, neighborhood Mexican-origin concentration, neighborhood immigrant concentration, and neighborhood poverty.

[Model 2]

$$\eta_{ij\ \text{(diabetes)}} = \beta_{0j}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} x_{j\ \text{(Mexican-origin concentration)}} + \gamma_{02} x_{j\ \text{(neighborhood covariates)}} + u_{0j}$$

In Model 3 I controlled for specific covariates at the individual level and compared the odds of diabetes by ethnic enclave level.

[Model 3]

$$\eta_{ij\ \text{(diabetes)}} = \beta_{0j} + \Sigma\, \beta_{p} x_{pij\ \text{(individual covariates)}}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} x_{j\ \text{(Mexican-origin concentration)}} + u_{0j}$$

$$\beta_{p} = \gamma_{10} + \gamma_{p1} x_{pij\ \text{(individual covariates)}}$$

Model 3 added individual level covariates to Model 1. x_{pij} represents the covariates for individual *i* in neighborhood *j*, which included age, gender, education, income, nativity, language of interview, BMI, and living alone.

The final full model, Model 4, provided the effect of ethnic neighborhood composition on diabetes, controlling for individual and neighborhood characteristics.

[Model 4]

$$\eta_{ij\ \text{(diabetes)}} = \beta_{0j} + \Sigma\, \beta_{p} x_{pij\ \text{(individual covariates)}}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} x_{j\ \text{(Mexican-origin concentration)}} + \gamma_{02} x_{j\ \text{(neighborhood covariates)}} + u_{0j}$$

$$\beta_{p} = \gamma_{10} + \gamma_{p1} x_{pij\ \text{(individual covariates)}}$$

The next research question in Aim 1 examined the role of social networks in the ethnic enclave and diabetes relationship.

1.2: How are social ties and social cohesion associated with ethnic enclaves and diabetes?

For research question 1.2, I first examined the role of social ties at the individual level, followed by the effect of social cohesion at the individual level. For each social network variable I first examined its association with the ethnic enclave variable, expecting to find that increasing ethnic concentration results in higher social ties and/or social cohesion. I then returned to the full model from research question 1.1 and examined the effect of social ties and social cohesion separately on the main relationship between the ethnic enclave variable and diabetes. Lastly I included a model with both social ties and social cohesion, examining their combined effect.

The first model examined the association between ethnic enclave concentration and social ties. This model shows us whether living in an ethnic enclave results in higher social ties for the neighborhoods.

[Model 1]

$$Y_{ij\ \text{(social ties)}} = \beta_{0j} + r_{ij}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} x_{j\ \text{(Mexican-origin concentration)}} + u_{0j}$$

β_{0j} is the level of social ties across all neighborhoods, γ_{00} is the average social cohesion across all neighborhoods, γ_{01} is the coefficient of the ethnic enclave predictor, x_j, at the neighborhood level, and μ_{0j} is the neighborhood specific effect.

Next I examined the possible mediating effect of social ties on the main focal relationship between ethnic enclave level and diabetes. I began with the main focal relationship and controlled for individual and neighborhood level characteristics, calling this Model 1 (same as

Model 4 from research question 1.1). This model served as the starting point for comparison to the following models that included the social network variables. Subsequently I included social ties in Model 2 at level 1 and compared the coefficient of the ethnic enclave variable between the models with and without social ties.

[Model 1]

$$\eta_{ij\ \text{(diabetes)}} = \beta_{0j} + \Sigma\ \beta_{p} x_{pij\ \text{(individual covariates)}}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} x_{j\ \text{(Mexican-origin concentration)}} + \gamma_{02} x_{j\ \text{(neighborhood covariates)}} + u_{0j}$$

$$\beta_{p} = \gamma_{10} + \gamma_{p1} x_{pij\ \text{(individual covariates)}}$$

[Model 2]

$$\eta_{ij\ \text{(diabetes)}} = \beta_{0j} + \beta_{1j} x_{ij\ \text{(social ties)}} + \Sigma\ \beta_{p} x_{pij\ \text{(individual covariates)}}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} x_{j\ \text{(Mexican-origin concentration)}} + \gamma_{0q} x_{j\ \text{(neighborhood covariates)}} + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{02} x_{ij\ \text{(social ties)}}$$

$$\beta_{p} = \gamma_{20} + \gamma_{p1} x_{pij\ \text{(individual covariates)}}$$

If mediation were present, the coefficient of the ethnic enclave variable would decrease, indicating that social ties explained some of the variation in diabetes.

The same process was followed as above but replacing neighborhood level social ties with social cohesion at level 1. The first model examined the association between ethnic concentration of the neighborhood and social ties at the individual level. The next model added the social cohesion variable to the full ethnic enclave and diabetes model in order to examine the effect social cohesion may have had on the main relationship.

[Model 2a]

$$\eta_{ij\ \text{(diabetes)}} = \beta_{0j} + \beta_{1j} x_{ij\ \text{(social cohesion)}} + \Sigma\ \beta_{p} x_{pij\ \text{(individual covariates)}}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}x_j \text{ (Mexican-origin concentration)} + \gamma_{0q}x_j \text{ (neighborhood covariates)} + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{02}x_{ij} \text{ (social cohesion)}$$

$$\beta_p = \gamma_{20} + \gamma_{p1}x_{pij} \text{ (individual covariates)}$$

If mediation were present, the coefficient of the ethnic enclave variable would decrease, indicating that social cohesion explained some of the variation in diabetes. Finally I added both social ties and social cohesion to the full model to determine the effect of social networks on the enclave and diabetes relationship.

[Model 3]

$$\eta_{ij} \text{ (diabetes)} = \beta_{0j} + \beta_{1j}x_{ij} \text{ (social ties)} + \beta_{2j}x_{ij} \text{ (social cohesion)} + \Sigma\, \beta_p x_{pij} \text{ (individual covariates)}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}x_j \text{ (Mexican-origin concentration)} + \gamma_{0q}x_j \text{ (neighborhood covariates)} + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{02}x_{ij} \text{ (social ties)}$$

$$\beta_{2j} = \gamma_{10} + \gamma_{02}x_{ij} \text{ (social cohesion)}$$

$$\beta_p = \gamma_{20} + \gamma_{p1}x_{pij} \text{ (individual covariates)}$$

The third research question in Aim 1 examines the role of ethnic-owned businesses.

1.3: Does the number of Latino-owned businesses in the community influence the relationship between ethnic enclaves and diabetes prevalence?

I began by exploring the relationship between the number of Latino-owned businesses and the ethnic enclave variable through a one-way ANOVA for the ethnic enclave variable. This allowed me to examine the patterns of Latino business ownership by degree of Mexican-origin concentration. In addition to the count of Latino-owned businesses, I also used an alternate version for the ratio of Latino-owned businesses, which as mentioned above was based on the

2010 census tract identifiers, which may vary from the 2000 census tract identifiers. Thus I ran all models with the count of Latino businesses and the ratio of Latino-owned businesses.

After looking at the crosstabs of Latino businesses by the ethnic enclave measure, I then examined the bivariate multilevel model with the ethnic enclave variable as the predictor and Latino owned businesses as the outcome. This model assessed if a higher ethnic concentration resulted in a higher number of Latino owned businesses for the neighborhoods.

[Model 1]

$$Y_{ij\ \text{(Latino owned businesses)}} = \beta_{0j} + r_{ij}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} x_{j\ \text{(Mexican-origin concentration)}} + u_{0j}$$

β_{0j} is mean Latino owned businesses across all neighborhoods, γ_{00} is the average Latino owned businesses across all neighborhoods, γ_{01} is the coefficient of the ethnic enclave predictor, x_j, at the neighborhood level, and μ_{0j} is the neighborhood specific effect.

After considering the association between ethnic enclaves and Latino owned businesses, I tested for a potential mediating and moderating effect of Latino owned business on the focal relationship. I again began with the full model controlling for individual and neighborhood level controls. I added the ratio of Latino-owned businesses as well as the total number of businesses to the full model.

[Model 2]

$$\eta_{ij\ \text{(diabetes)}} = \beta_{0j} + \Sigma\, \beta_p x_{pij\ \text{(individual covariates)}}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} x_{j\ \text{(Mexican-origin concentration)}} + \gamma_{02} x_{j\ \text{(Total businesses)}} + \gamma_{03} x_{j\ \text{(Ratio Latino-owned businesses)}} + \gamma_{0q} x_{j\ \text{(neighborhood covariates)}} + u_{0j}$$

$$\beta_p = \gamma_{20} + \gamma_{p1} x_{pij\ \text{(individual covariates)}}$$

In order to test whether certain types of businesses were more important to diabetes than others, I also included type of Latino-owned businesses in the analysis. Using similar models as above, I included the four different types of Latino-owned businesses in the full model to test for mediation, Model 3 (not shown). Model 4 includes an interaction variable between the ethnic enclave and the Latino-owned businesses variable.

[Model 4]

$$\eta_{ij\ \text{(diabetes)}} = \beta_{0j} + \Sigma\ \beta_{p} x_{pij\ \text{(individual covariates)}}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} x_{j\ \text{(Mexican-origin concentration)}} + \gamma_{02} x_{j\ \text{(Ratio Latino-owned businesses)}} +$$

$$\gamma_{03} x_{j\ \text{(Mexican-origin concentration x Ratio Latino-owned businesses)}} + \gamma_{0q} x_{j\ \text{(covariates)}} + u_{0j}$$

$$\beta_{p} = \gamma_{10} + \gamma_{p1} x_{pij\ \text{(individual covariates)}}$$

If the interaction variable were significant I would stratify by neighborhoods with a low and high number of Latino-owned businesses comparing the effect on the focal relationship. The models testing the number of Latino-owned businesses and the type of businesses will provide a better understanding of how the structural environment can impact the diabetes and depression rates of neighborhoods with varying ethnic concentrations.

The next aim focused on depression risk, allowing me to examine how living in an ethnic enclave might impact a psychosocial health outcome. While not much research has focused on diabetes, several studies have looked at depression, although few have studied the underlying pathways.

Aim 2: Determine if ethnic enclaves are protective of depression risk for older Mexican-origin adults and examine the underlying social and structural mechanisms.

Here I followed a similar analysis plan as discussed above for Aim 1. The research questions were also the same as with Aim 1. However since the immigrant enclave was a significant

predictor for the depression models, I ran parallel analyses for all models: first using the ethnic enclave as a random effect as with the diabetes models and secondly, using the immigrant enclave as a random effect in a sensitivity analyses. This allowed me to examine if variation between the immigrant enclaves was relevant to depression risk separately from the individual characteristics. Another important difference in the analyses for depression was the individual level controls used in the models. I will review the research questions and analysis plan for depression risk highlighting the differences from the diabetes models. Otherwise the analyses plan and models match the diabetes analyses.

2.1: Do older Mexican and Mexican-Americans living in ethnic enclaves have lower odds of depression risk?

For the first research question I began by establishing the bivariate relationship between ethnic enclaves and depression risk. I then added the neighborhood level controls only, the individual level controls only, and the final full model with both neighborhood and individual level controls. The neighborhood level controls included neighborhood poverty and neighborhood immigrant concentration. The individual level controls included age, gender, education, income, nativity, language of interview, if had at least one ADL, if had at least one chronic illness, having moved recently, and living alone. Since the immigrant enclave was a significant predictor, I ran a sensitivity analysis using a random effect for the immigrant enclave and ran the models again.

For the second research question I explored social ties and social cohesion as with the diabetes analyses.

2.2: How are social ties and social cohesion associated with ethnic enclaves and depression risk?

I added social ties and social cohesion individually to the full model, and then both together. I also continued the sensitivity analysis with the immigrant enclave as the random effect, which included the regression analyses of immigrant enclaves and social ties and social cohesion. As with the ethnic enclaves, I was able to observe if a high immigrant enclave is associated with social ties or social cohesion. I continued with the mediation and moderation analysis of social ties and social cohesion. Lastly, I analyzed the role of ethnic businesses on the enclave and depression relationship.

2.3: Does the number of Latino-owned businesses in the community influence the relationship between ethnic enclaves and depression risk?

As with the diabetes analysis, for the depression models I began with the full model and added first the ratio of Latino-owned businesses and count of total businesses. In a separate model I included the four types of Latino-owned businesses. I also tested for moderation using an interaction between the enclaves and Latino-owned businesses. The analyses were repeated using the immigrant enclave as the random effect.

CHAPTER 3: Descriptive Characteristics

3.1 Sample Characteristics

This chapter presents a review of the 2004-2005 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE) with descriptive characteristics of the complete sample, as well as by levels of ethnic concentration of neighborhoods and levels of foreign-born concentration of neighborhoods. I also provide information about the number of census tracts in the sample by state, as well as data on the observations per census tract. Lastly I present a correlation matrix of selected variables and begin to examine associations between the health outcomes of interest, diabetes and depression risk, and neighborhood- and individual-level variables.

Table 3.1 presents the unweighted characteristics of the study sample, including the sample size and the percent or mean and standard deviation of selected variables. About a third of the sample self-reports a diabetes diagnosis. This is higher than the overall national crude rate of 19.7% for older adults, but is similar to the national rate of 31.6% among Mexican and Mexican-Americans age 65 and over in the U.S (CDC, 2013a). Additionally, about one in five (18.9%) of the sample scored a 16 or higher on the CES-depression risk scale, with an unweighted mean and standard deviation of 9.7 (9.1). In comparison other studies have found lower rates of psychiatric illness among Latinos. A national study found among older adults age 65 and over 2.2% experienced serious psychological distress and among Latinos it was 4.6% (Schoenborn & Heyman, 2009).[k] Also, a national study observed 8% of older Latinos reported

[k] Based on the National Health Interview Survey of adults. Psychological distress was measured with the K6 instrument, a measure of serious "psychological distress associated with unspecified but potential diagnosable mental illness." This measure is different from the depression risk measure in the Hispanic EPESE.

being depressed in the past year, significantly higher than non-Latino Whites, yet still a lower rate than what was observed in this study (Jimenez et al, 2010). However other studies using the Hispanic EPESE have observed the similar high rates of depression risk and similar mean scores as this current study (Gerst et al., 2011; Ostir et al., 2003). Higher than average depression rates were also observed among Latinos in other studies; a Los Angeles Latino sample with an average age of 36.5 years had a sample rate of 14% of major depression diagnosed by a physician (Vega et al., 2011) and in a multi-city multi-ethnic study Latina women had the highest mean score of depression risk than all other groups (Mair et al., 2010). The high rates of depression in this study's sample may be due to their advanced age or other characteristics.

The neighborhood-level data is 2000 Census data merged with the 2004-2005 HEPESE. Among the HEPESE respondents, about a third live in ethnic enclaves, defined as census tracts with a Mexican-origin concentration greater than 77%. About a third live in low ethnic neighborhoods, census tracts with a Mexican-origin concentration of 60% or less. The respondents largely live in disadvantaged neighborhoods, with 71% of respondents living in high poverty neighborhoods, defined as census tracts with 20% or higher of residents living at 100% of the federal poverty level. Less than half, 46%, live in high immigrant neighborhoods, defined as census tracts with greater than 30% of residents born outside of the U.S. I also obtained business-related data at the census tract level that was merged with the 2004-2005 HEPESE. Overall the ratio of Latino-owned businesses is 0.26 with a standard deviation of 0.18 per census tract.

Examining the individual-level variables from the 2004-2005 HEPESE, I find that the sample has an average age of 82 years and almost two-thirds are female. About 41% of respondents have a household income of less than $10,000 and 70% have a 6th grade education

level or less or no education at all. While all identify as Mexican or Mexican-American, 56% were born in the U.S. and 44% were born in Mexico (data not shown). Among those born in Mexico most have been in the U.S. for many decades, averaging 48 years living in the U.S., but with a range of 1 to 98 years living in the U.S. (data not shown). Most prefer to speak Spanish, 80%, and only 20% chose to interview in English and interestingly 39% of the sample is U.S.-born and preferred to interview in Spanish.

Among the sample health characteristics, half are overweight or obese, an important predictor for diabetes and other health conditions. Almost 30% of the sample lives alone and over a third needs assistance with at least one of the activities of daily living, or ADL. Forty five percent have at least one of four health conditions (diabetes, cancer, heart attack, or stroke). Additionally, approximately 14% of the sample has moved in the last four years, indicating they may still be new to their current neighborhoods and have fewer social networks as a result. For the overall sample the social ties scale average is 3.5 with a standard deviation of 1.0 and the social cohesion and trust scale average is 18.4 with a standard deviation of 3.0. For comparison, among those that recently moved (within the last four years), the social ties scale and social cohesion scale averages are 3.1 (1.0) and 17.5 (2.7), respectively, slightly lower than the overall sample averages.

The next few tables provide information of the HEPESE sample by state and census tract. Later analyses will use multilevel models, thus it is important to have a sense of the sample at the census tract level. Table 3.2 provides a summary of the number and percent of respondents from each state. Sixty percent of the sample resides in Texas and 30% in California. The remaining 10% of the sample was surveyed in Arizona, Colorado, and New Mexico. There are a total of

415 census tracts in the 2004-2005 HEPESE. Table 3.3 presents the number of census tract from each state. As with the number of respondents, most census tracts are in Texas and California.

With multilevel analyses the sample size at the neighborhood level is important if examining variations between neighborhoods. Also important is the number of respondents per neighborhood level measure. For example, this sample has 415 census tracts with a range of 1-43 respondents per census tract. Table 3.4 provides the mean and range of respondents per census tract for each state. Texas has the largest mean of respondents at 5.9 per census tract and Colorado has a mean of 2.5 respondents per census tract. Table 3.5 presents the distribution of respondents for the 415 census tracts, with 162 census tracts, or 39%, having only one respondent. Fifteen percent of census tracts have two respondents and 46% of census tracts have three or more respondents.

Since the ethnic concentration of the neighborhood is the predictor of interest in this study, Table 3.6 presents unweighted sample characteristics of the three types of neighborhoods by Mexican-origin concentration level. With these descriptives I find that the neighborhoods vary across several characteristics. Those living in ethnic enclaves (high ethnic concentration) have the lowest rates of diabetes and depression risk, while those in neighborhoods with low ethnic concentration have higher diabetes and depression risk rates. About 30% of ethnic enclave residents report having diabetes and 19% report depression risk. The overall chi-square test presents a statistically significant relationship between diabetes and the ethnic concentration of neighborhoods as well as for depression risk and the ethnic concentration of neighborhoods. Analysis in later chapters will further explore these relationships.

Among those living in an ethnic enclave, 81% are also living in a high immigrant neighborhood. As might be expected, high ethnic neighborhoods are generally also high

immigrant neighborhoods. However 19% of respondents are living in high ethnic neighborhoods with low immigrant concentrations. These ethnic enclaves may be neighborhoods with unique characteristics. Taking a closer look at the data I find that these high ethnic and low immigrant neighborhoods are mostly in Texas and a few in California for this sample. By making a list of the census tracts, I find examples of high ethnic and low immigrant neighborhoods include Pima, Arizona and Hidalgo, Texas. By comparison, areas like Ventura, San Diego, and Sacramento, California are included in the census tracts with high immigrant, low ethnic concentrations.

I also find that high ethnic neighborhoods are also high poverty neighborhoods. Ninety-two percent of enclaves are neighborhoods with high neighborhood poverty. The mid-level and low ethnic concentration neighborhoods have decreasing levels of neighborhood poverty and immigrant concentration, however the mid-level ethnic neighborhoods have similar rates of neighborhood poverty as the high ethnic enclaves, with 84% of mid-level neighborhoods reporting high neighborhood poverty concentrations. The ratio of Latino-owned businesses is similar for the high and mid-level ethnic neighborhoods, and lowest for the low ethnic neighborhoods. In other words, low ethnic neighborhoods have lower ratio of Latino-owned businesses compared to the higher ethnic neighborhoods.

At the individual level, ethnic enclaves have higher proportions of respondents with low household incomes and lower education levels compared to the low ethnic concentration neighborhoods. Almost half of high ethnic enclave neighborhoods have household incomes less than $10,000 with slightly lower rates for the mid-level and low-level ethnic neighborhoods. While education levels generally increase with decreasing neighborhood ethnic concentration, the mid-level ethnic neighborhood has the highest rate of individuals with a high school degree or higher. Only 8% of ethnic enclave residents have a high school degree or higher. In this

sample, over half of respondents living in enclaves were born in Mexico, 56%, and 90% responded to the survey in Spanish.

The health characteristics do not vary much by neighborhood. For example, weight status levels are similar among the three levels of ethnic concentration neighborhoods. Enclave residents have the highest percentage of residents that need assistance with at least one ADL, 39%, with the mid-level residents having the lowest rate at 35%, however there is no statistical difference in ADLs by neighborhood ethnic concentration level. Half of the low ethnic neighborhood residents report having at least one of four chronic conditions, compared to 46% of mid-level residents and 40% of enclave residents. This follows the expected trend of enclaves being protective of health and having the lowest rates of health conditions compared to the neighborhoods with lower ethnic concentrations.

A slightly higher proportion of low ethnic neighborhood residents live alone, 30%, compared to 27% for the mid-level and high enclave neighborhoods. Among respondents in low ethnic neighborhoods, 30% have recently moved, with decreasing rates of having moved with increasing ethnic concentration. In examining the social network measures, no clear pattern is found. The mid-level ethnic concentration neighborhood has the highest mean of the social ties score and the social cohesion and trust score. Respondents living in an ethnic enclave have the lowest social ties score and mid-value for the social cohesion and trust score.

Since a significant percentage of the sample lives in high immigrant neighborhoods, Table 3.7 presents the characteristics of the sample by neighborhood foreign-born concentration. A low immigrant neighborhood is defined as a census tract with 30% or less of foreign-born residents and a high immigrant neighborhood is greater than a 30% foreign-born concentration. There is no statistically significant difference in diabetes between high and low immigrant

neighborhoods, but there is for depression risk. Among respondents living in a high immigrant neighborhood, 23% have depression risk, compared to 18% of depression risk among those living in a low immigrant neighborhood.

Among the neighborhood-level variables, higher proportions of residents in high immigrant neighborhoods also live in high ethnic and high poverty neighborhoods. They also have higher proportions of Latino-owned businesses compared to the low immigrant neighborhoods. Taking a closer look at the data I explore the 18% of neighborhoods with high immigrant and low ethnic concentrations. These census tracts are mostly in California with a few in New Mexico and Texas. By making a list of the census tracts, I find examples of high immigrant and low ethnic neighborhoods include Ventura, San Diego, and Sacramento California.

Among the individual-level characteristics, both high and low immigrant neighborhoods have similar average age and gender proportions of residents. High immigrant neighborhoods have lower income and education rates. However even the low immigrant neighborhoods have households with low incomes, 38% with household incomes less than $10,000. Similarly, education levels are higher for those living in low immigrant neighborhoods, but rates are still low with 8% of those living in a high immigrant neighborhood having a high school degree or higher, compared to 14% living in a low immigrant neighborhood. Not surprisingly, neighborhoods with high immigrant concentrations also have a higher percentage of Spanish speakers, 86%, and Mexican born residents, 59%, compared to low immigrant neighborhoods.

Next I examine the health characteristics by neighborhood immigrant concentration. More than half of respondents living in high immigrant neighborhoods are overweight or obese, 55%, slightly higher than the 51% in low immigrant neighborhoods. Among those living in low

immigrant neighborhoods, 40% need assistance with at least one ADL and 47% report having at least one health condition (diabetes, heart attack, cancer, or stroke). Similar to the protective ethnic enclaves, immigrant enclaves may also be protective of health as well, although this is not true of every health measure as observed with higher overweight and obesity rates among those living in high immigrant enclaves.

There is no statistical difference in rates of living alone by neighborhood immigrant concentration. Results indicate that there is a statistical difference by immigrant neighborhood and having recently moved. Among those living in a low immigrant neighborhood, 16% recently moved, compared to 13% among those in a high immigrant neighborhood. Additionally, respondents in low immigrant neighborhoods have higher average social ties scores and social cohesion scores. These values are surprising because if immigrant neighborhoods overlap with ethnic enclaves, I would expect immigrant neighborhoods to have high levels of social ties and social cohesion. I would also expect higher social ties and social cohesion scores in high immigrant neighborhoods under the assumption that social networks are one method in which residents come to live in the immigrant enclave, and sharing an immigrant experience would be conducive of social ties and social cohesion.

In order to examine associations between the variables used in the analyses, I present the correlation matrices for the neighborhood- and individual-level covariates, Table 3.8. I find that neighborhood Mexican-origin concentration is correlated with the other neighborhood-level characteristics, indicating the presence of multicollinearity between Mexican-origin concentration, neighborhood poverty, and neighborhood immigrant concentration. This is not surprising since I would expect most ethnic enclaves to also be neighborhoods with high poverty and high immigrant concentration. Also, there is some multicollinearity between the social ties

measure and the social cohesion and trust scale. While I use both together in the models, I also examine each on its own, often with minimal differences.

I also present the correlations for diabetes and depression risk by the neighborhood- and individual-level covariates, Table 3.9. For most I include the Pearson's Chi-square for comparisons of categorical variables, and where noted I include Spearman's correlation for comparisons between categorical and continuous variables. As we see in these bivariate relationships, diabetes is correlated with only one neighborhood-level characteristic, the neighborhood ethnic concentration measure. This differs from depression risk, which is correlated with all three neighborhood characteristics. Depression risk and diabetes also differ in their associations with the social network measures. Diabetes is associated with the social cohesion and trust measure, but depression is correlated with both the social ties and social cohesion and trust measures. With these bivariate relationships I begin to observe differences between the two health outcomes in regards to what neighborhood- and individual-level variables may be important.

3.2 Tables

Table 3.1. Selected neighborhood- and individual-level characteristics of study participants.

	Unweighted		Weighted
Variable	**N**	**Percent or Mean (SD)**	**Percent or Mean (range)**
Health Outcomes			
Diabetes	2,069		
No	1,379	66.7%	65.7%
Yes	690	33.4%	34.3%
Depression risk	1,902		
No	1,511	73.0%	76.8%
Yes	391	18.9%	23.2%
Neighborhood-level Variables [a]			
Mexican-origin Concentration of census tract	2,069		
Low (≤ 60%)	691	33.4%	52.4%
Mid (61-77%)	679	32.8%	24.5%
Enclave (> 77%)	699	33.8%	23.1%
Poverty Concentration of census tract[b]	2,069		
Low (< 20%)	587	28.4%	46.0%
High (≥ 20%)	1,482	71.6%	54.0%
Foreign-born Concentration of census tract	2,069		
Low (≤ 30%)	1,123	54.3%	56.1%
High (> 30%)	946	45.7%	43.9%
Ratio of Latino-owned businesses per census tract[c]	2,069	0.26 (0.18)	0.21 (0.004)
Individual-level Variables[d]			
Age (years, range 74-109)	2,069	81.9 (5.15)	81.6%
Gender	2,069		
Male	796	38.5%	39.9%
Female	1,273	61.5%	60.1%
Household Income	2,069		
< $10,000	845	40.8%	36.4%
Between $10,000 - 19,999	710	34.3%	33.6%
≥ $20,000	232	11.2%	15.6%
No response/missing	282	13.6%	14.4%
Education	2,069		
HS grad or higher	231	11.2%	15.8%
7th-11th grade	370	17.9%	19.3%
4th-6th grade	578	27.9%	27.2%
≤ 3rd grade	515	24.9%	20.4%
None	375	18.1%	17.3%

Language and Nativity	2,069		
Spanish, Mexican-born	845	40.8%	40.7%
Spanish, US-born	816	39.4%	35.9%
English, Mexican-born	66	3.2%	3.1%
English, US-born	342	16.5%	20.3%
Weight status (by Body Mass Index, BMI)	2,069		
Normal/underweight (BMI < 25 kg/m^2)	542	26.2%	26.1%
Overweight (BMI 25-29.9 kg/m^2)	640	30.9%	32.1%
Obese (BMI ≥ 30 kg/m^2)	461	22.3%	22.8%
No response/missing	426	20.6%	19.0%
Activities of Daily Living (ADL)	2,068		
None	1,307	63.2%	66.7%
One or more ADLs	761	36.8%	33.3%
Health conditions	2,069		
None	1,133	54.8%	53.4%
One or more health conditions (diabetes, heart attack, cancer, stroke)	936	45.2%	46.7%
Living alone	2,069		
No	1,492	72.1%	73.2%
Yes	577	27.9%	26.8%
Recently moved (within last 4 years)	1,965		
No	1,672	80.8%	84.2%
Yes	293	14.2%	15.8%
Social ties scale (range 2-6)[e]	1,926	3.5 (1.0)	3.5 (0.03)
Social cohesion and trust scale (range 0-25)[f]	1,927	18.4 (3.0)	18.2 (0.1)

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

[a] Neighborhood variable data from the 2000 Census. (415 census tracts corresponding with the 2004-2005 HEPESE sample).

[b] Poverty is defined as 100% of Federal Poverty Level (FPL) based on the 2000 value of $8794 for 1 person. Thus a high poverty neighborhood is defined as a census tract with 20% or greater living below the FPL.

[c] Ratio of Latino-owned businesses per census tract defined as number of Latino-owned businesses over total businesses per census tract. Data from Infogroup using 2010 Census tract identifications.

[d] Individual variable data from 2004-2005 HEPESE.

[e] Social ties scale is a combination of 2 items, scored 1-3 each (scale scored from 2-6, high=more social ties): How many of your relatives/family members live in your neighborhood? How many friends live in your neighborhood?

[f] Social cohesion and trust scale is a combination of 5 items, scored 1-5 each (scale scored from 5-25, high=more social cohesion). Based on Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. Science, 277(5328), 918-924.

Table 3.2. Number of respondents per state

Variable	N	Percent
Arizona	95	4.6%
California	624	30.2%
Colorado	20	1.0%
New Mexico	89	4.3%
Texas	1,241	60.0%
Total	2,069	100%

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Table 3.3. Number of unique census tracts per state.

Variable	N	Percent
Arizona	19	4.6%
California	164	39.5%
Colorado	8	1.9%
New Mexico	16	3.9%
Texas	208	50.1%
Total	415	100%

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Table 3.4. Mean observations per unique census tracts in each state

Variable	Mean (Range)
Arizona	5.0 (1-22)
California	3.8 (1-32)
Colorado	2.5 (1-4)
New Mexico	5.6 (1-17)
Texas	5.9 (1-43)

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Table 3.5. Distribution of respondents per census tract.

Number of respondents	N (census tracts)	Percent
Census tracts with 1 respondent	162	39.0%
Census tracts with 2 respondents	63	15.2%
Census tracts with 3 respondents	36	8.7%
Census tracts with 4 respondents	23	5.5%
Census tracts with 5+ respondents	131	31.6%
Total	415	100.0%

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Table 3.6. Neighborhood- and individual-level characteristics of HEPESE 2004-2005 by concentration of Mexican-origin neighborhoods. Unweighted.

Variables	N	Total % or mean (SD)	Mexican-origin concentration of census tract			P-value[a]
			Low ≤ 60%	Medium 61-76%	High (Enclave) > 77%	
		(n=2,069)	(n=691)	(n=679)	(n=699)	
Health Outcomes						
Diabetes						0.011
No	1,379	66.7%	62.7%	67.0%	70.2%	
Yes	690	33.4%	37.3%	33.0%	29.8%	
Depression risk						0.033
No	1,511	79.4%	76.1%	81.1%	81.3%	
Yes	391	20.6%	23.9%	18.9%	18.7%	
Neighborhood-level Variables[b]						
Poverty Concentration of census tract[c]						< 0.001
Low (< 20%)	587	28.4%	61.4%	16.2%	7.6%	
High (≥ 20%)	1,482	71.6%	38.6%	83.8%	92.4%	
Foreign-born Concentration of census tract						< 0.001
Low (≤ 30%)	1,123	54.3%	75.0%	70.0%	18.6%	
High (> 30%)	946	45.7%	25.0%	30.0%	81.4%	
Ratio of Latino-owned businesses per census tract[d]	2,069		0.2 (0.1)	0.3 (0.2)	0.3 (0.2)	< 0.001
Individual-level Variables[e]						
Age (years, range 74-109)	2,069	81.9 (5.2)	82.0 (5.1)	81.5 (4.9)	82.3 (5.4)	0.008
Gender						0.680
Male	796	38.5%	39.8%	37.9%	37.8%	
Female	1273	61.5%	60.2%	62.2%	62.2%	
Household Income						< 0.001
< $10,000	845	40.8%	35.0%	38.4%	48.9%	
Between $10,000 - 19,999	710	34.3%	35.5%	34.0%	33.5%	
≥ $20,000	232	11.2%	14.6%	10.3%	8.7%	
No response/missing	282	13.6%	14.9%	17.2%	8.9%	
Education						< 0.001
HS grad or higher	231	11.2%	12.5%	13.6%	7.6%	
7th-11th grade	370	17.9%	22.1%	17.7%	13.9%	
4th-6th grade	578	27.9%	24.6%	28.1%	31.0%	
≤ 3rd grade	515	24.9%	20.4%	23.3%	30.9%	

None	375	18.1%	20.4%	17.4%	16.6%	
Language and Nativity						< 0.001
Spanish, Mexican-born	845	40.8%	35.6%	34.8%	51.9%	
Spanish, US-born	816	39.4%	35.0%	45.7%	37.8%	
English, Mexican-born	66	3.2%	2.5%	3.5%	3.6%	
English, US-born	342	16.5%	26.9%	16.1%	6.7%	
Weight status (by Body Mass Index, BMI)						0.284
Normal/underweight (BMI < 25 kg/m^2)	542	26.2%	26.2%	25.3%	27.0%	
Overweight (BMI 25-29.9 kg/m^2)	640	30.9%	30.5%	30.9%	31.3%	
Obese (BMI ≥ 30 kg/m^2)	461	22.3%	20.0%	23.4%	23.5%	
No response/missing	426	20.6%	23.3%	20.3%	18.2%	
Activities of Daily Living (ADL)						0.335
None (reference)	1,307	63.2%	63.8%	64.8%	61.1%	
One or more ADLs	761	36.8%	36.2%	35.2%	38.9%	
Health conditions						0.001
None	1,133	54.8%	49.8%	54.3%	60.1%	
One or more health conditions (diabetes, heart attack, cancer, stroke)	936	45.2%	50.2%	45.7%	39.9%	
Living alone						0.358
No	1,492	72.1%	70.2%	72.6%	73.5%	
Yes	577	27.9%	29.8%	27.4%	26.5%	
Recently moved (within last 4 years)						< 0.001
No	1,672	85.1%	78.7%	85.2%	91.2%	
Yes	293	14.9%	21.3%	14.8%	8.8%	
Social ties scale (range 2-6)[f]	1,926	3.5 (1.0)	3.5 (1.0)	3.6 (1.1)	3.4 (0.9)	0.014
Social cohesion and trust scale (range 0-25)[g]	1,927	18.4 (3.0)	18.1 (3.0)	18.7 (3.2)	18.4 (2.9)	0.003

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

[a] P-values are presented for Chi-square or ANOVA statistics.

[b] Neighborhood variable data from 2000 Census. (415 census tracts corresponding with the 2004-2005 HEPESE sample).

[c] Poverty is defined as 100% of Federal Poverty Level (FPL) based on the 2000 value of $8794 for 1 person. Thus a high poverty neighborhood is defined as a census tract with 20% or greater living below the FPL.

[d] Ratio of Latino-owned businesses per census tract defined as number of Latino-owned businesses over total businesses per census tract. Data from Infogroup using 2010 Census tract identifications.

[e] Individual variable data from 2004-2005 HEPESE.

[f] Social ties scale is a combination of 2 items, scored 1-3 each (scale scored from 2-6, high=more social ties): How many of your relatives/family members live in your neighborhood? How many friends live in your neighborhood?

[g] Social cohesion and trust scale is a combination of 5 items, scored 1-5 each (scale scored from 5-25, high=more social cohesion). Based on Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. Science, 277(5328), 918-924.

Table 3.7. Neighborhood- and individual-level characteristics of HEPESE 2004-2005 by concentration of foreign-born neighborhoods. Unweighted.

Variables	N	Total % or mean (SD)	Foreign-born concentration of census tract		P-value[a]
			Low	High	
			≤ 30%	> 30%	
		(n=2,069)	(n=1,123)	(n=946)	
Health Outcomes					
Diabetes					0.675
No	1,379	66.65%	66.25%	67.12%	
Yes	690	33.35%	33.75%	32.88%	
Depression risk					0.022
No	1,511	79.44%	81.42%	77.18%	
Yes	391	20.56%	18.58%	22.82%	
Neighborhood-level Variables [b]					
Mexican-origin Concentration of census tract					< 0.001
Low (≤ 60%)	691	33.40%	46.13%	18.29%	
Mid (61-77%)	679	32.82%	42.30%	21.56%	
Enclave (> 77%)	699	33.78%	11.58%	60.15%	
Poverty Concentration of census tract[c]					< 0.001
Low (< 20%)	587	28.37%	31.79%	24.31%	
High (≥ 20%)	1,482	71.63%	68.21%	75.69%	
Ratio of Latino-owned businesses per census tract[d]	2,069	0.3 (0.2)	0.2 (0.2)	0.3 (0.2)	< 0.001
Individual-level Variables[e]					
Age (years, range 74-109)	2,069	81.9 (5.2)	81.9 (4.9)	82.0 (5.4)	0.887
Gender					0.367
Male	796	38.5%	39.36%	37.42%	
Female	1,273	61.5%	60.64	62.58	
Household Income					0.052
< $10,000	845	40.8%	38.2%	44.0%	
Between $10,000 - 19,999	710	34.3%	36.4%	31.8%	
≥ $20,000	232	11.2%	11.3%	11.1%	
No response/missing	282	13.6%	14.1%	13.1%	
Education					< 0.001

HS grad or higher	231	11.2%	13.6%	8.3%	
7th-11th grade	370	17.9%	19.1%	16.5%	
4th-6th grade	578	27.9%	26.0%	30.2%	
≤ 3rd grade	515	24.9%	22.4%	27.9%	
None	375	18.1%	18.9%	17.2%	
Language and Nativity					< 0.001
Spanish, Mexican-born	845	40.8%	27.9%	56.2%	
Spanish, US-born	816	39.4%	47.5%	29.9%	
English, Mexican-born	66	3.2%	3.4%	3.0%	
English, US-born	342	16.5%	21.3%	10.9%	
Weight status (by Body Mass Index, BMI)					0.002
Normal/underweight (BMI < 25 kg/m^2)	542	26.2%	24.7%	28.0%	
Overweight (BMI 25-29.9 kg/m^2)	640	30.9%	30.1%	31.9%	
Obese (BMI ≥ 30 kg/m^2)	461	22.3%	21.6%	23.2%	
No response/missing	426	20.6%	23.69%	16.90%	
Activities of Daily Living (ADL)					0.002
None (reference)	1,307	63.2%	60.3%	66.7%	
One or more ADLs	761	36.8%	39.8%	33.3%	
Health conditions					0.157
None	1,133	54.8%	53.3%	56.5%	
One or more health conditions (diabetes, heart attack, cancer, stroke)	936	45.2%	46.7%	43.6%	
Living alone					0.502
No	1,492	72.1%	71.5%	72.8%	
Yes	577	27.9%	28.5%	27.2%	
Recently moved (within last 4 years)					0.037
No	1,672	85.1%	83.6%	86.9%	
Yes	293	14.9%	16.43%	13.06%	
Social ties scale (range 2-6)[f]	1,926	3.5 (1.0)	3.6 (1.0)	3.4 (0.9)	< 0.001
Social cohesion and trust scale (range 0-25)[g]	1,927	18.4 (3.0)	18.7 (3.1)	18.0 (3.0)	< 0.001

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

[a] P-values are presented for Chi-square or ANOVA statistics.

[b] Neighborhood variable data from 2000 Census. (415 census tracts corresponding with the 2004-2005 HEPESE sample).

[c] Poverty is defined as 100% of Federal Poverty Level (FPL) based on the 2000 value of $8794 for 1 person. Thus a high poverty neighborhood is defined as a census tract with 20% or greater living below the FPL.

[d] Ratio of Latino-owned businesses per census tract defined as number of Latino-owned businesses over total businesses per census tract. Data from Infogroup using 2010 Census tract identifications.

[e] Individual variable data from 2004-2005 HEPESE.

[f] Social ties scale is a combination of 2 items, scored 1-3 each (scale scored from 2-6, high=more social ties): How many of your relatives/family members live in your neighborhood? How many friends live in your neighborhood?

[g] Social cohesion and trust scale is a combination of 5 items, scored 1-5 each (scale scored from 5-25, high=more social cohesion). Based on Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. Science, 277(5328), 918-924.

Table 3.8. Correlations between neighborhood- and individual-level covariates.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Neighborhood Mexican-origin concentration	1.00															
2 Neighborhood poverty	**0.49**	1.00														
3 Neighborhood immigrant concentration	**0.46**	**0.08**	1.00													
4 Ratio Latino-owned businesses	**0.35**	**0.37**	**0.14**	1.00												
5 Age	0.02	0.00	0.00	0.03	1.00											
6 Gender	0.02	0.03	0.02	0.02	0.03	1.00										
7 Household Income	**-0.13**	**-0.16**	-0.04	**-0.11**	**0.05**	**-0.07**	1.00									
8 Education	**0.07**	**0.06**	**0.06**	0.01	**0.14**	-0.02	**-0.13**	1.00								
9 Language/nativity	**-0.22**	**-0.07**	**-0.24**	**-0.08**	**-0.07**	0.03	**0.07**	**-0.32**	1.00							
10 Weight status	-0.03	-0.01	**-0.07**	-0.04	**0.07**	**0.07**	**0.09**	**0.06**	**0.00**	1.00						
11 One or more ADLs	0.02	**0.05**	**-0.07**	-0.01	**0.26**	**0.12**	0.02	**0.11**	**-0.05**	**0.40**	1.00					
12 One or more health conditions[a]	**-0.08**	**-0.05**	-0.03	-0.04	**-0.09**	0.00	-0.02	-0.01	0.02	**0.14**	**0.11**	1.00				
13 Living alone	-0.03	**0.07**	-0.01	**0.09**	**0.07**	**0.18**	**-0.26**	0.00	0.03	**-0.05**	-0.02	**-0.07**	1.00			
14 Moved recently	**-0.13**	**-0.13**	**-0.05**	**-0.07**	0.03	0.02	0.04	**0.07**	-0.03	**0.08**	**0.08**	0.02	0.01	1.00		
15 Social ties scale	0.02	0.02	**-0.12**	-0.03	0.04	-0.01	**0.06**	-0.03	**0.08**	-0.01	0.02	0.04	-0.02	**-0.17**	1.00	
16 Social cohesion and trusts scale	0.04	0.04	**-0.10**	**0.06**	-0.01	-0.01	0.02	-0.02	-0.02	0.01	0.02	0.04	0.00	**-0.12**	**0.34**	1.00

Bold p < 0.05

[a] Having one or more of the following health conditions: diabetes, heart attack, cancer, and/or stroke.

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005. 2000 Census data.

Table 3.9. Correlations between health outcomes (diabetes and depression risk) and neighborhood- and individual-level covariates.

	Diabetes	Depression risk
Diabetes	0.00	
Depression risk	3.18	0.00
Neighborhood Mexican-origin concentration	**9.04**	**6.81**
Neighborhood poverty	2.48	**9.55**
Neighborhood immigrant concentration	0.18	**5.21**
Ratio Latino-owned businesses [a]	0.00	**-0.05**
Age [a]	**-0.12**	0.03
Gender	2.80	**18.31**
Household Income	6.24	6.04
Education	1.34	**13.62**
Language/nativity	2.00	**21.66**
Weight status	**35.75**	**92.02**
One or more ADLs	**12.18**	**82.02**
One or more health conditions (diabetes, heart attack, cancer, stroke)	0.00	**17.08**
Living alone	3.67	**10.36**
Moved recently	2.29	0.05
Social ties scale [a]	0.07	**-0.07**
Social cohesion and trusts scale [a]	**0.04**	**-0.09**

Bold p < 0.05

All correlations are a Pearson's Chi-square test, unless noted.

[a] Spearman correlation

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005. 2000 Census data.

CHAPTER 4: The enclave effect on diabetes among older Mexican-origin adults – do social networks or Latino-owned businesses explain the association?

This chapter first seeks to establish the relationship between neighborhood Mexican-origin concentration and diabetes. Other studies have established a protective enclave effect for a variety of health outcomes; however few studies have examined diabetes. Next I explore the role of social networks, using social ties and social cohesion measures, as a mechanism to explain the protective effect of the ethnic enclave on diabetes. Finally, using business related data I examine if the business environment can account for the protective health effects of ethnic enclaves. I present the analysis results and discuss the findings for each of the three research questions.

4.1 Diabetes and the enclave effect

4.1.1 Results: What is the effect of enclaves on diabetes?

In order to examine the compositional and contextual impacts of living in an enclave on diabetes rates I use multilevel logistic regression models. I begin the analysis with an empty model with the diabetes outcome and random intercept (data not shown), which results in a log likelihood of -1313.52, a constant of -0.72 significant at $p<0.001$, and variance between census tracts of 0.12. The intercept is statistically significant indicating there is some variance of diabetes across census tracts. This also serves as a baseline for comparison with the models that follow. Table 4.1 Model 1, the bivariate model, includes the neighborhood Mexican-origin concentration variable to analyze its effect on diabetes. Model 2 adds the neighborhood-level variables, model 3 includes the individual-level variables with only the neighborhood ethnic concentration, and model 4 is the full model with both neighborhood- and individual-level controls. For all models I use a random intercept and a random effect for the neighborhood

ethnic concentration variable, all other variables are fixed effects. This allows for variation of the ethnic concentration between neighborhoods separately from the individual-level characteristics.

In Table 4.1, model 1 I include the neighborhood-level Mexican-origin concentration variable as the random effect, with no other covariates. The reference group, a low ethnic concentration neighborhood, corresponds to census tracts with a Mexican-origin concentration of 60% or less. The middle group corresponds to a neighborhood with a Mexican-origin concentration of 61%-76% and the highest group, an ethnic enclave, is defined as a census tract with a Mexican-origin concentration of 77% or greater. This bivariate model shows that a resident living in an enclave has 0.74 odds of having diabetes compared to residents in low Mexican-origin concentration neighborhoods, with a p-value of 0.02. In other words, enclave residents have 26% lower odds of having diabetes than residents of low ethnic concentration neighborhoods. The mid-level ethnic neighborhoods have lower odds in comparison to the low ethnic concentration tracts, however there is no statistical difference between the two.

The next models examine the effect of the neighborhood- and individual-level controls separately. Model 2 includes two neighborhood-level controls: neighborhood poverty, with a cut-off value of 20% or higher of residents below poverty level,[1] and neighborhood immigrant concentration, with a high immigrant neighborhood defined as a census tract with greater than 30% foreign-born residents. Findings show that controlling for neighborhood poverty and immigrant concentration, living in an ethnic enclave results in even lower odds of diabetes compared to the bivariate model. However a log likelihood test comparing model 1 and model 2 finds that the models are statistically similar and adding the neighborhood controls does not improve the fit of the bivariate model.

[1] Poverty level is defined as 100% of the 2000 Federal Poverty Level, which was $8,794 for one person.

Continuing with model 2, neither neighborhood poverty nor neighborhood immigrant concentration are statistically significant, nevertheless their patterns are noteworthy. Living in a neighborhood with a high poverty concentration results in a slightly lower odds of diabetes, OR=0.98, compared to neighborhoods with lower neighborhood poverty. Conversely, living in a high immigrant neighborhood results in higher odds of diabetes, OR=1.17, compared to neighborhoods with lower immigrant concentrations. However these patterns are not statistically significant.

Model 3 includes the individual-level controls with only the neighborhood variable measuring Mexican-origin ethnic concentration. This model finds that the enclave variable remains statistically significant with 0.72 odds of having diabetes, similar to the bivariate model 1. Age, gender, and BMI are also statistically significant predictors of diabetes. Increasing age is protective of diabetes while being female, overweight, or obese are risk factors for diabetes.

Model 4 presents the full model with the neighborhood- and individual-level covariates. This model controls for possible neighborhood-level confounders and individual-level predictors to diabetes. A log likelihood test comparing model 1, the bivariate, and model 4, the full, shows that the models are statistically different and the full model with the neighborhood- and individual-level controls is a better model. The random effect variance for the enclave variable is 0.005, up from 0.003 in model 1, indicating that slightly more variance is explained by neighborhoods, although it is a minimal improvement.

The final model indicates that living in an ethnic enclave for Mexican-origin elders results in lower odds of diabetes, OR=0.66 at $p < 0.05$ compared to living in a low Mexican-origin concentration neighborhood, controlling for neighborhood and individual characteristics. In other words, ethnic enclave residents have 34% lower odds of diabetes compared to the low

ethnic neighborhoods. The association between the ethnic enclave and diabetes is strengthened in the full model. Living in a mid-level Mexican-origin ethnic neighborhood results in lower odds of diabetes compared to the low ethnic neighborhoods, although there is no statistical difference. Neighborhood poverty and neighborhood immigrant concentration are not statistically significant, however the relationships are the same as in model 2; living in a high poverty neighborhood lowers the odds of diabetes by 5% and living in a high immigrant neighborhood increases the odds of diabetes by 25%.

Model 4 also highlights important predictors of diabetes. While the neighborhood control variables are not significant, at the individual level age, gender, and BMI are statistically significant. Increasing age results in lower odds of diabetes, although only by 6%. Women have 23% higher odds of having diabetes when compared to men. Increasing BMI results in higher odds of diabetes. Being overweight compared to normal weight or underweight results in 41% greater odds of diabetes and being obese leads to 94% greater odds, statistically significant at $p<0.05$ and $p<0.001$, respectively. Household income, education, language of interview and place of birth, and living alone, all at the individual level, are not statistically significant predictors of diabetes.

Diabetes variance within neighborhoods slightly increases from 0.10 in model 1 to 0.13 in model 4, indicating that more variance is explained by the full model compared to the bivariate. Diabetes variance between neighborhoods nears zero for all models, but there is an increase in the variance explained between neighborhoods from model 1 to model 4. For the full model, the intraclass correlation (ICC) is 0.002, which means that 0.2% of the variability in diabetes rates is due to differences between neighborhoods. The ICC is low indicating that most of the variance of diabetes rates is due to differences in individuals.

Sensitivity analyses

I examine two separate variations to the full model. First I control for years since moved into home. Next I use the neighborhood immigrant concentration as the random effect in the multilevel model instead of the neighborhood ethnic concentration, allowing me to see the variation by the immigrant neighborhood independent of the individual-level characteristics.

In order to control for the amount of time a respondent has lived in their home I included a measure of years since moved into home to the full model. Specifically I identify those who moved within the last three to four years versus those that have lived in their homes longer. This was the only measure of time in home available in the 2004-2005 Hispanic EPESE. The amount of time a respondent has lived in their neighborhood could potentially impact their level of social embededness with the neighborhood, which could affect social cohesion. The amount of time in a new home could also impact their familiarity with the resources available to them, which might impact their diet, physical activity levels, and medical care, all which can have an effect on the onset of diabetes or the management of health overall. When the variable "years since moved" is added to the full model, there is no change to the odds ratio of the ethnic enclave and diabetes association (data not shown). Those living in an enclave have lower odds of diabetes even when controlling for recently moving to their current home. Also, there is no statistical difference in diabetes rates between those who recently moved and those who have lived longer in their homes. Since the time in home variable did not contribute to the model, I left it out of the final full model.

All models in Table 4.1 are multilevel models with a random intercept and a random effect for the neighborhood Mexican-origin concentration variable. Because the neighborhood immigrant concentration variable appears to have a different effect on diabetes although not

statistically significant, as a sensitivity analysis I examine the full model with the neighborhood immigrant concentration variable as the random effect instead of the neighborhood ethnic concentration as the random effect (data not shown). Using the immigrant neighborhood as the random effect did not result in any difference in the ethnic enclave and diabetes relationship nor in the immigrant neighborhood and diabetes association. The protective effect of living in an ethnic enclave on diabetes remains consistent even when using the neighborhood foreign-born concentration as the random effect. Despite exploring several potential confounders to the ethnic enclave diabetes relationship, the protective effect remains consistently strong.

4.1.2. Discussion: Diabetes and the enclave effect

Using multilevel logistic regression analyses, this study finds that diabetes rates vary by concentration levels of Mexican-origin residents in a neighborhood, controlling for neighborhood- and individual-level characteristics. Living in a high Mexican-origin concentration neighborhood, an ethnic enclave defined as 77% or higher, is protective of diabetes compared to neighborhoods of low Mexican-origin concentration, 60% or less. This finding is consistent with previous enclave research examining other health outcomes, including studies using earlier waves of the Hispanic EPESE (Eschbach et al., 2004; Gerst et al., 2011; Osypuk et al., 2009). My hypothesis that ethnic enclaves would be protective of diabetes is confirmed. Additionally unlike some of the previous enclave research, I included neighborhood poverty and neighborhood immigrant concentration in the analyses. When applied as controls, I find that even when accounting for neighborhood differences in poverty and immigrant concentration the neighborhood ethnic concentration remains a significant indicator of diabetes.

Furthermore, although neighborhood-level poverty and immigrant concentration were not statistically significant predictors in the final model, they presented some notable patterns. The

parameter for neighborhood immigrant concentration was positive but not significant on diabetes; this pattern highlights the potential varying effects of an immigrant neighborhood versus an ethnic neighborhood. This is important because ethnic enclaves, in particular Latino enclaves, are often low income and high immigrant neighborhoods (John R. Logan et al., 2002), thus while not as extensive, differences by neighborhood subgroups may be present. In the current study controlling for neighborhood-level characteristics demonstrated that the protective effect of an ethnic enclave was consistent despite the poverty or immigrant concentrations of the neighborhood. This finding indicates that there is something unique about the ethnic make-up of the neighborhood that provides a protective effect for diabetes among older Latinos of Mexican-origin.

The neighborhood variance was very small and did not change much across the models. In the empty model the intercept is statistically significant indicating there is some variance of diabetes across census tracts although very small, however this is not uncommon in neighborhood studies (A.V. Diez Roux, 2004). The intraclass correlation (ICC) in the full model found that 0.2% of diabetes variance was a result of the contextual effect. The low variance in diabetes explained by neighborhoods may be a result of inaccurate approximations of neighborhoods or the difficulty of capturing associations between a distal health outcome such as diabetes that is impacted by a complex interaction of several risk factors.

Several individual-level covariates are included in the model: age, gender, household income, education, language of interview and nativity, BMI, and living alone. The variable measuring neighborhood Mexican-origin concentration remains significant in the model with only the individual level controls and in the full model with the neighborhood- and individual-level controls. Thus even when the models account for the mentioned individual level

characteristics, differences in diabetes rates remain between enclaves and low ethnic concentration neighborhoods.

The statistically significant individual level predictors in these models include age, gender, and BMI. Increasing age results in lower odds of diabetes, with each additional year resulting in 6% lower odds of diabetes. This is counterintuitive since increasing age is usually associated with poorer health. For example, age is identified as a risk factor for diabetes in the general U.S. population (CDC, 2011). Research also finds that individuals, often racial minorities including Latinos, are getting diabetes at younger ages, which exposes them to comorbidities and diabetes-related complications for a longer period of their lifetime or at a younger age (CDC, 2004; Karter et al., 2002). Among the study's Mexican-origin population it is possible that with increasing age fewer have diabetes because some respondents at risk have already died from diabetes or other related health complications. Alternatively, those who survive to older ages may have learned to manage their diabetes risks among other competing health complications. Also, there may be a selection effect that is responsible for increasing age appearing as a protective factor for diabetes. Those that are healthier or without diabetes may be more likely to live in an enclave, thus older adults living in an enclave, which normally have poorer health as they age, appear healthier.

While increasing age is protective of diabetes, being female is a risk factor for diabetes. The models consistently demonstrate that women have higher odds of diabetes compared to men. Gender has not been shown to be a risk factor for diabetes in the U.S. population (CDC, 2011), but there may be gender effects on known diabetes risk factors, such as obesity and sedentary levels. U.S. studies find little difference in obesity rates among men and women, although a recent study found increasing obesity rates for Mexican-American women compared to non-

Hispanic White women (Flegal, Carroll, Kit, & Ogden, 2012). Mexican-origin women may be at higher risk for diabetes and its associated risk factors. In addition, men have lower life expectancies than women and those with diabetes may be dying earlier than some women. Alternatively, there may be a selection effect, with women with diabetes being more likely to live in ethnic enclaves. If women never leave the enclave, or return to the enclave at an older age either because of family or availability of services, women with diabetes could end up living in ethnic enclaves in greater numbers than men.

BMI, as expected, is associated with diabetes. Research has shown obesity to be an important risk factor of diabetes (CDC, 2011; Mokdad et al., 2003). In this study, overweight and obese respondents have higher odds of diabetes compared to those within a normal weight or underweight, with overweight and obese respondents having 1.41 and 1.94 greater odds, respectively. Missing cases for the BMI question were included as a separate category and have the highest odds of diabetes at 2.02. Respondents who withheld their height and weight and failed to answer the BMI questions possibly have higher BMI values than those who did provide their height and weight. A study of youth in Portugal found that those with missing BMI values have poorer body image and a sedentary lifestyle compared to those who report BMI (Fonseca & Gaspar de Matos, 2012). It is possible that those who do not provide their BMI information are in fact at greater risk for diabetes.

The results confirm my first hypothesis for Aim 1; we see the expected enclave protective effect for diabetes even when controlling for neighborhood- and individual-level characteristics. The results from Table 4.1 are consistent with the literature and provide further support to the protective effects of ethnic enclaves for various health outcomes. The use of multilevel analyses also confirms that the enclave effect operates at the neighborhood level. While much of the early

enclave research did not use multilevel analyses, the use of multilevel methodologies serves to confirm that living in an enclave provides an impact at an individual level and a neighborhood level.

Previous research has found a protective enclave effect among older Mexican-origin Latinos for various health outcomes using the Hispanic EPESE. These include mortality, self-reported health, frailty, cognitive decline, and depressive symptoms (Aranda et al., 2011; Eschbach et al., 2004; Ostir et al., 2003; Patel et al., 2003; Sheffield & Peek, 2009). Research that has used other data has found some differences in the protective effect of an enclave, but the findings are generally consistent (Mair et al., 2010; Nobari et al., 2013; Osypuk et al., 2009; Reyes-Ortiz et al., 2009). The research generally defines an enclave as a high ethnic concentration; however, other possible confounders are not always controlled for, such as neighborhood poverty, immigrant concentration, or nativity. This study attempts to consider the various dimensions of neighborhoods by accounting for some of these potentially influential aspects of a neighborhood and isolate the enclave effect as a function of ethnic concentration. Consequently, findings from the current study confirm the impact of the ethnic neighborhood, but also point to the possible distinct effect of living in a high immigrant neighborhood.

While not statistically significant, the results point to differences in diabetes for ethnic versus immigrant neighborhoods. There may be several reasons for this finding. One, there may be variation in how an enclave is defined that differs in this study from previous research. Other studies generally define an enclave by a continuous ratio of the ethnic concentration for a census tract, but many also use a categorical version of the ethnic concentration of a census tract. Alternatively some studies use a combined ethnic and immigrant concentration, or language preference (Nobari et al., 2013; Osypuk et al., 2009; Viruell-Fuentes, Morenoff, Williams, &

House, 2013). Analyzing the effect of ethnic concentration separately from foreign-born concentration reveals differences that may be confounded when one is not controlled for. The measures of a high ethnic neighborhood and a high immigrant neighborhood may be serving as proxies for other neighborhood characteristics that affect diabetes. Secondly, there may be some real differences in high ethnic concentration neighborhoods and high immigrant concentration neighborhoods. The ethnic versus immigrant effect is further detailed in Chapter 6 (Conclusion). Briefly, there may be some important differences in the experiences of residents of ethnic neighborhoods versus immigrant neighborhoods that impact diabetes, in particular the known diabetes risk factors: obesity, poor diet, and lack of physical activity. Ethnic neighborhoods may provide more knowledge of these risk factors, more resources in diabetes prevention focusing on an ethnic group, or more social networks that support better overall health or have greater capacity to counteract negative risks of diabetes. These resources and prevention education may especially be important for older adults.

Conversely, the findings of the protective ethnic enclave effect may be the result of a selection effect and not one of causality. While I attempt to control for neighborhood- and individual-level characteristics, it is possible that the lower levels of diabetes seen in the enclaves are a result of self-selection with healthier individuals or those with lower diabetes risk more likely to live in ethnic neighborhoods.

4.2 Social Network Effects on the Enclave and Diabetes Relationship

In the previous section I established that living in an ethnic enclave, or a high concentration Mexican-origin neighborhood, is protective of diabetes, controlling for both neighborhood and individual characteristics. This association is consistent with previous research

of enclave effects for other health outcomes. Next I explore if social networks explain the enclave and diabetes relationship by testing a social ties measure and the social cohesion and trust measure.

4.2.1. Results: Social network effects

Social Ties Scale

Table 4.2 begins with the full model previously seen in Table 4.1. Model 1 controls for neighborhood- and individual-level characteristics and establishes the protective effect of living in an ethnic enclave with those in the enclave having 34% lower odds of diabetes, significant with a p-value of 0.02. Next for Model 2 I add the social ties scale, measured at the individual-level, to the full model. The social ties scale is the sum of two questions that ask the number of family and friends in the respondent's neighborhood: none, a few, many, or most. This measure attempts to capture the immediate personal relationships respondents have in their neighborhood. These relationships represent social ties that can provide immediate assistance if necessary, as well as companionship and a general sense of community through recognizable faces in the respondent's neighborhood. The social ties scale was recoded and summed so that the lowest possible value, 2, represents no family or friends in the neighborhood and a value of 6 represents the highest possible value of many or most family and friends in the neighborhood.

In Table 4.2 Model 2 we see that the addition of the social ties scale results in a negligible change to the ethnic neighborhood odds ratio and confidence interval. Additionally, controlling for social ties results in 31% higher odds of diabetes for respondents in high immigrant neighborhoods compared to those in low immigrant neighborhoods, a 6% increase from model 1 which is also now statistically significant. Controlling for social networks as measured by a social ties scale results in a statistically significant higher risk of diabetes for

those living in immigrant neighborhoods but remains protective of diabetes for those living in ethnic enclaves.

Furthermore, the social ties scale itself is a risk factor for diabetes. A one-point increase in social ties results in 11% higher odds of diabetes, controlling for neighborhood and individual characteristics. This association is contrary to what I expected as I had anticipated for more social ties to result in better health and thus a lower diabetes prevalence. If social networks were to explain the protective effect of an enclave, I would expect for social networks to be predictive of better health.

Test for Mediation

The main goal of the second research question is to determine whether social networks play a mediating or moderating role in the ethnic enclave and diabetes relationship. A mediating variable is determined by the addition of the variable in question to the model and observing the change in the coefficient for the original relationship, in this case how neighborhood ethnic concentration predicts diabetes. Also an import part of the mediation test is examining the relationships between the predictor and the mediation variable, then the mediation variable and the outcome. Appendix A presents the bivariate regression model of ethnic enclaves and social ties and the bivariate logistic regression model of the social ties scale and diabetes. I find that living in an enclave compared to a low ethnic concentration neighborhood is not associated with increasing social ties, Appendix A Table A.5. Similarly, the social ties scale is not associated with diabetes, although the odds ratio of 1.09 is near significance with a p-value 0.079, Table A.6. The bivariate associations indicate that there is no mediation by social ties, confirming what I observe in the full model with social ties, Table 4.2 model 2.

While the social ties scale variable is a risk factor for diabetes once I control for neighborhood and individual characteristics, it has no mediating effect as demonstrated by the lack of change to the enclave diabetes association. The odds of diabetes for those living in an enclave remain the same with the addition of the social ties measure. Thus I reject my hypothesis and find that social ties do not serve as a mediating variable and do not explain the protective effect of living in an ethnic enclave on diabetes. The protective effect of living in an enclave remains consistent despite the addition of theoretically significant variables to the model.

Test for Moderation

In order to test for a moderation effect of social ties, I include an interaction variable of the ethnic neighborhood variable and the social ties scale (data not shown). The interaction variable is not statistically significant, thus the ethnic enclave and diabetes association does not vary by level of social ties. The main effects are also not significant with the addition of the interaction variable. Social ties do not mediate nor moderate the protective enclave effect on diabetes.

Social Cohesion and Trust Scale

As a different measure of social networks I then added the social cohesion and trust scale variable to the full model with the social ties scale, shown in Table 4.2 Model 3. Controlling for neighborhood and individual level characteristics, results indicate that the social cohesion and trust scale is a risk factor for diabetes. A one-point increase in the social cohesion and trust scale results in 4% higher odds of diabetes significant at $p<0.05$. However the addition of the social cohesion and trust scale to the model resulted in the social ties scale being no longer statistically significant. It initially appears that social ties are an important predictor of diabetes, but once I

control for the social cohesion and trust scale there is no longer any difference in diabetes by social ties.[m]

To further understand the social cohesion and trust scale association with diabetes, I include this variable in the full model without the social ties scale (data not shown). Results were similar as in Model 3, but increasing social cohesion is associated with 11% greater odds of diabetes significant at $p < 0.05$. This indicates that the association between the social cohesion and trust scale consistently serves as a risk factor to diabetes, even when not accounting for other social network measures such as the social ties scale.

In Model 3 I also find that living in an enclave continues to be protective, resulting in lower odds of diabetes, OR=0.64 and p-value=0.02, when controlling for social cohesion and social ties, along with the neighborhood and individual characteristics. The enclave and diabetes association is slightly strengthened once I account for differences in social cohesion among respondents.

The neighborhood variables follow similar patterns as in previous models, and controlling for social cohesion strengthens the association between neighborhood immigrant concentration and diabetes. Living in an immigrant neighborhood results in 33% higher odds of diabetes statistically significant at $p < 0.05$, an 8% increase when compared to the original full model without the social network variables, Model 1. Thus once I account for variations in social cohesion levels, results indicate that living in an immigrant neighborhood is a statistically significant risk factor for diabetes. Controlling for either social networks measure results in a statistically significant risk of diabetes for those living in immigrant neighborhoods, while those living in ethnic enclaves experience a protective effect.

[m] While social ties and social cohesion may be similar, their correlation is not significant, thus they appear to be measuring different constructs.

For the individual level variables, age and BMI remain statistically significant predictors of diabetes as in previous models. Gender on the other hand is no longer a predictor once I control for both social ties and social cohesion and trust. It appears that social networks may be responsible for the differences by gender observed in diabetes rates.

Test for Mediation

The social cohesion and trust scale, measured at the individual level, does not mediate the association between ethnic enclaves and diabetes. Living in an ethnic enclave continues to be statistically significant even once I control for social cohesion, and in fact the relationship is strengthened by 2% (enclaves are more protective) as seen in Table 4.2, Model 3. A likelihood ratio test comparing the full model without social ties and social cohesion and the model with both social network measures did find an improvement in the model.

To fully confirm the lack of mediation I also examined the association between neighborhood ethnic concentration and the social cohesion and trust scale (Appendix A, Table A.7), as well as the bivariate relationship between social cohesion and diabetes (Appendix A, Table A.8). I hypothesized that an increase in Mexican-origin concentration for a neighborhood would result in higher social cohesion levels. Results show that the ethnic concentration of the neighborhood is not significantly associated with social cohesion, although there is a pattern of increased ethnic concentration with increased levels of social cohesion (Table A.7). In Table A.8 I find a statistically significant association between increased levels of social cohesion and increased odds of diabetes. While social cohesion is associated with diabetes, the relationship with ethnic enclaves is not definitive. If social cohesion had mediated the enclave and diabetes relationship, there should have been some association present between the neighborhood ethnic concentration and the social cohesion variable. There should have also been a reduction in the

predictive value of ethnic enclaves for diabetes when social cohesion was added to the full model. Thus I failed to find mediation by the social cohesion and trust scale, refuting my initial hypotheses. Neither of the social network measures account for the protective effect of living in a high Mexican-origin neighborhood. However there is an association between social cohesion and diabetes, suggesting that social networks can be an important predictor of health.

Test for Moderation

I also test if social cohesion serves as a moderator in the enclave and diabetes relationship. Adding an interaction variable of the neighborhood Mexican-origin concentration and the social cohesion scale is not statistically significant and the main effects are no longer significant (data not shown). Since the interaction variable is not statistically significant, social cohesion does not serve as a moderating variable. The enclave and diabetes association does no differ by level of social cohesion.

Based on the social network measurements used in this study, the enclave and diabetes relationship cannot be explained by social networks as I found no mediation or moderation by the social cohesion and trust scale or the social ties scale.

4.2.2 Discussion: Diabetes, Enclaves, and Social Networks

My analysis supports the protective health effects of living in an ethnic enclave that has also been established in the literature. This study also examines what factors may be responsible for the protective effect and tests the potential mediating and moderating effects of social networks, which are a common explanation for the relationship between neighborhood ethnic concentration and health. I use a social ties scale as well as the social cohesion and trust scale to measure the potential impact of social networks operating within the enclave effect. Social

networks can be defined and measured in many ways. Since the social ties scale and the social cohesion and trust scale measure different aspects of a social network, I expected that each would be protective of health and either mediate or moderate the relationship between enclaves and diabetes. None of these proved to be convincingly true.

Social Ties Scale

In this study social ties is one way I measure close social networks, i.e. having family and/or friends near. Initially it appears that social ties are a predictor of diabetes, resulting in 11% higher odds of diabetes for a one-point increase in the social ties scale. Having more family and/or friends in the neighborhood resulted in higher odds of diabetes. This finding was unexpected since research predicts that an increase in social support results in better health. Thus I would expect lower diabetes rates with more social ties. Here I find that social ties leads to higher odds of diabetes. However once I control for social cohesion and trust there is no longer any difference in diabetes by social ties. Any relationship between social ties and diabetes is explained by the social cohesion measure. It is possible that the social cohesion measure overlaps with the social ties measure in terms of their effect on diabetes. Also, the association between social cohesion and diabetes suggests that social networks may be a consequence of diabetes, with those with diabetes having an increase in social networks. The cross-sectional design of the study prevents me from definitively predicting causality between social networks and diabetes

Another important finding from the addition of the social ties variable is the newly significant neighborhood immigrant concentration variable. Living in an immigrant neighborhood results in 31% higher odds of diabetes, statistically significant at $p < 0.05$. Once we account for differences in social ties, living in an immigrant neighborhood is a statistically

significant risk factor to diabetes.[n] This finding is interesting because Latino immigrants generally have better health than non-immigrants (Lara et al., 2005), hence we might expect that living in a neighborhood with a higher immigrant concentration would result in better health odds at the neighborhood level as well. Additionally, an immigrant neighborhood would be expected to have more social networks through a shared culture, language, and migration experience (Almeida et al., 2009; Logan et al., 2002; Viruell-Fuentes et al., 2013). The increased social networks would then result in better health outcomes (Berkman et al., 2000; Seeman, 1996). However, once tested this is not always the case. For example, a study of Chicago neighborhoods found that Latino immigrants had lower levels of social networks, except for informational support, and the positive effect of Latino/immigrant neighborhoods on social networks varied by nativity with the US-born benefiting (Viruell-Fuentes et al., 2013). As the full model demonstrated in this study, an immigrant neighborhood was a non-significant risk factor to diabetes, but once I controlled for individual differences in social ties the relationship became statistically significant. A high immigrant neighborhood does not appear to have the same health benefits of a high ethnic neighborhood (further discussed in Chapter 6 Conclusion). Additionally, social ties mediate the relationship between neighborhood immigrant concentration and diabetes. While social ties may not explain the ethnic enclave and diabetes relationship, social ties may be more important for those living in a high immigrant neighborhood. I also test the interaction between immigrant neighborhood and the social ties scale variable but find no statistical significance, thus no moderation effect.

Social Cohesion and Trust Scale

[n] The newly significant high immigrant neighborhood as a risk factor is consistent whether the social ties scale is added to the full model alone, the social cohesion and trust scale is added to the full model alone, or both social ties and social cohesion are added to the full model.

In this study the social cohesion and trust scale serves as a different measure of social networks. While there are several ways to measure social networks and the support they provide, the social cohesion and trust scale has been used in other studies to approximate the level of social trust and connectedness individuals perceive within their neighborhoods (Berkman et al., 2000; Sampson et al., 1997). Specifically it asks about perception of trust, shared values, and interconnection with people in their neighborhood. I expected to see increasing levels of social cohesion result in better health, or lower odds of diabetes, and to mediate the relationship by reducing the protective effect of the enclave. I did not see either of these relationships.

Social cohesion was found to be a risk factor for diabetes. A one-point increase in social cohesion resulted in 4% higher odds of diabetes significant at $p < 0.05$. Other studies have found mixed results in the association of social cohesion and health with some not finding any association for neighborhood-level social cohesion (Mulvaney-Day, Alegria, & Sribney, 2007) and others finding a negative association between social cohesion and health (Echeverria, 2008). While social support and social networks are often cited as the pathway relating enclaves and health, when tested the results do not find a clear answer. Research has also failed to find a clear link between ethnic enclaves and social networks, with some types of social support found in ethnic enclaves but other types have not (Almeida et al., 2009; Viruell-Fuentes et al., 2013).

In this study I did not observe mediation by the social cohesion and trust measure. Adding the social cohesion and trust variable slightly lowered the odds of diabetes for those living in an enclave, from 0.66 to 0.64 and strengthened the association with a slightly lower p-value, failing to lessen the association between neighborhood Mexican-origin concentration and diabetes. To fully confirm the lack of mediation, I also examined the direct association between neighborhood ethnic concentration and the social cohesion and trust scale. The ethnic

concentration of the neighborhood is not predictive of social cohesion (see Appendix A Table A.7). This finding is consistent with the limited change in the enclave diabetes association when the social cohesion variable is added to the model. However, once I account for differences in social cohesion, the immigrant neighborhood and diabetes association becomes significant, indicating that social cohesion and trust is important to high immigrant neighborhoods.

In sum, the social cohesion and trust scale does not moderate the ethnic concentration and diabetes relationship. When added as an interaction variable (data not shown), the Mexican-origin concentration and social cohesion scale interaction variable is not statistically significant. Thus, according to this study, the level of social cohesion does not have an impact on the ethnic concentration and diabetes relationship.

Social ties versus the Social Cohesion and Trust Scale

In predicting diabetes, the social cohesion and trust scale proves to be a more important risk factor than the social ties scale. The social ties scale was no longer statistically significant once the social cohesion and trust scale was added to the model. This finding was consistent across several models, including: both health outcomes, ethnic concentration as a random effect, immigrant concentration as a random effect (data not shown), and removing the household income and education covariates (data not shown). The social cohesion and trust scale serves as a predictor of diabetes and accounts for the effect of social ties. Why would a measure of perceived neighborhood social cohesion and trust be more important than self-reported social ties for diabetes rates? Possibly the perception of having support is better captured by the social cohesion and trust scale, as it has been validated in previous research while the social ties scale is based on two questions and may not accurately capture real ties that provide any support. Diabetes is a chronic disease that has several risk factors, can be difficult to manage, and is

prevalent among Latinos, especially for Mexican-origin Latinos. Perhaps the complexity of diabetes risk is best predicted by a broader social networks measure that assesses a global feeling of support as opposed to direct support through family and friends. The measures may also overlap in the dimensions they measure, or how respondents interpret the questions, thus the broader measure of social cohesion accounts for the dimension that the social ties questions were measuring.

Another interesting finding consistent for both social cohesion and social ties is their association with diabetes as risk factors. If social networks are responsible for the protective health effect of ethnic enclaves I would expect to see lower odds of diabetes with increasing social networks. My results show the opposite, an increase in social networks results in higher odds of diabetes. One possible explanation is that there may be a reverse association between social networks and diabetes than what I hypothesized. I predicted that ethnic enclaves result in higher social networks, which then would provide an environment for improved health. But the relationship can also operate in the opposite direction. Having diabetes can result in increased social networks for the individual, hence in this example increased levels of diabetes could result in increased social networks. Those with diabetes may seek out more support or assistance from family, friends, and their overall community, resulting in higher social ties or social cohesion. The relationship between social networks and diabetes may operate in the opposite direction than what I assumed.

Social Networks and Enclave Effects

The lack of mediation and moderation is surprising because social networks are a main explanation for the protective effect of enclaves on health outcomes. I expected to find the social ties scale or the social cohesion and trust scale to impact the enclave diabetes relationship in

some way. This study finds that social networks, as measured by a social ties scale and the social cohesion and trust scale, do not account for the protective effects of living in an enclave.

One possibility is that the two measures used here as proxies for social networks do not capture the social relationships among co-ethnics that provide the protective effect on diabetes. The social ties scale is especially limiting because it does not provide a count of family or friends in the neighborhood. Additionally, this subjective assessment of social ties may be influenced by others in their age group, their migration experience, or their cultural expectations of relationships. For example, in responding to the inquiry of the number of family or friends in their neighborhood, they may use as a reference the contacts of their peers or their experience with neighborhood family and friends in their home country. This could result in the perception of isolation when in fact they have several ties in their community, or vice versa.

It is also possible that in this older population social networks operate differently and are not captured well with the current measures. An older respondent may need a much greater level of social support to see an impact on their health. For this older adult sample in the Hispanic EPESE, social cohesion may not serve as a good measure for the social networks. There are other ways to measure social networks that may be better for this population. A count of family and friends in the near area, the frequency of contact with family and friends, or the type of companionship, such as friendship or assistance with health issues, may be more important measures for older adults (Seeman, 1996).

Alternatively the protective effect of enclaves may not be explained by social networks at all, at least for diabetes. There may be a different mechanism within ethnic enclaves beyond these social network measures. The known risk factors for diabetes include obesity or overweight, poor diet, lack of physical activity, as well as family history. These risk factors may not be

influenced by social support, or social support may not be enough to counteract the effect of the risk factors.

Studies have attempted to examine the prevalence of social networks within Latino communities. Some studies have found that concentrated Latino neighborhoods are predictive of more social ties or some aspect of social networks (Almeida et al., 2009; Mulvaney-Day et al., 2007; Viruell-Fuentes et al., 2013). Other studies point to the decreased number of social support and social cohesion for immigrants (Almeida et al., 2009; Mulvaney-Day et al., 2007; Viruell-Fuentes & Schulz, 2009). Considering the varying results linking social networks and Latino groups, the results from this study and a lack of mediation or moderation by the social networks is not surprising. The social network measures used in this study may not have captured the nature of the social relationships expected in an ethnic enclave, or the effect of the measures may vary by the characteristics of the neighborhood, thus resulting in a mixed impact.

If social networks do no account for the protective effect of living in an ethnic enclave, then what else could explain the enclave effect for diabetes? The third research question examines the role of the business environment as another possible mechanism explaining the protective enclave effect.

4.3 Effect of the Business Environment on the Enclave and Diabetes Relationship

The business environment can play an important role in creating and sustaining an ethnic enclave by providing economic opportunities for the ethnic group, providing culturally relevant goods and services, and creating a larger sense of community and stability. I examine if the business environment has an impact on the health of the community's residents. Specifically I assess if the business measures mediate or moderate the ethnic enclave and diabetes relationship.

4.3.1 Results: Multilevel Logistic Regression Models for Diabetes and the Business Environment

Table 4.3 Model 1 is included as a reference of the full model from the first research question. In Model 2 I add the ratio of Latino-owned businesses per census tract, which is not a statistically significant predictor of diabetes. An increasing proportion of Latino-owned businesses results in higher odds of diabetes although not statistically significant, which is not what I expected. An increased concentration of Latino-owned businesses would likely be in an ethnic enclave, thus I would expect to see a protective effect. Yet since this relationship is not statistically significant a pattern cannot be established.

The neighborhood-level variables change very little with the addition of the ratio of Latino-owned businesses. There is no change in the effect of neighborhood poverty or immigrant concentration with the addition of the business variables. In Model 2 controlling for the business environment does decrease the odds of diabetes for the enclave neighborhood by 3%, strengthening the protective effect, however a log likelihood test shows that the addition of the business variables does not improve the full model. The Latino-owned business variable does not explain the enclave-diabetes relationship. The individual level variables are not impacted when I control for the business environment. Age, gender, and BMI remain consistent predictors when controlling for variation in the ratio of Latino-owned businesses.

In Model 3 I look at specific types of businesses. There are four types of Latino-owned businesses included in the model: number of food stores, restaurants, recreational, and social businesses (see Chapter 2 for more detailed descriptions). None are statistically significant and all have odds ratios of diabetes near 1.00. There is no difference in odds of diabetes by each type of Latino-owned business. To further confirm the lack of effect, I also include each business type

individually in the model, as well as the food stores and restaurants in one model and the recreation and social in another model (data not shown), with no difference in the odds ratio as when they are all included together.

Furthermore, the addition of the specific types of businesses in Model 3 results in no change for the neighborhood- and individual-level variables. The odds of diabetes based on the enclave variable in Model 1 and Model 3 are the same. The addition of the types of businesses does not improve the model, as shown by similar log likelihood values and variances, and has no effect on the enclave-diabetes relationship.

Sensitivity Analysis

As mentioned in the methods Chapter 2, the data of Latino-owned businesses was provided by Infogroup based on the 2000 Census tract identifiers as they matched the Hispanic EPESE. However they were not able to provide a total business count using the 2000 Census tract identifiers so that I could create a proportion of Latino-owned businesses. Thus in the analysis above I used the count of Latino-owned businesses and total businesses based on 2010 Census tracts as that was available. To ensure there are no major differences between the results with the 2000 versus the 2010 Census identifiers, I also analyzed the full model with the addition of the number of Latino-owned businesses from the 2000 Census tract identifiers. The resulting model provides very similar coefficients for the ethnic enclave variable and other neighborhood and individual variables. The count of Latino-owned businesses is also no statistically significant with an odds ratio of 0.99, thus there is no difference in diabetes rates by the number of Latino-owned businesses in a neighborhood (data not shown). I also used a version similar to that of Subramanian and co-authors (2006) that resulted in a ratio of Latino-owned businesses by the total census tract population. This version of the Latino business variable was also not

statistically significant with a large confidence interval, but there was a negative association between the Latino-owned business variable and diabetes (data not shown).

Test for mediation

As discussed above, the addition of the ratio of Latino-owned businesses results in a small increase in the ethnic enclave and diabetes association, from 34% lower odds of diabetes in the original full model for those living in an ethnic enclave to 37% lower odds of diabetes in the model accounting for the business environment. However a log likelihood test did not show improvement in model fit when the businesses variable was added. Thus there is no mediation observed by the Latino-owned business measure.

Test for moderation

To test if Latino-owned businesses moderate the ethnic enclave and diabetes relationship I include an interaction variable in the full model. The interaction between the ratio of Latino-owned businesses and ethnic enclaves is not statistically significant, nor are the main effects. Overall, the business environment did not mediate nor moderate the ethnic enclave and diabetes relationship.

4.3.2 Discussion: Diabetes, Enclaves, and the Business environment

This study examined the role of the business environment and its potential modifying or moderating effect on the ethnic enclave and diabetes association. Using the ratio of Latino-owned businesses by census tract as the measure of the business environment, results do not find a significant effect on diabetes directly or the enclave and diabetes relationship.

In order to consider the impact of certain types of businesses that could have an effect on diabetes, I included the count of businesses that were food related stores, restaurants, recreational

businesses, and social type establishments. These types of businesses had no effect on the odds of diabetes and had no impact on the ethnic enclave diabetes relationship. I could not confirm my third hypotheses stating that the business environment would have a modifying or moderating effect on the protective effect of ethnic enclaves on diabetes. In this study inclusion of the business variables did not further explain the underlying mechanisms that describe the protective effect of ethnic enclaves.

Few studies have used the business environment as a predictor of health. Among those that have, there are mixed findings. Subramanian et al. (2006) examined the impact of the availability of services in a neighborhood on overall self-reported health for elders in New Haven. Similar to this current study, the authors did not find the density of services in a neighborhood to have a significant impact on health or serve as modifiers of other neighborhood characteristics (Subramanian, Kubzansky, Berkman, Fay, & Kawachi, 2006). They did however find that neighborhood characteristics such as poverty, residential stability, and elderly concentration predicted self-reported health. Similarly, this current study found that neighborhood level measures using census-tract characteristics were predictive of diabetes such as ethnic and immigrant concentration, but the business measures were not significant. One possibility for the lack of effect could be that the measures do not capture the contextual effect of the business environment and fail to translate the interactions that can influence health. For example, Latino-owned businesses may result in greater availability of traditional foods that can impact the individual's diet, which can result in good or bad dietary behaviors. Latino-owned businesses may also improve the economy of the community, which can impact the services available, however this may not have an impact on diabetes directly.

Additionally, the business concentration is based on a census tract, which may be too large of an area to establish the impact of businesses on health. A comparable study examining the social environment and mortality risk included local commercial stores (grocery stores, supermarkets, barber shops, beauty parlors, laundromats), parks, and motor vehicle crashes and then determining the number of these per 1,000 people (Yen & Kaplan, 1999). Yen and Kaplan (1999) found that census tracts with a higher number of commercial businesses had a higher mortality risk. A measure that more accurately quantifies the local business environment or one that captures a smaller geographic area may be a more exact measure of the business environment.

There are other limitations with using the business environment and examining its effect on health. While I have measures for the ratio of Latino-owned businesses, I am unable to examine whom these businesses serve. The businesses in a neighborhood may cater to the local community and serve a specific ethnic group especially if the neighborhood is an ethnic enclave, but the actual owners could be of a different ethnicity. For example, a Latino enclave may have businesses that provide items, foods, and services that are culturally relevant or preferred, even hiring staff from the same ethnic group, but the owner could be of another race or ethnicity. The ethnic origin of the owners does not need to be the same as the community it serves in order to have a successful business that serves the neighborhood. Additionally, it may not be the actual business or the items and services it provides that has an effect on health. It could be the financial stability the business neighborhood provides, the social networks that the businesses enable, or the general comfort of being able to access ethnically familiar items and services. A neighborhood with a higher density of businesses could be more conducive to walking and increase physical activity for the community and improve health. Thus, there may be other

mechanisms in which a business environment influences health that this study is unable to describe.

While the business measures included in this study did not have a statistically significant effect on diabetes, it is one of a few studies to consider the effect of businesses on health. More research is needed with different measures, other ethnic groups, and additional geographic locations to fully understand the impact businesses may have on health.

4.4 Summary

In this chapter I reviewed the impact of the ethnic enclave on diabetes and the potential underlying pathways. I found that the ethnic enclave is protective of diabetes even when controlling for neighborhood- and individual-level characteristics. More specifically, for older adults of Mexican-origin, living in an ethnic enclave resulted in a 34% decrease in the odds of diabetes compared to those living in a low ethnic neighborhood. When testing the mechanisms that might explain this protective effect, I found the social cohesion and trust scale may be providing a mediating effect, however the effect observed was minimal. The social ties scale did not have a mediating effect. Furthermore, the social network variables, social ties and social cohesion and trust, had a positive association with diabetes, which was unexpected. Finally, the concentration of Latino-owned businesses did not prove to have a mediating or moderating impact on the ethnic enclave and diabetes relationship.

Another surprising result was the risk effect of living in a high immigrant neighborhood on diabetes when I controlled for social ties and/or social cohesion and trust, indicating a mediating effect by the social network measures. Thus social ties and social cohesion and trust may be more important for immigrant neighborhoods than for ethnic enclaves.

In light of these findings, I would propose there are other unmeasured factors driving the enclave effect for diabetes. There may be other stressors that are minimized by living in an ethnic enclave, such as migration stress, acculturative stress, or perceived discrimination, that may result in lower diabetes risk. Alternatively, it may be a different aspect of the social network that is beneficial to preventing diabetes that was not measured in this analysis. While my analysis did not provide a convincing explanation for the mechanisms within an ethnic enclave, it did result in some interesting findings in further understanding the intricacies of neighborhood characteristics in regards to ethnic and immigrant concentration. More research is needed to better understand the mechanisms of an ethnic enclave because they do play a role in the health patterns for Latinos.

4.5 Tables

Table 4.1. Multilevel logistic regression models of neighborhood- and individual-level characteristics predicting diabetes. Unweighted.

	Model 1[e] (n=2,069)		Model 2[f] (n=2,069)		Model 3[g] (n=2,069)		Model 4[h] (n=2,069)	
Neighborhood-level Variables [a]	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Mexican-origin Concentration of census tracts[b]								
Low (≤60%) (reference)	1.00		1.00		1.00		1.00	
Mid (61-77%)	0.86	(0.66-1.11)	0.86	(0.64-1.15)	0.81	(0.63-1.06)	0.82	(0.61-1.11)
Enclave (> 77%)	**0.74**	**(0.57-0.96)**	**0.69**	**(0.49-0.96)**	**0.72**	**(0.55-0.95)**	**0.66**	**(0.46-0.93)**
Poverty Concentration of census tract[c]								
Low (<20%) reference			1.00				1.00	
High (≥20%)			0.98	(0.75-1.28)			0.95	(0.72-1.25)
Foreign-born Concentration of census tract								
Low (≤30%) (reference)			1.00				1.00	
High (>30%)			1.17	(0.92-1.48)			1.25	(0.97-1.62)
Individual-level Variables[d]								
Age, years					**0.94**	**(0.92-0.96)**	**0.94**	**(0.92-0.96)**
Gender								
Male (reference)					1.00		1.00	
Female					**1.23**	**(1.00-1.51)**	**1.23**	**(1.00-1.50)**
Household Income								
< $10,000 (reference)					1.00		1.00	
Between $10,000 - 19,999					1.17	(0.93-1.48)	1.17	(0.93-1.49)
≥ $20,000					0.99	(0.70-1.42)	0.97	(0.68-1.39)
No response/missing					0.81	(0.59-1.13)	0.80	(0.57-1.10)
Education								
HS grad or higher (reference)					1.00		1.00	
7th-11th grade					0.91	(0.63-1.31)	0.89	(0.61-1.29)
4th-6th grade					1.05	(0.73-1.50)	1.04	(0.72-1.49)

≤ 3rd grade			1.14	(0.79-1.64)	1.13	(0.78-1.63)
No education			1.06	(0.72-1.57)	1.06	(0.72-1.56)
Language and Nativity						
Spanish, Mexican-born (reference)			1.00		1.00	
Spanish, US-born			1.09	(0.87-1.37)	1.15	(0.91-1.45)
English, Mexican-born			0.99	(0.56-1.76)	1.03	(0.58-1.83)
English, US-born			1.07	(0.78-1.47)	1.12	(0.81-1.54)
Weight status (by Body Mass Index, BMI)						
Normal/underweight (BMI < 25 kg/m^2) (reference)			1.00		1.00	
Overweight (BMI 25-29.9 kg/m^2)			**1.41**	**(1.08-1.84)**	**1.41**	**(1.08-1.84)**
Obese (BMI ≥ 30 kg/m^2)			**1.93**	**(1.46-2.56)**	**1.94**	**(1.46-2.57)**
No response/missing			**1.98**	**(1.48-2.66)**	**2.02**	**(1.50-2.72)**
Living alone						
No (reference)			1.00		1.00	
Yes			0.82	(0.65-1.04)	0.82	(0.65-1.04)
Log likelihood statistic	-1310.66	-1309.84	-1267.07		-1265.39	
Variance at Level 1	0.099	0.112	0.113		0.132	
Variance at Level 2	0.003	0.007	0.004		0.005	
Intraclass correlation (ICC)	<0.001	0.003	<0.001		0.002	

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Neighborhood variable data from the 2000 Census. (415 census tracts corresponding with the 2004-2005 HEPESE sample).

[b] Mexican-origin concentration is the random effect, while the other neighborhood variables are fixed effects.

[c] Poverty is defined as 100% of Federal Poverty Level (FPL) based on the 2000 value of $8794 for 1 person. Thus a high poverty neighbohrood is defined as a census tract with 20% or greater living below the FPL.

[d] Individual variable data from 2004-2005 HEPESE.

[e] Model 1: Bivariate multilevel logistic regression of Mexican-origin concentration of neighborhood and diabetes.

[f] Model 2: Model 1 plus neighborhood-level controls for neighborhood poverty and neighbohrood immigrant concentration.

[g] Model 3: Model 1 plus individual-level controls for demographic characteristics and health conditions.

[h] Model 4: Model 1 plus neighborhood-level controls (Model 2) and individual-level controls (Model 3).

Table 4.2. Multilevel logistic regression models of neighborhood characteristics predicting diabetes with the addition of social network measures. Unweighted.

	Model 1[g] (n=2,069)		**Model 2[h]** (n=1,926)		**Model 3[i]** (n=1,908)	
Neighborhood-level Variables [a]	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Mexican-origin Concentration of census tracts[b]						
Low (≤60%) (reference)	1.00		1.00		1.00	
Mid (61-77%)	0.82	(0.61-1.11)	0.84	(0.62-1.14)	0.82	(0.60-1.12)
Enclave (> 77%)	**0.66**	**(0.46-0.93)**	**0.66**	**(0.46-0.94)**	**0.64**	**(0.45-0.92)**
Poverty Concentration of census tract[c]						
Low (<20%) (reference)	1.00		1.00		1.00	
High (≥20%)	0.95	(0.72-1.25)	0.92	(0.69-1.23)	0.92	(0.69-1.23)
Foreign-born Concentration						
Low (<30%) (reference)	1.00		1.00		1.00	
High (≥30%)	1.25	(0.97-1.62)	**1.31**	**(1.01-1.70)**	**1.33**	**(1.02-1.73)**
Individual-level Variables[d]						
Age, years	**0.94**	**(0.92-0.96)**	**0.94**	**(0.92-0.96)**	**0.94**	**(0.92-0.96)**
Gender						
Male (reference)	1.00		1.00		1.00	
Female	**1.23**	**(1.00-1.50)**	**1.24**	**(1.00-1.53)**	1.23	(1.00-1.53)
Household Income						
< $10,000 (reference)	1.00		1.00		1.00	
Between $10,000 - 19,999	1.17	(0.93-1.49)	1.16	(0.91-1.47)	1.14	(0.89-1.45)
≥ $20,000	0.97	(0.68-1.39)	0.96	(0.66-1.40)	0.93	(0.64-1.36)
No response/missing	0.80	(0.57-1.10)	0.82	(0.58-1.16)	0.81	(0.57-1.16)
Education						
HS grad or higher (reference)	1.00		1.00		1.00	
7th-11th grade	0.89	(0.61-1.29)	0.94	(0.64-1.38)	0.94	(0.64-1.39)
4th-6th grade	1.04	(0.72-1.49)	1.09	(0.75-1.59)	1.09	(0.75-1.58)
≤ 3rd grade	1.13	(0.78-1.63)	1.22	(0.83-1.79)	1.22	(0.83-1.79)
No education	1.06	(0.72-1.56)	1.14	(0.75-1.72)	1.14	(0.75-1.72)
Language and Nativity						
Spanish, Mexican-born (reference)	1.00		1.00		1.00	
Spanish, US-born	1.15	(0.91-1.45)	1.15	(0.91-1.46)	1.15	(0.90-1.47)
English, Mexican-born	1.03	(0.58-1.83)	0.90	(0.46-1.74)	0.90	(0.46-1.76)
English, US-born	1.12	(0.81-1.54)	1.23	(0.88-1.70)	1.26	(0.90-1.75)
Weight status (by Body Mass Index, BMI)						
Normal/underweight (BMI < 25 kg/m^2) (reference)	1.00		1.00		1.00	
Overweight (BMI 25-29.9 kg/m^2)	**1.41**	**(1.08-1.84)**	**1.35**	**(1.03-1.77)**	**1.35**	**(1.03-1.77)**
Obese (BMI ≥ 30 kg/m^2)	**1.94**	**(1.46-2.57)**	**1.94**	**(1.46-2.58)**	**1.92**	**(1.44-2.57)**
No response/missing	**2.02**	**(1.50-2.72)**	**2.07**	**(1.51-2.85)**	**2.15**	**(1.56-2.96)**

Living alone						
No (reference)	1.00		1.00		1.00	
Yes	0.82	(0.65-1.04)	0.80	(0.62-1.02)	0.80	(0.63-1.03)
Social Ties Scale (range 2-6)[e]			**1.11**	**(1.00-1.24)**	1.06	(0.95-1.19)
Social Cohesion and Trust Scale (range 5-25)[f]					**1.04**	**(1.00-1.08)**
Log likelihood statistic	-1265.39		-1172.34		-1159.44	
Variance at Level 1	0.132		0.173		0.178	
Variance at Level 2	0.005		0.021		0.024	
Intraclass correlation (ICC)	0.002		0.015		0.018	

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Neighborhood level data from the 2000 Census.

[b] Mexican-origin concentration is a random effect while the other neighborhood-level variables are fixed effects.

[c] Poverty is defined as 100% of Federal Poverty Level (FPL) based on the 2000 value of $8794 for 1 person. Thus a high poverty neighborhood is defined as a census tract with 20% or greater living below the FPL.

[d] Individual variable data from 2004-2005 HEPESE.

[e] Social ties scale is a combination of 2 items, scored 1-3 each (scale scored from 2-6, high=more social ties): How many of your relatives/family members live in your neighborhood? How many friends live in your neighborhood?

[f] Social cohesion and trust scale is a combination of 5 items, scored 1-5 each (scale scored from 5-25, high=more social cohesion). Based on Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. Science, 277(5328), 918-924.

[g] Model 1: Full model with Mexican-origin ethnic concentration with neighborhood- and individual-level controls.

[h] Model 2: Model 1 plus social ties scale.

[i] Model 3: Model 1 plus social ties scale and social cohesion and trust scale.

Table 4.3. Multilevel logistic regression models of neighborhood characteristics predicting diabetes with the addition of business ownership measures. Unweighted.

	Model 1[j]		**Model 2[k]**		**Model 3[l]**	
	(n=2,069)		(n=2,069)		(n=2,069)	
Neighborhood-level Variables [a]	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Mexican-origin Concentration of census tracts[b]						
Low (≤60%) (reference)	1.00		1.00		1.00	
Mid (61-77%)	0.82	(0.61-1.11)	0.81	(0.60-1.09)	0.81	(0.60-1.10)
Enclave (> 77%)	**0.66**	**(0.46-0.93)**	**0.63**	**(0.44-0.90)**	**0.66**	**(0.46-0.94)**
Poverty Concentration of census tract[c]						
Low (<20%) (reference)	1.00		1.00		1.00	
High (≥20%)	0.95	(0.72-1.25)	0.92	(0.70-1.22)	0.98	(0.74-1.30)
Foreign-born Concentration						
Low (<30%) (reference)	1.00		1.00		1.00	
High (≥30%)	1.25	(0.97-1.62)	1.25	(0.97-1.62)	1.26	(0.98-1.63)
Individual-level Variables[d]						
Age, years	**0.94**	**(0.92-0.96)**	**0.94**	**(0.92-0.96)**	**0.94**	**(0.92-0.96)**
Gender						
Male (reference)	1.00		1.00		1.00	
Female	**1.23**	**(1.00-1.50)**	**1.23**	**(1.00-1.50)**	1.23	(1.01-1.51)
Household Income						
< $10,000 (reference)	1.00		1.00		1.00	
Between $10,000 - 19,999	1.17	(0.93-1.49)	1.16	(0.92-1.47)	1.17	(0.93-1.49)
≥ $20,000	0.97	(0.68-1.39)	0.97	(0.68-1.39)	0.97	(0.68-1.39)
No response/missing	0.80	(0.57-1.10)	0.80	(0.57-1.10)	0.80	(0.58-1.11)
Education						
HS grad or higher (reference)	1.00		1.00		1.00	
7th-11th grade	0.89	(0.61-1.29)	0.89	(0.61-1.29)	0.88	(0.60-1.28)
4th-6th grade	1.04	(0.72-1.49)	1.04	(0.73-1.49)	1.03	(0.72-1.48)
≤ 3rd grade	1.13	(0.78-1.63)	1.13	(0.78-1.63)	1.12	(0.77-1.62)
No education	1.06	(0.72-1.56)	1.06	(0.72-1.57_	1.04	(0.71-1.54)
Language and Nativity						
Spanish, Mexican-born (reference)	1.00		1.00		1.00	
Spanish, US-born	1.15	(0.91-1.45)	1.15	(0.91-1.45)	1.14	(0.91-1.44)
English, Mexican-born	1.03	(0.58-1.83)	1.04	(0.59-1.86)	1.03	(0.58-1.83)
English, US-born	1.12	(0.81-1.54)	1.12	(0.81-1.54)	1.10	(0.80-1.52)
Weight status (by Body Mass Index, BMI)						

Normal/underweight (BMI < 25 kg/m^2) (reference)	1.00		1.00		1.00	
Overweight (BMI 25-29.9 kg/m^2)	**1.41**	**(1.08-1.84)**	**1.41**	**(1.08-1.84)**	**1.41**	**(1.08-1.84)**
Obese (BMI ≥ 30 kg/m^2)	**1.94**	**(1.46-2.57)**	**1.94**	**(1.46-2.57)**	**1.92**	**(1.45-2.55)**
No response/missing	**2.02**	**(1.50-2.72)**	**2.03**	**(1.51-2.74)**	**2.01**	**(1.49-2.70)**
Living alone						
No (reference)	1.00		1.00		1.00	
Yes	0.82	(0.65-1.04)	0.81	(0.64-1.03)	0.83	(0.65-1.05)
Ratio of Latino-owned businesses in census tract[e]			1.42	(0.73-2.74)		
Count of type of business per census tract (food store businesses)[f]					0.97	(0.89-1.06)
Count of type of business per census tract (restaurant businesses)[g]					0.99	(0.94-1.04)
Count of type of business per census tract (recreational businesses)[h]					0.91	(0.78-1.08)
Count of type of business per census tract (social businesses)[i]					1.01	(0.98-1.04)
Log likelihood statistic	-1265.39		-1264.85		-1264.29	
Variance at Level 1	0.132		0.114		0.138	
Variance at Level 2	0.005		0.002		0.010	
Intraclass correlation (ICC)	0.002		<0.001		0.019	

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Neighborhood level data from 2000 Census.

[b] Mexican-origin concentration is a random effect while the other neighborhood-level variables are fixed effects.

[c] Poverty is defined as 100% of Federal Poverty Level (FPL) based on the 2000 value of $8794 for 1 person. Thus a high poverty neighborhood is defined as a census tract with 20% or greater living below the FPL.

[d] Individual variable data from 2004-2005 HEPESE.

[e] Ratio of Latino-owned businesses per census tract defined as number of Latino-owned businesses over total businesses per census tract. Data from Infogroup using 2010 Census tract identifications.

[f] Based on 2002 NAICS codes. Food store businesses include retail stores that sell food and beverages (but are not restaurants), including grocery stores, specialty food, and alcohol. (Codes include 4451=grocery stores, 4452=specialty food stores)

[g] Restaurant businesses include restaurants, small eating places, and snack or non-alcoholic beverage places (Codes include 722=Food services and drinking places)

[h] Recreational businesses include arts and entertainment industries, including spectator sports and performing arts. (Codes include 71=arts, entertainment, and recreation)

[i] Social businesses include personal care services, such as beauty salons and barber shops, and religious and civic organizations. (Codes include 81=other services, except public administration)

[j] Model 1: Full model with Mexican-origin ethnic concentration with neighborhood- and individual-level controls.

[k] Model 2: Model 1 plus proportion of Latino-owned businesses.

[l] Model 3: Model 1 plus count of type of businesses with Latino ownership.

CHAPTER 5: The enclave effect on depression among older Mexican-origin adults – do social networks or Latino-owned businesses explain the relationship?

This chapter seeks to establish the relationship between neighborhood Mexican-origin concentration and depression risk, as well as the underlying mechanisms. Previous research has shown a protective enclave effect on a variety of health outcomes, including for depression. This analysis will examine predictors of depression risk to confirm or counter previous research about possible protective mechanisms. The depression risk measure is based on the Center for Epidemiological Studies-Depression (CES-D) scale, a 20-item scale with an established cut-off score of 16 or greater, indicating depression risk (CES-D, Accessed April 2016). I first examine the effect of Mexican-origin concentration controlling for neighborhood and individual level variables. I then examine the potential mediating or moderating role of social networks measured by a social ties scale and the social cohesion and trust scale. Finally I assess if the business environment plays a mediating or moderating role in the enclave and depression association. I present the analyses results and discuss the findings for the three research questions.

5.1 What is the effect of enclaves on depression risk?

5.1.1 Results: Depression and the enclave effect

As with the diabetes models, several models are presented for the depression outcome. The empty model (data not shown), which examines variation in depression rates by census tract with no predictors, is statistically significant (log likelihood of -953.53, constant = -1.45, $p<0.001$). While the variance between census tracts is minimal (0.44), the model indicates there are some differences in depression risk between neighborhoods. Table 5.1 Model 1, the bivariate model, only includes the neighborhood Mexican-origin concentration variable. Model 2 adds the

neighborhood-level control variables, Model 3 includes the individual-level control variables with only the neighborhood ethnic concentration, and Model 4 is the full model with both neighborhood- and individual-level controls. For all models I use a random intercept and a random effect for the neighborhood ethnic concentration variable, all other variables are fixed effects. This allows for variation of the ethnic concentration between neighborhoods independent of the individual effects.

In the bivariate model, Table 5.1, Model 1, I find that depression rates are statistically similar for all levels of neighborhood Mexican-origin concentration, although there is a pattern of increasing ethnic concentration resulting in lower odds of depression. Lacking statistical significance, the bivariate model shows there is no protective effect by the ethnic enclave for depression. A log likelihood test comparing the empty multilevel model for depression risk and the bivariate, Model 1, shows that adding the ethnic concentration variable does not improve the fit of the model.

Model 2 includes the enclave variable, the random effect, along with neighborhood-level controls as fixed effects. The relationship between the ethnic enclave category and depression is strengthened, with an OR of 0.66, however it is not significant at a p-value of 0.09 controlling for neighborhood poverty and neighborhood immigrant concentration. Neighborhood poverty itself is not significantly associated with depression. However high immigrant neighborhoods are a risk factor for depression, with 1.46 higher odds of depression for high immigrant neighborhoods compared to low immigrant neighborhoods, with a p-value of 0.03, controlling for ethnic concentration and poverty level of a neighborhood.

The next model, Model 3, examines the Mexican-origin neighborhood concentration variable with individual-level controls. As in the previous models, the ethnic enclave variable is

not significantly associated with depression. Among the individual level variables significant predictors of depression include: gender, language and nativity, needing assistance with at least one activity of daily living (ADL), having at least one of four health conditions, and living alone. Females have 1.5 higher odds of depression compared to males. Additionally, U.S. born Spanish speakers have lower odds of depression, 0.63, compared to Mexican-born Spanish speakers. There is no difference between English speakers, both US and foreign-born, and Mexican-born Spanish speakers. Among the health conditions, having any ADL results in 3.27 higher odds for depression and having any one of four health conditions results in 1.69 higher odds. Living alone is also a risk factor for depression, with 1.71 higher odds compared to those not living alone. There are no statistical differences in depression risk by age, household income, education, or having recently moved.

The final full model, Table 5.1 Model 4, includes both neighborhood- and individual-level controls. The associations found in previous models are consistent in the full model. However controlling for neighborhood- and individual-level characteristics, those living in an ethnic enclave now have statistically significant lower odds of depression risk, 44%, compared to those living in a low ethnic neighborhood. Once I control for both neighborhood- and individual-level controls in the full model, the ethnic enclave becomes statistically significant and provides a protective effect. Alternatively, living in a high immigrant neighborhood continues to be a significant risk factor for depression risk, with 58% high odds of depression risk, controlling for neighborhood- and individual-level characteristics. This relationship is slightly strengthened in the full model compared to the model with only neighborhood variables. Neighborhood poverty is not statistically significant in any model, although it follows a protective pattern with increasing neighborhood poverty associated with lower odds of depression.

The individual level predictors remain the same in the full model as in the previous model. Females have 52% greater odds of depression compared to men, with a p-value of 0.004. Additionally U.S.-born Spanish speakers have 34% lower odds of depression, compared to Mexican-born Spanish speakers. Having any ADL increases the odds of depression by 3.37 and having any one of four health conditions increases the odds of depression by 65%. Living alone is also a risk factor to depression, with those living alone having 1.72 higher odds of depression compared to those not living alone, controlling for neighborhood and individual characteristics. There is no difference in depression risk by household income, education, or having recently moved.

Using a log likelihood test I compared the fit of the models in Table 5.1. Model 4, the full model, provides a statistically significant better fit than Model 1, the bivariate. The driving force comes from the individual-level variables as Model 3 also has a significantly better fit than Model 1, but Model 2 with only neighborhood-level variables does not. The intraclass correlation (ICC) is used to provide information on how much of the variance is due to contextual effects as opposed to individual effects. Using the ICC, the full model indicates that 0.2% of the variability in depression risk is due to neighborhood differences. Thus while the full model does not explain much of the between neighborhood differences in depression risk, the empty model did indicate that there was some difference at the neighborhood-level for depression risk.

Sensitivity analyses

I examine two variations to the full model. First I removed the variable controlling for years since moved into home and examine the effect on the full model. Next, I test the full model using the neighborhood immigrant concentration as the random effect in the multilevel model,

which is important since immigrant concentration was a neighborhood-level predictor for depression risk.

When I initially began building the full model and considering relevant variables to control for, I examined the full models with and without the recently moved variable. In the diabetes analysis, Chapter 4, controlling for years since moved into home did not have an impact on any of the predictors, thus in order to create a parsimonious model I did not include recently moved in the final full model. However for the depression risk analysis including the recently moved variable has an important effect on the ethnic concentration variable. When the variable for recently moved in home is removed from the full model, the ethnic enclave category loses statistical significance. Controlling for recently moving into home, along with the neighborhood- and individual-level variables, living in an ethnic enclave is significantly protective of depression risk. The high immigrant concentration variable remained a statistically significant risk factor for depression. Recently moving to home is itself not a predictor of depression. The amount of time a respondent has lived in their neighborhood could potentially impact their level of social embededness within the neighborhood, which could affect social ties or social cohesion. Those with less time in their home may have fewer social networks established in their neighborhood, as well as less familiarity with available services. Therefore, those living in a new neighborhood may experience more isolation and less familiarity with resources, including social events or services. Social networks and social isolation are important factors to consider when examining depression risk, which may explain why the recently moved variable has an impact on the ethnic enclave and depression relationship but not the ethnic enclave and diabetes association.

In determining depression risk, controlling for recently moved to home resulted in a significant ethnic enclave effect. It appears that there are differences in the ethnic enclave and depression risk relationship by having recently moved. To further explore this I include an interaction variable between ethnic concentration and recently moved to the full model (data not shown). The interaction variable is statistically significant. I then stratify the full model by those who have recently moved and those who have not. The resulting table, Table 5.2 demonstrates that among those that recently moved, Model 1, there is no statistical difference by ethnic concentration of the neighborhood. Among those that have not recently moved, Model 2, there is also no statistical difference by neighborhood ethnic concentration. However the ethnic enclave category does approach significance with those in the enclave who have not recently moved having 39% lower odds of depression risk with a p-value of 0.075. One limitation is the small sample size of those that have recently moved, 245 respondents, thus the power may not be large enough to detect a difference. It may also be that having moved recently only impacts those living in the low ethnic neighborhoods. When I stratify by neighborhood ethnic concentration (data not shown), those that recently moved do have higher odds of depression risk, however this is not statistically significant. By comparison, those that have recently moved have lower odds of depression risk within the mid and high ethnic neighborhoods compared to those that have not recently moved, but these associations are also not statistically significant.

All models in Table 5.1 are multilevel models with a random intercept and a random effect for the neighborhood Mexican-origin concentration variable. As a sensitivity analysis I examined the neighborhood immigrant concentration variable as the random effect for the full model predicting depression risk. I only used one random effect at a time because the model would not converge using two random effects, indicating the instability of the model with more

than one random effect. When using immigrant concentration as the random effect, the relationships in the full models were consistent with minimal changes. The main difference is the odds ratios for high immigrant neighborhood and ethnic enclave are slightly strengthened. In the full model with a random effect for neighborhood immigrant concentration, a high immigrant neighborhood results in 1.82 higher odds of depression risk and the ethnic enclave results in 0.49 lower odds of depression risk, compared to odds ratios of 1.58 for high immigrant neighborhoods and 0.56 for ethnic enclaves in models with the ethnic concentration as the random effect. Thus, allowing the model to use the immigrant concentration as the random effect does not alter the results. While there appears to be differences in depression risk by neighborhood immigrant concentration, allowing for variation at the neighborhood-level does not change the findings. I further analyze the immigrant neighborhood effect in the next section and examine if the risk effect I found can be explained by other factors, such as social networks.

5.1.2 Discussion: Depression and the enclave effect

The depression analysis finds that depression rates vary by neighborhood ethnic concentration, with the ethnic enclave providing a protective effect when controlling for neighborhood- and individual-level characteristics, including having recently moved. I also find differences by neighborhood immigrant concentration, with a high immigrant neighborhood a risk factor for depression. My hypothesis is supported for ethnic enclaves, but the immigrant neighborhood impact is unexpected.

Previous research has yielded mixed results in the associations between ethnic enclaves and depression. Many studies have identified associations between the ethnic concentration of a neighborhood and health, including depression rates (Gerst et al., 2011; Ostir et al., 2003; Shell

et al., 2013). However other neighborhood studies have found variations in the relationship between neighborhood racial or ethnic composition and depression. For example, Mair et al (2010) did not find a statistically significant association between racial concentration and depression among Latinos, although the pattern was protective. Denton et al (2015) did not find a protective ethnic enclave effect for depression for foreign-born Latinos, but did find a positive association for U.S. born Latinos. As research continues to examine the intricacies of neighborhood effects and health, we begin to see that the health benefits of ethnic enclave are not clear-cut and may vary.

In this study I find that the ethnic neighborhood has a protective effect on depression risk, while a high immigrant neighborhood is a risk factor. While this does not fall in line with most of the enclave research, there may be a couple reasons for these findings. First, by including both the ethnic concentration and the immigrant concentration of a neighborhood, I am able to better isolate the distinct neighborhood characteristics by only measuring the ethnic concentration. Most studies do not distinguish between the ethnic and immigrant concentrations of a neighborhood. In this sample 18% of the respondents live in high immigrant, low ethnic neighborhoods and 12% live in high ethnic, low immigrant neighborhoods. By controlling for one or the other, the analysis allows me to distinguish the effects of each neighborhood characteristic for depression. This may lead to different results when compared to previous studies that have found decreased depression risk for those living in an enclave.

Secondly, a high immigrant neighborhood may result in greater depression risk than lower immigrant neighborhoods. For example, high immigrant neighborhoods may have limited resources, fewer social networks, or limited community safety, which may result in higher depression risk. The fear of deportation, even for those who are residents of the U.S., may have

psychological effects that echo through a community (Sabo & Lee, 2015; Salas-Wright, Robles, Vaughn, Cordova, & Perez-Figueroa, 2015). For high immigrant neighborhoods this fear may translate into fewer social events or opportunities to congregate and forge friendships and ties. The high immigrant neighborhoods may also be isolating if there is high variation in the home countries of the immigrants. A neighborhood with immigrants from a variety of countries may have more difficulty creating an environment of support and camaraderie. The process of living in a new country will be more difficult if the residents do not share a language or culture. This can result in increased isolation, fewer outlets for creating social networks, a more difficult adjustment process, and potentially higher risk for depression. While this may not be as overt if the immigrants are all from Latin America, there are still cultural differences between Latin American countries that could result in divisions between residents. Lastly, differences in a high ethnic neighborhood and a high immigrant neighborhood can result in different health effects, which I explore in more detail below.

Furthermore, the sensitivity analysis revealed that controlling for recently moving into home resulted in a high ethnic neighborhood being protective of depression. While an ethnic enclave was protective of depression in the full model, it was not statistically significant until controlling for recently moving into home. Time in the neighborhood may be an important mechanism in the ethnic enclave and depression relationship. Additionally, when I include neighborhood immigrant concentration as the random effect in the full model, again the ethnic enclave variable becomes statistically significant and protective of depression risk. My findings for depression risk have produced different results compared to previous enclave research by examining specific neighborhood characteristics as well as measuring distinct factors that may explain the underlying mechanisms of the neighborhood and health relationship.

At the individual level, research has shown depression to be more likely among females, those with a disability or an illness, and those living alone (Penninx et al., 1999; Roberts et al., 1997). This study supports previous research finding gender, ADLs, chronic conditions, and living alone as risk factors for depression. The individual level predictors of depression also include some interesting results for language and nativity. Nativity and language offers a protective effect, with Spanish speaking US-born Mexican-Americans having lower odds of depression compared to Spanish speaking Mexican-born individuals. It appears that being born in the U.S. is protective of depression compared to the foreign-born, but mainly for those that also speak Spanish

U.S.-born Spanish speakers have lower odds of depression compared to Mexican-born Spanish speakers. In order to examine the effect of each variable I also ran the multilevel logistic regression model with individual language preference and nativity variables (data not shown). In the full model with neighborhood- and individual-level controls, depression rates do not vary by language of interview, however nativity is a predictor of depression. Specifically, U.S.-born respondents have 44% lower odds of depression compared to Mexican-born respondents. While this in itself is surprising since research has found that U.S.-born Latinos usually have worse health than Latino immigrants, the combined language and nativity variable provides a more nuanced picture. It is actually those that speak Spanish and are born in the U.S. that experience lower odds of depression compared to Spanish speaking foreign-born respondents. While U.S.-born Latinos are more likely to speak English, in this sample the percentage that prefer Spanish and are born in the U.S. is fairly large, 39%. This makes sense since the Hispanic EPESE samples elder Mexican-origin adults in the Southwest. Thus while U.S.-born Latinos experience a protective effect, it is those that speak Spanish that experience the most protection. While not a

focus of this study, there may be some interesting reasons why those that speak Spanish and are born in the U.S. have lower depression risk. Being a U.S. citizen and growing up in the U.S. affords some benefits and the ability to navigate in Spanish and English may allow for more support and access to a greater variety of networks. If we consider speaking Spanish as a proxy for limited acculturation, those born in Mexico may have fewer social networks and greater limitations than the U.S.-born, regardless of the ethnic or immigrant concentration of their neighborhood.

5.2 Social Network Effects on the Enclave and Depression Relationship

In the previous section I establish that living in an enclave, or a high concentration Mexican-origin neighborhood, is associated with depression risk, controlling for both neighborhood- and individual-level characteristics including having recently moved. This association is consistent with research of enclave effects on health outcomes, including depression. However this study also finds that living in a high immigrant neighborhood is a risk factor for depression compared to living in a low immigrant neighborhood. In this next section I explore possible mechanisms, specifically if social networks impact the ethnic and immigrant neighborhood and depression relationship. As with the diabetes models, I measure social networks using a social ties measure and the social cohesion and trust measure.

5.2.1 Results: Social network effects

Social Ties Scale

Table 5.3 begins with the full model previously seen in Table 5.1. To review, in Model 1 I control for neighborhood- and individual-level characteristics and find a protective association between neighborhood Mexican-origin concentration and depression risk, as well as increased

odds of depression risk for respondents living in high immigrant neighborhoods compared to those in low immigrant neighborhoods. For Model 2 I add the social ties scale, which is a combination of the respondent reporting family and/or friends present in their neighborhood. The social ties scale was recoded and summed so that the lowest possible value, 2, represents no family or friends in the neighborhood and a value of 6 represents the highest possible value of "many" or "most" family and friends in the neighborhood. The multilevel logistic regression model shows that the social ties scale, controlling for neighborhood- and individual-level characteristics, is protective of depression, with increasing social ties resulting in lower odds of depression. A one-point increase on the social ties scale is associated with a 20% decrease in depression risk, significant at $p< 0.05$. As expected, increasing social ties results in lower risk of depression. All of the individual level predictors that were significant in Model 1 continue to be statistically significant when adjusting for social ties.

Test for Mediation

In the second research question I hypothesize that social networks will have a mediating effect on the enclave and depression relationship. In terms of the ethnic enclave, once I add the social ties scale in Model 2 the ethnic enclave variable loses statistical significance, indicating mediation by the social ties measure of the ethnic enclave and depression relationship. The high immigrant neighborhood association with depression risk results in a slightly lower odds ratio with the addition of the social ties measure, but it still remains statistically significant, indicating partial mediation at most.

As part of the mediation analysis I also examined the individual bivariate relationships between ethnic enclaves and social ties, as well as social ties and depression risk. This is similar to the analysis from Chapter 4 for diabetes. Appendix A, Table A.5 presents the bivariate

analysis of Mexican-origin concentration and the social ties scale, finding no difference in social ties score by Mexican-origin concentration. Since neighborhood immigrant concentration was a predictor for depression risk I also examined the bivariate relationships for an immigrant neighborhood. Table A.9 shows that living in a high immigrant neighborhood results in statistically significant lower social ties. In Appendix A I also examine the bivariate relationship between the social ties scale and depression risk, Table A.10, indicating that a one-point increase in the social ties scale results in 16% lower odds of depression risk, significant at $p<0.01$. Thus the mediation observed by the social ties scale for the ethnic enclave and depression risk association is a result of the negative association between the social ties scale and depression risk.

Test for Moderation

In order to test for a moderation effect of social ties, I include an interaction variable of the ethnic neighborhood variable and the social ties scale (data not shown). The interaction variable is not statistically significant, thus the ethnic enclave and depression association does not vary by level of social ties. Social ties do not moderate the protective ethnic enclave effect on depression.

I also use an interaction variable between immigrant neighborhood and social ties (data not shown). The interaction variable is not statistically significant and the main effects are also not significant. The social ties scale does not moderate the relationship between immigrant neighborhood concentration and depression risk.

Social Cohesion and Trust Scale

I continue to examine the role of social networks by adding the social cohesion and trust scale to the full model with the social ties scale, with results presented in Table 5.3 Model 3. The social cohesion and trust scale was measured at the individual level. Model 3 indicates that

increasing levels of social cohesion result in lower odds of depression risk, with an odds ratio of 0.93 and a p-value < 0.01. In other words, a one-point increase in social cohesion reduces the odds of depression by 7%. This relationship was expected as it has been theorized that increased social networks, measured by social cohesion in this case, results in better health and thus lower odds of having a disease. However, the addition of the social cohesion and trust scale and controlling for its effect impacts several other predictors.

Controlling for social cohesion and trust results in an increase in the odds ratio of the social ties variable making the social ties scale no longer significant. Adjusting for social cohesion reduces the impact of social ties where there is no longer any association between social ties and depression risk. As measures of social networks, the social cohesion and trust scale appears to account for the effect of the social ties measure. In a sensitivity analysis, I include the social cohesion and trust scale into the full model without the social ties measure and the relationship between social cohesion and depression remains the same (data not shown). The social cohesion and trust scale consistently remains a protective predictor of depression risk.

Furthermore, in Table 5.3 Model 3, the neighborhood variables are no longer significant when I control for social ties and social cohesion together. Thus controlling for social cohesion results in no difference in depression risk by neighborhood level characteristics, including the ethnic enclave and immigrant neighborhood variables. This is also true when the social cohesion and trust variable is added to the model alone without the social ties scale (data not shown).

The individual level predictors remain the same with the addition of the social cohesion variable in Model 3. Being female, having one or more ADLs, having one or more health conditions, and living alone continue to be risk factors for depression risk, controlling for social cohesion. Being a US-born Spanish speaker is protective of depression when compared to

Mexican-born Spanish speakers. The odds ratio between nativity/language, and depression risk increases slightly, indicating that social ties and social cohesion are responsible for some of the protective effect we see for those who are born in the U.S. and speak Spanish.

Test for Mediation

The goal of the second research question is to determine whether social networks play a mediating or moderating role in the enclave and depression relationship. Adding the social cohesion and trust measure did result in loss of statistical significance between the ethnic enclave and depression association, as well as for the immigrant neighborhood and depression association. Both the social ties scale and the social cohesion and trust measure when added individually and together to the full model result in mediation of the ethnic enclave and depression risk association. Thus the protective effect of living in an ethnic enclave on depression risk can be explained by the social networks of the respondents. The social cohesion and trust scale also mediates the risk effect of living in a high immigrant neighborhood on depression risk. Thus the social cohesion and trust measure accounts for some of the neighborhood-level effects on depression risk that had resulted in previous models and tables.

Moreover, a likelihood ratio test found that Model 3 with the social ties and social cohesion scales was a better model compared to the full model, Model 1. However when I compared the parameters, of the odds ratios of the ethnic enclave between Model 1 and Model 3, the effect differences were not statistically significant. In interpreting the mediation impact of the social networks, especially the social cohesion and trust scale, I use caution in stating whether mediation was fully observed.

To further explore the mediation effect, I examined the bivariate relationships between the enclave and social cohesion, as well as social cohesion and depression risk (see Appendix A).

Table A.7 shows that neighborhoods with higher ethnic concentrations do lead to higher levels of social cohesion and Table A.12 indicates that increased social cohesion is associated with lower odds of depression risk. Thus I can confirm some mediating impact of the social cohesion and trust measure on the ethnic enclave and depression risk relationship. Comparably, in Table A.11 living in a high immigrant neighborhood results in a lower social cohesion and trust score, while in Table A.12 the social cohesion and trust measure is negatively associated with depression. The mediation of social cohesion and trust on the immigrant neighborhood and depression relationship is not as definitive as indicated by the bivariate models. Not surprisingly, the change in the odds ratio of the immigrant neighborhood variable when added to the model, Table 5.3 Model 3, is enough to barely lose significance.

Test for Moderation

In order to test for a possible moderation effect of the social cohesion and trust scale, I used an interaction variable between neighborhood Mexican-origin concentration and social cohesion. Since immigrant concentration had a significant association with depression risk, I also used an interaction variable between neighborhood immigrant concentration and social cohesion, although the interactions were included separately (data not shown). Neither interaction terms were statistically significant, indicating that social cohesion does not moderate the relationship between neighborhood ethnic concentration and depression or neighborhood immigrant concentration and depression.

5.2.2 Discussion: Depression, Enclaves and Social Networks

Social networks, as measured by social ties and social cohesion, do have some mediating effect on the ethnic enclave and depression association, as well as for the immigrant neighborhood and depression relationship. Additionally, social ties and social cohesion

individually are protective of depression risk. My hypothesis that social networks mediate the relationship between ethnic enclaves and depression risk is supported.

There are two important findings from these analyses. First, social ties and social cohesion are protective of depression risk, providing further support to the hypothesis that social networks can be protective of health, in this case for older Mexican-origin adults. However the protective effect was only seen for depression risk and not for diabetes. Secondly, mediation by social networks was found for high ethnic neighborhoods, and partially for high immigrant neighborhoods. There may be several reasons for these two findings, which I discuss below.

Research has shown that social support can be protective of health (Berkman et al., 2000; Broadhead et al., 1983), and this may be especially true for mental health (Echeverria, 2008; Mair et al., 2010; Vega & Rumbaut, 1991). In this study social ties and social cohesion were individually protective of depression risk, controlling for neighborhood- and individual-level factors. Having family and/or friends close by can result in less isolation and provide more support for the older adult, decreasing the risk of depression. The same is true for feelings of connectedness with your community, as measured by the social cohesion and trust scale. The social resources in a neighborhood can also provide more opportunities for friendship and assistance, and serve as a resource if mental health issues occur.

Additionally, the concrete association between social networks and depression corresponds with the mediation effect we see from social networks in the ethnic enclave and depression relationship. When adding the social ties and/or the social cohesion scale to the full model, the ethnic enclave odds ratio increases and is no longer statistically significant association with depression risk. Once I control for differences in social ties and social cohesion among individuals, there are no differences in depression risk by neighborhood ethnic concentration;

indicating that social networks explain the protective effect of enclaves observed in previous models. For depression risk, social networks explain the protective effect of ethnic enclaves for older Mexican-origin adults living in the Southwest. Other research has found similar results. Shell et al (2013) observed mediation by social support, discrimination, and perceived stress for the ethnic neighborhood and depression relationship for a sample of Mexican-origin adults in Texas. Alternatively, Mair et al (2010) did not find mediation by social cohesion but recommended the use of other social measures such as social capital or social control, which might be informative in explaining the protective enclave effect for depression that they observed. Thus there is some evidence of social networks playing an important role within enclaves in protecting against depression across adult age groups, but further research is needed, especially in exploring various dimensions of social networks and why they may be important for depression and other mental health outcomes.

In this study I also found partial mediation of the immigrant neighborhood and depression risk association by social cohesion and trust. While the odds ratio for the immigrant neighborhood and depression association was no longer significant when I included social cohesion in the model, the change was minimal and barely non-significant at p=0.054. Analyzing the bivariate relationships also highlighted the fact that a high immigrant neighborhood was associated with a lower social cohesion score (Appendix A, Table A.11). This makes sense since high immigrant neighborhoods have a lower mean social cohesion score in comparison to lower immigrant neighborhoods. This indicates that living with other immigrants does not always lead to higher social cohesion, despite the shared migration experience and potential cultural and language similarities. Although seldom tested, a couple studies confirm that immigrants have lower levels of social ties or social cohesion in comparison to the U.S.-born (Mulvaney-Day et

al., 2007; Viruell-Fuentes et al., 2013). Social cohesion appears to play an important role in linking neighborhood characteristics with depression risk, however its impact differs for an ethnic enclave versus an immigrant neighborhood.

5.3 Effect of the Business Environment on the Enclave and Depression Relationship

As with social networks, I hypothesize that the business environment is an important aspect in the identity and formation of enclaves. In this section I examine the role of the business environment on the enclave-depression relationship, in particular the potential moderating effect.

5.3.1. Results: The role of the business environment

Table 5.4 includes three models, with the first, Model 1, serving as a reference point of the full model with the neighborhood- and independent-level controls. Model 2 adds the ratio of Latino-owned businesses per census tract.[o] In Model 3 I include the type of businesses owned by Latinos to the full model. There are four types of businesses that may be relevant to health: food stores, restaurants, recreational, and social businesses. The types of businesses are a count per census tract and are Latino-owned.[p]

In Model 2 an increasing ratio of Latino-owned business is protective of depression, with an odds ratio of 0.76, however this is not statistically significant. Thus there is no difference in

[o] The ratio of Latino-owned businesses per census tract measures the number of Latino-owned businesses over total businesses for a census tract. The number of total businesses was only available using 2010 Census tract information, this this measure uses both Latino-owned businesses and total businesses using the 2010 Census tract identifiers. The Hispanic EPESE used census tract identifiers from the 2000 Census. As a sensitivity analysis I use the count of Latino-owned businesses based on the 2000 Census tract identifiers, finding no difference in the results (see Appendix B).

[p] For types of Latino-owned businesses I was only able to include a count of the businesses. I did not have the total number of businesses for each specific type and was unable to create a ratio.

depression risk by the level of Latino-ownership in a neighborhood. The ethnic enclave odds ratio in Model 2 remains the same as in Model 1, with respondents living in an ethnic enclave having 43% lower odds of depression risk compared to those living in a low ethnic neighborhood, significant at $p<0.05$. Similarly, the effect of neighborhood immigrant concentration on depression does not change with the addition of the business variable. Overall, the individual-level variables do not change with the addition of the measure for Latino-owned businesses. There is minimal impact on the neighborhood- and individual-level variables with the addition of the ratio of Latino-owned businesses in a census tract to the model. The ratio of Latino-owned businesses in a census tract also does not have an impact on depression risk.

In addition to examining the impact of Latino-owned businesses, I use general measures of four types of Latino-owned businesses that may have an impact on health. In Model 3 I included a count of Latino-owned food stores, restaurants, recreational businesses, and social businesses. The four types were identified using North American Industry Classification System (NAICS) codes. Model 3 presents all four types of Latino-owned businesses at once. I also tried each individually, but there was little difference thus I chose to add all together. None of the types of Latino-owned businesses have a statistically significant effect on depression risk. An increasing number of food-related stores is slightly protective of depression but is not statistically significant. Also, adding the types of businesses into the model results in minimal changes to the ethnic enclave and the immigrant concentration variables.

Test for moderation

In order to test if Latino businesses moderate the ethnic enclave and depression risk association, I included an interaction variable of the ratio of Latino-owned businesses per census tract and the ethnic enclave variable. The interaction was not statistically significant, thus there is

no moderation by the ratio of Latino-owned businesses per census tract. Since neighborhood immigrant concentration was a risk factor for depression risk, I also included an interaction variable of the neighborhood immigrant concentration and the ratio of Latino-owned businesses per census tract. This interaction was also not significant. Latino-ownership of businesses does not moderate the associations between ethnic enclaves and depression risk or immigrant neighborhoods and depression risk.

Sensitivity Analysis

As mentioned above, Table 5.4, Model 2 includes the ratio of Latino-owned businesses by census tract based on 2010 Census data because the total number of businesses per census tract needed to create the ratio was only available based on 2010 census tract identifiers. Since the Hispanic EPESE is based on 2000 Census identifiers, I ran alternative models using the count of Latino-owned businesses based on the 2000 census tract identifiers. I originally had the count of Latino-owned businesses per census tract based on the 2000 Census from the Infogroup data. I used this as one version of Latino-owned businesses. When I include the count of Latino-owned businesses to the full model, results are very similar to Table 5.4, Model 2. The count of Latino-owned businesses is not significantly associated with depression risk, with an odds ratio of 1.00 (data not shown, see Appendix B).

I also used a version of Latino-owned businesses per census tract over the total census tract population based on the 2000 Census. This allowed me examine the ratio of Latino-owned businesses per census tract population. This variable may better capture the concentration of Latino-owned business in the neighborhood since it is being compared to the total neighborhood (census tract) population. Because of its skewness I take the log to create a more normal distribution. Adding the log of Latino-owned businesses per total census tract population results

in similar findings as for the other versions. The ratio of Latino-owned businesses per total census tract population is not significantly associated with depression risk (data not shown). The odds ratios for the other variables in the model do not change much from the full model, Table 5.4, Model 1. Thus, alternative versions of the business variable do not present any new or differing results as what is presented in Table 5.4, Model 2. More importantly, while the ratio of Latino-owned businesses per total businesses per census tract is based on 2010 census tract identifiers, the difference in census tract years has little impact on the findings.

5.3.2 Discussion: Depression, Enclaves, and the Business Environment

This study examined the role of the business environment and its potential moderating effect on the enclave and depression association. Using the ratio of Latino-owned businesses by total businesses per census tract, I found no significant effect on depression as a predictor nor on the enclave and depression relationship. In the analyses I also included types of businesses, which included food stores, restaurants, recreational businesses, and social type establishments, in order to examine the effect of certain types of businesses on the enclave and depression relationship. These also did not have an effect as a predictor or mediator. I reject the hypothesis that a business environment that includes Latino-ownership would serve as a moderator for the enclave and depression association.

There may be a couple of reasons why the Latino-owned businesses did not result in a significant effect on depression risk. One, the current measurements of the business environment may not be addressing the appropriate aspects of the businesses in a neighborhood that would impact health, thus resulting in no effect. Perhaps the types of services provided or the economic benefits to the community may be more important to depression risk or health in general.

Secondly, there may be other business-related mechanisms operating in the enclave and depression relationship that I am not considering in this analysis.

This study defines the business environment as the ratio of Latino-owned businesses and the type of Latino-owned businesses. However these measures were not predictive of depression and did not act as moderators. There may be others aspects of the business environment that are more relevant to depression risk. While there are few studies that consider the business structure of a neighborhood (Subramanian et al., 2006; Yen & Kaplan, 1999), other studies have considered the economic structure of a neighborhood with mixed findings (Cozier et al., 2007; Ortiz & Zimmerman, 2013; Roy, Hughes, & Yoshikawa, 2013; Wen, Browning, & Cagney, 2003). For example, a recent study of homeownership in California did not find an association with self-rated health for Latinos and African Americans, but there was a small protective factor for delay of services and prescriptions (Ortiz & Zimmerman, 2013). Alternatively, a study of African American women did find an inverse relationship between hypertension and neighborhood median home values (Cozier et al., 2007). The health effects may be highly dependent on the neighborhood aspect measured. A broader measure of neighborhood economic stability may be more appropriate and result in observable effects on health as opposed to individual measures of the neighborhood economy (Wen et al., 2003).

In addition to measurement concerns, there may be a different underlying mechanism that links enclaves and depression risk. It may not be based on race/ethnicity, or the type of businesses as this study measures. There may be other business-related measures that are more appropriate for depression risk and health in general, such as business that increase access to health care, socialization, or support. The businesses of a neighborhood may also contribute to the general stability of the neighborhood, which was not captured in this analysis. Additionally,

other factors may explain the association between ethnic or immigrant enclaves and depression risk, such as social networks, cohesiveness of the community, availability of services, places to congregate, community events, or presence of religious institutions. These are all important factors that can create a strong and connected community, potentially minimizing depression risk. Future studies should explore other possible mechanisms linking neighborhood characteristics with health outcomes, including business-related characteristics, in order to better understand what aspects of the neighborhood are important and can be targeted in interventions and policies.

5.4 Summary

This analysis examined the ethnic enclave and depression risk relationship and the potential underlying mechanisms. Using the 2004-2005 Hispanic EPESE, I found ethnic enclaves to be protective of depression risk for older Mexican-origin adults in the Southwest, controlling for neighborhood- and individual-level characteristics. Living in an ethnic enclave resulted in 44% lower odds of depression risk compared to those living in a low ethnic neighborhood. Additionally I observed a mediating effect by a social ties scale and a social cohesion and trust measure, indicating that social networks in part explain the protective enclave effect on depression risk. The business environment, specifically concentration of Latino-owned businesses, did not impact the ethnic enclave and depression risk relationship.

Another important finding in this study was the role of the immigrant neighborhood. Results indicate that living in a high immigrant neighborhood was a risk to depression, controlling for neighborhood- and individual-level characteristics. Some of the risk effect was mediated by the social cohesion and trust measure, however neighborhoods with high immigrant

concentrations were associated with lower social cohesion and trust scores. Latino-owned businesses did not impact the immigrant neighborhood and depression risk association.

These findings emphasize the complexity of a neighborhood and the need for research to examine the various characteristics that might affect health. While there is much overlap in neighborhoods with a high ethnic concentration and a high immigrant concentration, there may be differences in the role of each characteristic. In this study the ethnic neighborhood had a protective role on depression risk and the immigrant neighborhood was a risk to depression. Identifying the intricacies of neighborhood effects and examining the mechanisms operating within neighborhoods is important as research attempts to recognize the role of place and health, but also identifying what can be improved and supported to improve health.

5.5 Tables

Table 5.1 Multilevel logistic regression models of neighborhood- and individual-level characteristics predicting depression risk. Unweighted.

	Model 1[e]		**Model 2**[f]		**Model 3**[g]		**Model 4**[h]	
	(n=1,902)		(n=1,902)		(n=1,803)		(n=1,803)	
Neighborhood-level Variables[a]	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Mexican-origin Concentration of census tracts[b]								
Low (≤ 0.6) (reference)	1.00		1.00				1.00	
Mid (0.61-0.77)	0.86	(0.59-1.25)	0.85	(0.56-1.27)	0.86	(0.56-1.32)	0.88	(0.57-1.38)
Enclave (> 0.77)	0.79	(0.53-1.17)	0.66	(0.41-1.07)	0.66	(0.42-1.02)	**0.56**	**(0.33-0.95)**
Poverty Concentration of census tract[c]								
Low (<20%) (reference)			1.00				1.00	
High (≥20%)			0.89	(0.62-1.29)			0.84	(0.55-1.27)
Foreign-born Concentration of census tract								
Low (≤30%) (reference)			1.00				1.00	
High (>30%)			**1.46**	**(1.05-2.03)**			**1.58**	**(1.09-2.28)**
Individual-level Variables[d]								
Age, years					0.99	(0.96-1.07)	0.99	(0.96-1.02)
Gender								
Male (reference)					1.00		1.00	
Female					**1.53**	**(1.15-2.03)**	**1.52**	**(1.15-2.01)**
Household Income								
< $10,000 (reference)					1.00		1.00	
Between $10,000 - 19,999					1.11	(0.80-1.53)	1.10	(0.80-1.52)
≥ $20,000					0.96	(0.57-1.60)	0.91	(0.55-1.52)
No response/missing					1.12	(0.72-1.75)	1.09	(0.70-1.70)
Education								

HS grad or higher (reference)			1.00		1.00	
7th-11th grade			1.02	(0.59-1.75)	0.97	(0.56-1.67)
4th-6th grade			1.25	(0.74-2.10)	1.21	(0.72-2.03)
≤ 3rd grade			1.53	(0.90-2.60)	1.50	(0.89-2.53)
None			1.65	(0.95-2.89)	1.62	(0.93-2.82)
Language and Nativity						
Spanish, Mexican-born (reference)			1.00			
Spanish, US-born			**0.61**	**(0.45-0.84)**	**0.66**	**(0.48-0.90)**
English, Mexican-born			1.19	(0.58-2.46)	1.27	(0.62-2.62)
English, US-born			0.74	(0.48-1.15)	0.80	(0.51-1.23)
Activities of Daily Living (ADL)						
None (reference)			1.00		1.00	
One or more ADLs			**3.27**	**(2.46-4.34)**	**3.37**	**(2.54-4.48)**
Health conditions						
None (reference)			1.00		1.00	
One or more health conditions (diabetes, heart attack, cancer, stroke)			**1.69**	**(1.29-2.21)**	**1.65**	**(1.26-2.15)**
Living alone						
No (reference)			1.00		1.00	
Yes			**1.71**	**(1.26-2.33)**	**1.72**	**(1.26-2.34)**
Recently moved (within last 4 years)						
No (reference)			1.00		1.00	
Yes			0.79	(0.53-1.17)	0.79	(0.54-1.17)
Log likelihood statistic	-950.47	-947.82	-822.74		-819.31	
Variance at Level 1	0.659	0.510	0.922		0.75	
Variance at Level 2	0.225	0.150	0.051		0.04	
Intraclass correlation (ICC)	0.105	0.080	0.003		<0.001	

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Neighborhood variable data from the 2000 Census. (415 census tracts corresponding with the 2004-2005 HEPESE sample).

[b] Mexican-origin concentration is the random effect, while the other neighborhood variables are fixed effects.

[c] Poverty is defined as 100% of Federal Poverty Level (FPL) based on the 2000 value of $8794 for 1 person. Thus a high poverty neighborhood is defined as a census tract with 20% or greater living below the FPL.

[d] Individual variable data from 2004-2005 HEPESE.

[e] Model 1: Bivariate multilevel logistic regression of Mexican-origin concentration of neighborhood and depression risk.

[f] Model 2: Model 1 plus neighborhood-level controls for neighborhood poverty and neighborhood immigrant concentration.

[g] Model 3: Model 1 plus individual-level controls for demographic characteristics and health conditions.

[h] Model 4: Model 1 plus neighborhood-level controls (Model 2) and individual-level controls (Model 3).

Table 5.2. Multilevel logistic regression models of neighborhood- and individual-level characteristics predicting depression risk stratified by having recently moved into current residence. Unweighted.

	Model 1[e]		**Model 2[f]**	
	Recently moved (within past 4 years)		Did not recently move (more than 4 years in current residence)	
	(n=245)		(n=1,558)	
Neighborhood-level Variables [a]	**OR**	**95% CI**	**OR**	**95% CI**
Mexican-origin Concentration of census tracts[b]				
Low (≤ 0.6) (reference)	1.00		1.00	
Mid (0.61-0.77)	0.37	(0.09-1.57)	1.03	(0.65-1.62)
Enclave (> 0.77)	0.30	(0.03-2.65)	0.61	(0.36-1.05)
Poverty Concentration of census tract[c]				
Low (<20%) (reference)	1.00		1.00	
High (≥20%)	0.86	(0.28-2.65)	0.78	(0.50-1.22)
Foreign-born Concentration of census tract				
Low (≤30%) (reference)	1.00		1.00	
High (>30%)	1.01	(0.31-3.32)	**1.69**	**(1.15-2.47)**
Individual-level Variables[d]				
Age, years	1.02	(0.93-1.11)	0.99	(0.96-1.02)
Gender				
Male (reference)	1.00		1.00	
Female	1.46	(0.59-3.61)	**1.53**	**(1.13-2.08)**
Household Income				
< $10,000 (reference)	1.00		1.00	
Between $10,000 - 19,999	0.71	(0.21-2.35)	1.17	(0.83-1.63)
≥ $20,000	0.74	(0.13-4.19)	0.99	(0.57-1.71)
No response/missing	1.23	(0.35-4.36)	1.08	(0.66-1.76)
Education				
HS grad or higher (reference)	1.00		1.00	
7th-11th grade	0.21	(0.02-1.85)	1.23	(0.69-2.20)
4th-6th grade	0.28	(0.04-1.80)	1.48	(0.85-2.59)
≤ 3rd grade	0.63	(0.12-3.35)	1.73	(0.98-3.07)
None	0.36	(0.06-2.19)	**2.04**	**(1.12-3.73)**
Language and Nativity				
Spanish, Mexican-born (reference)	1.00		1.00	
Spanish, US-born	0.44	(0.13-1.41)	**0.68**	**(0.49-0.95)**
English, Mexican-born	2.77	(0.26-29.15)	1.22	(0.56-2.67)
English, US-born	0.28	(0.05-1.45)	0.97	(0.61-1.54)
Activities of Daily Living (ADL)				
None (reference)	1.00		1.00	
One or more ADLs	2.34	(0.88-6.21)	**3.57**	**(2.63-4.85)**
Health conditions				

None (reference)	1.00		1.00	
One or more health conditions (diabetes, heart attack, cancer, stroke)	1.56	(0.60-4.05)	**1.64**	**(1.24-2.19)**
Living alone				
No (reference)	1.00		1.00	
Yes	1.93	0.67-5.58)	**1.79**	**(1.29-2.49)**
Log likelihood statistic	-108.56		-703.43	
Variance at Level 1	2.708		0.40	
Variance at Level 2	0.212		<0.001	
Intraclass correlation (ICC)	0.01		<0.001	

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Neighborhood variable data from 2000 Census. (415 census tracts corresponding with the 2004-2005 HEPESE sample).

[b] Mexican-origin concentration is a random effect while the other neighborhood variables are fixed effects.

[c] Poverty is defined as 100% of Federal Poverty Level (FPL) based on the 2000 value of $8794 for 1 person. Thus a high poverty neighborhood is defined as a census tract with 20% or greater living below the FPL.

[d] Individual variable data from 2004-2005 HEPESE.

[e] Model 1: Sample of those who have recently moved to their residence. Multilevel logistic regression of Mexican-origin concentration of neighborhood and depression risk with neighborhood- and individual level controls.

[f] Model 2: Sample of those who have not recently moved to their residence. Multilevel logistic regression of Mexican-origin concentration of neighborhood and depression risk with neighborhood- and individual level controls.

Table 5.3. Multilevel logistic regression models of neighborhood characteristics predicting depression risk with the addition of social network measures. Unweighted.

	Model 1[g]		**Model 2[h]**		**Model 3[i]**	
	(n=1,908)		(n=1,765)		(n=1,754)	
Neighborhood-level Variables [a]	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Mexican-origin Concentration of census tracts[b]						
Low (≤ 0.6) (reference)	1.00		1.00		1.00	
Mid (0.61-0.77)	0.88	(0.57-1.38)	0.95	(0.61-1.49)	0.97	(0.63-1.51)
Enclave (> 0.77)	**0.56**	**(0.33-0.95)**	0.63	(0.37-1.07)	0.65	(0.38-1.09)
Poverty Concentration of census tract[c]						
Low (<20%) (reference)	1.00		1.00		1.00	
High (≥20%)	0.84	(0.55-1.27)	0.80	(0.53-1.22)	0.81	(0.53-1.23)
Foreign-born Concentration of census tract						
Low (≤30%) (reference)	1.00		1.00		1.00	
High (>30%)	**1.58**	**(1.09-2.28)**	**1.50**	**(1.03-2.18)**	1.43	(0.99-2.07)
Individual-level Variables[d]						
Age, years	0.99	(0.96-1.02)	0.99	(0.97-1.02)	0.99	(0.97-1.02)
Gender						
Male (reference)	1.00		1.00		1.00	
Female	**1.52**	**(1.15-2.01)**	**1.57**	**(1.18-2.09)**	**1.53**	**(1.14-2.04)**
Household Income						
< $10,000 (reference)	1.00		1.00		1.00	
Between $10,000 - 19,999	1.10	(0.80-1.52)	1.10	(0.79-1.52)	1.15	(0.83-1.59)
≥ $20,000	0.91	(0.55-1.52)	0.97	(0.58-1.63)	1.02	(0.61-1.71)
No response	1.09	(0.70-1.70)	1.04	(0.66-1.64)	1.07	(0.68-1.69)
Education						
HS grad or higher (reference)	1.00		1.00		1.00	
7th-11th grade	0.97	(0.56-1.67)	1.00	(0.58-1.73)	1.02	(0.59-1.78)
4th-6th grade	1.21	(0.72-2.03)	1.30	(0.77-2.19)	1.32	(0.78-2.25)
≤ 3rd grade	1.50	(0.89-2.53)	1.50	(0.88-2.56)	1.54	(0.90-2.64)
None	1.62	(0.93-2.82)	1.61	(0.92-2.85)	1.66	(0.94-2.94)
Language and Nativity						
Spanish, Mexican-born (reference)			1.00		1.00	
Spanish, US-born	**0.66**	**(0.48-0.90)**	**0.70**	**(0.51-0.96)**	**0.71**	**(0.51-0.97)**
English, Mexican-born	1.27	(0.62-2.62)	1.48	(0.69-3.17)	1.50	(0.70-3.21)
English, US-born	0.80	(0.51-1.23)	0.82	(0.53-1.29)	0.84	(0.54-1.30)
Activities of Daily Living (ADL)						
None (reference)	1.00		1.00		1.00	
One or more ADLs	**3.37**	**(2.54-4.48)**	**3.34**	**(2.50-4.47)**	**3.44**	**(2.57-4.59)**
Health conditions						
None (reference)	1.00		1.00		1.00	
One or more health conditions (diabetes, heart attack, cancer, stroke)	**1.65**	**(1.26-2.15)**	**1.73**	**(1.32-2.27)**	**1.70**	**(1.30-2.24)**
Living alone						
No (reference)	1.00		1.00		1.00	
Yes	**1.72**	**(1.26-2.34)**	**1.72**	**(1.26-2.36)**	**1.73**	**(1.27-2.37)**
Recently moved (within last 4 years)						
No (reference)	1.00		1.00		1.00	

Yes	0.79	(0.54-1.17)	0.77	(0.51-1.15)	0.73	(0.48-1.10)
Social Ties Scale (range 2-6)[e]			**0.80**	**(0.69-0.93)**	0.86	(0.74-1.00)
Social Cohesion and Trust Scale (range 5-25)[f]					**0.93**	**(0.89-0.97)**
Log likelihood statistic	-876.22		-791.75		-781.24	
Variance at Level 1	0.663		0.812		0.721	
Variance at Level 2	0.042		0.055		0.054	
Intraclass correlation (ICC)	0.004		0.005		0.006	

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Neighborhood level data from 2000 Census.

[b] Mexican-origin concentration is the random effect while the other neighborhood-level variables are fixed effects.

[c] Poverty is defined as 100% of Federal Poverty Level (FPL) based on the 2000 value of $8794 for 1 person. Thus a high poverty neighborhood is defined as a census tract with 20% or greater living below the FPL.

[d] Individual variable data from 2004-2005 HEPESE.

[e] Social ties scale is a combination of 2 items, scored 1-3 each (scale scored from 2-6, high=more social ties): How many of your relatives/family members live in your neighborhood? How many friends live in your neighborhood?

[f] Social cohesion and trust scale is a combination of 5 items, scored 1-5 each (scale scored from 5-25, high=more social cohesion). Based on Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. Science, 277(5328), 918-924.

[g] Model 1: Full model with Mexican-origin ethnic concentration with neighborhood- and individual-level controls.

[h] Model 2: Model 1 plus social ties scale.

[i] Model 3: Model 1 plus social ties scale and social cohesion and trust scale.

Table 5.4. Multilevel logistic regression models of neighborhood characteristics predicting depression risk with the addition of business ownership measures. Unweighted.

	Model 1[j]		**Model 2[k]**		**Model 3[l]**	
	(n=1,908)		(n=1,803)		(n=1,803)	
Neighborhood-level Variables [a]	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Mexican-origin Concentration of census tracts[b]						
Low (≤60%) (reference)	1.00		1.00		1.00	
Mid (61-77%)	0.88	(0.57-1.38)	0.89	(0.57-1.37)	0.83	(0.53-1.29)
Enclave (> 77%)	**0.56**	**(0.33-0.95)**	**0.57**	**(0.34-0.97)**	**0.57**	**(0.33-0.96)**
Poverty Concentration of census tract[c]						
Low (<20%) reference	1.00		1.00		1.00	
High (≥20%)	0.84	(0.55-1.27)	0.86	(0.56-1.31)	0.87	(0.57-1.32)
Foreign-born Concentration of census tract						
Low (≤30%) (reference)	1.00				1.00	
High (>30%)	**1.58**	**(1.09-2.28)**	**1.58**	**(1.09-2.28)**	**1.59**	**(1.10-2.29)**
Individual-level Variables[d]						
Age, years	0.99	(0.96-1.02)	0.99	(0.96-1.02)	0.99	(0.96-1.01)
Gender						
Male (reference)	1.00				1.00	
Female	**1.52**	**(1.15-2.01)**	**1.52**	**(1.15-2.02)**	**1.51**	**(1.14-2.00)**
Household Income						
< $10,000 (reference)	1.00		1.00		1.00	
Between $10,000 - 19,999	1.10	(0.80-1.52)	1.10	(0.80-1.52)	1.10	(0.80-1.51)
≥ $20,000	0.91	(0.55-1.52)	0.91	(0.55-1.52)	0.93	(0.56-1.54)
No response/missing	1.09	(0.70-1.70)	1.09	(0.70-1.69)	1.08	(0.70-1.68)
Education						
HS grad or higher (reference)	1.00		1.00		1.00	
7th-11th grade	0.97	(0.56-1.67)	0.97	(0.56-1.67)	0.95	(0.55-1.63)
4th-6th grade	1.21	(0.72-2.03)	1.21	(0.72-2.02)	1.22	(0.73-2.03)
≤ 3rd grade	1.50	(0.89-2.53)	1.49	(0.88-2.52)	1.49	(0.88-2.51)
No education	1.62	(0.93-2.82)	1.61	(0.93-2.80)	1.63	(0.94-2.84)
Language and Nativity						
Spanish, Mexican-born (reference)					1.00	
Spanish, US-born	**0.66**	**(0.48-0.90)**	**0.66**	**(0.48-0.90)**	**0.66**	**(0.48-0.90)**

English, Mexican-born	1.27	(0.62-2.62)	1.26	(0.61-2.60)	1.19	(0.58-2.47)
English, US-born	0.80	(0.51-1.23)	0.80	(0.51-1.23)	0.77	(0.50-1.19)
Activities of Daily Living (ADL)						
None (reference)	1.00				1.00	
One or more ADLs	**3.37**	**(2.54-4.48)**	**3.36**	**(2.53-4.47)**	**3.41**	**(2.57-4.53)**
Health conditions						
None (reference)	1.00		1.00		1.00	
One or more health conditions (diabetes, heart attack, cancer, stroke)	**1.65**	**(1.26-2.15)**	**1.65**	**(1.27-2.16)**	**1.65**	**(1.27-2.15)**
Living alone						
No (reference)	1.00		1.00		1.00	
Yes	**1.72**	**(1.26-2.34)**	**1.73**	**(1.27-2.35)**	**1.70**	**(1.25-2.31)**
Recently moved (within last 4 years)						
No (reference)	1.00		1.00		1.00	
Yes	0.79	(0.54-1.17)	0.79	(0.54-1.17)	0.78	(0.53-1.16)
Ratio of Latino-owned businesses in census tract[e]			0.76	(0.29-1.96)		
Count of type of business per census tract (food store businesses)					0.91	(0.80-1.03)
Count of type of business per census tract (restaurant businesses)					0.99	(0.94-1.07)
Count of type of business per census tract (recreational businesses)					1.02	(0.80-1.26)
Count of type of business per census tract (social businesses)					1.03	(0.99-1.07)
Log likelihood statistic	-876.22		-819.15		-817.33	
Variance at Level 1	0.663		0.732		0.69	
Variance at Level 2	0.042		0.032		0.04	
Intraclass correlation (ICC)	0.001		0.002		0.004	

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Neighborhood level data from 2000 Census.

[b] Mexican-origin concentration is a random effect while the other neighborhood-level variables are fixed effects.

[c] Poverty is defined as 100% of Federal Poverty Level (FPL) based on the 2000 value of $8794 for 1 person. Thus a high poverty neighborhood is defined as a census tract with 20% or greater living below the FPL.

[d] Individual variable data from 2004-2005 HEPESE.

[e] Ratio of Latino-owned businesses per census tract defined as number of Latino-owned businesses over total businesses per census tract. Data from Infogroup using 2010 Census tract identifications.

[f] Based on 2002 NAICS codes. Food store businesses include retail stores that sell food and beverages (but are not restaurants), including grocery stores, specialty food, and alcohol. (Codes include 4451=grocery stores, 4452=specialty food stores)

[g] Restaurant businesses include restaurants, small eating places, and snack or non-alcoholic bevarge places (Codes include 722=Food services and drinking places)

[h] Recreational businesses include arts and entertainment industries, including spectator sports and performing arts. (Codes include 71=arts, entertainment, and recreation)

[i] Social businesses include personal care services, such as beauty salons and barber shops, and religious and civic organizations. (Codes include 81=other services, except public administration)

[j] Model 1: Full model with Mexican-origin ethnic concentration with neighborhood- and individual-level controls.

[k] Model 2: Model 1 plus proportion of Latino-owned businesses.

[l] Model 3: Model 1 plus count of type of businesses with Latino ownership.

CHAPTER 6: Conclusion

6.1 Summary of findings

This study finds that ethnic enclaves are protective of diabetes, controlling for neighborhood- and individual-level characteristics, however I did not find a mediating effect from social ties or social cohesion, and no moderating effect by Latino-owned businesses. While this study provides further support to previous enclave research that ethnic enclaves are protective of health for Latinos, I was not able to identify the mechanisms by which ethnic enclaves operate for diabetes among older Mexican-origin Latinos.

Moreover, in the depression risk analysis I established that ethnic enclaves were protective of health, but only once I controlled for neighborhood- and individual-level characteristics, including having recently moved. I also found that living in a high immigrant neighborhood was a risk factor for depression risk. In analyzing the underlying mechanisms of enclaves and depression risk, I found that social ties and social cohesion and trust mediated the ethnic enclave and depression risk association, and social cohesion also mediates the high immigrant enclave and depression risk relationship. Hence an increase in social cohesion and trust resulted in a protective effect of depression risk, and explained a significant amount of the protective effect of living in an ethnic enclave and partially the risk of living in a high immigrant neighborhood.

This study also explored other potential mechanisms within ethnic enclaves by considering the impact of Latino-owned businesses on the enclave and health relationship. However, the concentration of business ownership by Latinos did not moderate the enclave and health relationship.

6.2 Comparison of enclave effects among diabetes and depression risk

Examining two different health outcomes, diabetes as a physiological illness and depression risk as a mental health illness, allowed me to observe two distinctive results with potentially different underlying mechanisms. While I have reviewed the findings individually for diabetes and depression risk in previous chapters, to conclude I focus on highlighting a few comparisons.

The theory that social networks explain part or all of the protective effect of enclaves has often been noted but seldom tested (Eschbach et al., 2004; Osypuk et al., 2009; Viruell-Fuentes et al., 2013). In this study I find that social networks operate differently for diabetes and depression risk. In examining the ethnic enclave and diabetes relationship, I did not find mediation by social ties or social cohesion, and as individual predictors social ties and social cohesion and trust served as risk factors for diabetes. In contrast, social cohesion and trust mediated the ethnic enclave and depression risk relationship, and as individual predictors social ties and social cohesion and trust were protective of depression risk. Also notable is the effect of social networks on high immigrant neighborhoods and diabetes or depression risk. A high immigrant neighborhood is a significant risk factor for diabetes once I control for social ties and social cohesion and trust. On the other hand, social cohesion and trust appears to mediate the relationship between the immigrant neighborhood and depression risk. Thus, while social networks may have different impacts on diabetes and depression risk, I do find an association between social networks, enclaves, and health, although the relationship is not as clear as has been previously predicted. There may be several reasons for the differences observed in social networks and enclaves between the diabetes and depression risk analyses, some of which I explore below.

One reason for the difference in the findings might be that social networks simply have a different effect on depression risk compared to diabetes. Diabetes is a chronic illness that is impacted by several factors, including family history, diet, physical activity, and obesity, among other influences. Risk factors for diabetes generally focus on individual characteristics. While research has shown the importance of social support in diabetes management (Strom & Egede, 2012; van Dam et al., 2005; Zhang & Ta, 2009), few studies have examined the impact of social support in preventing diabetes (Dunkley et al., 2014; Holtgrave & Crosby, 2006). A recent study looked at the social environment at the neighborhood-level and did not find an association with incident diabetes, although other neighborhood characteristics were important (Christine et al., 2015). The pathway linking social support to diabetes may be confounded by other more immediate outcomes, such as diet and physical activity, thus limiting the effect on diabetes itself. Social networks may impact different risk factors along the pathway to diabetes that cancel out or result in mixed effects. For example, increased social networks may encourage more physical activity while also encouraging poor nutrition. Some research has pointed to the social aspects of obesity and the role of social networks on obesity levels, although findings have been mixed (Christakis & Fowler, 2013; Cohen-Cole & Fletcher, 2008). Social networks may be impacting diabetes, but not in the direct pathway as with other health outcomes. There may be several potential pathways linking social networks with diabetes, of which this study was only able to examine a small part of.

The pathway between social networks and depression risk may be more direct than those for diabetes, thus our ability to find a relationship between social ties and social cohesion and depression. For example, risk factors for depression among older adults include disability, a new illness, poor health status, prior depression, and bereavement (Cole & Dendukuri, 2003). Social

support can be important in countering depression by reducing social isolation and simply having support available (Berkman et al., 2000), which may be important for someone with a disability, a new diagnosis, or a recent loss. Additionally, for Latino immigrants the role and emotional support of family or friends can be important predictors of depression (Vega, Kolody, Valle, & Weir, 1991). Previous research has linked social support and social networks with depression, thus in examining the impact of an ethnic enclave or immigrant neighborhood on depression risk it is reasonable that social ties and social cohesion and trust would mediate the relationship. The same cannot be said about diabetes and social networks, which involves a more upstream association with potentially several different biological and psychological mechanisms in-between (Berkman et al., 2000).

Attempting to establish an association between a neighborhood characteristic and diabetes is difficult because of the distal impact on diabetes. As mentioned, risk factors for diabetes are based on individual characteristics, making it difficult to link distal factors such as neighborhoods with diabetes. Social networks and support may impact both diabetes and depression, however the benefits or risks may not be observed immediately for diabetes whereas for depression there may be a more immediate effect. Few studies have examined neighborhood characteristics and diabetes (Auchincloss et al., 2009; Christine et al., 2015; Ludwig et al., 2011; Piccolo, Duncan, Pearce, & McKinlay, 2015). One such study did find a modest inverse relationship between neighborhood poverty and diabetes, but this was a randomized longitudinal study that surveyed respondents over a 10 year period and was able to move respondents to a new neighborhood (Ludwig et al., 2011). The impact of a neighborhood on diabetes may be difficult to capture, in particular when considering the challenges of length of exposure and the many mechanisms that can operate in the neighborhood and diabetes association.

The measures included in this study attempted to capture direct support through the social ties score and broader social engagement through the social cohesion and trust scale. These measures may function better in explaining depression risk but may not be relevant in addressing diabetes. There may also be other social network measures that better capture the support needed in preventing diabetes, such as supports that impact health behaviors or increase self-efficacy. Measuring the depth of the social network may also be important. Stronger social networks may provide more assistance in changing health behaviors such as diet and exercise, while lighter social support may be enough to reduce social isolation or reduce other depression risk factors. Alternatively social networks can also have a negative effect on health behaviors, for example by encouraging poor diet or sedentary behaviors, which may have been the case in this sample since social ties and social cohesion and trust were risk factors to diabetes.

In addition to differences in mediation by social networks, the depression risk outcome also presented the dichotomy of a protective effect from ethnic enclaves but a risk effect from a high immigrant neighborhood. For diabetes the immigrant neighborhood was also a significant risk factor once I controlled for the social network measures. These results suggest there may be varying health effects from living in a high ethnic neighborhood versus a high immigrant neighborhood, and the effects may be influenced by social networks. As mentioned above, social networks may influence diabetes and depression risk differently. There may also be unique characteristics between a high ethnic neighborhood versus a high immigrant neighborhood, such as high residential turnover or high crime rates, resulting in different effects on health.

While most enclave research has found a protective effect on health, the measure used to identify enclaves often varies. Most studies use a measure of the ethnic concentration of the neighborhood to define an enclave, but this can be continuous, categorical, or dichotomous. The

variety of measures does pose a limitation when comparing results across studies. Other researchers go a step further and consider other aspects of an enclave in addition to or separately from the ethnic concentration. As such, while some studies use ethnic concentration alone (Aranda et al., 2011; Eschbach et al., 2004; Mair et al., 2010; Patel et al., 2003), others use a combination of ethnicity and immigrant concentration or another proxy such as preferred language (Nobari et al., 2013; Osypuk et al., 2009). For example, Osypuk and authors found that a combined ethnic and immigrant concentration variable yields both protective dietary effects and decreased odds of physical activity for Latinos (Osypuk et al., 2009). Another study that includes immigrant concentration finds nativity as a varying factor, with U.S.-born Mexican Americans living in high immigrant neighborhoods experiencing a protective effect on birthweight compared to those in low immigrant neighborhoods; however living in a high ethnic neighborhood was a risk to low birthweight (Osypuk et al., 2010), the opposite ethnic and immigrant enclave effects that I found for depression risk. When considered as individual neighborhood characteristics, ethnic and immigrant enclaves do not always provide similar effects on health.

Beyond the various types of measures of enclaves that can result in different effects on health, there may be actual differences between an ethnic and immigrant neighborhood that produce the varying health effects. While these neighborhoods are often considered as one and the same, looking at them separately allows us to see their differences and consider unique factors that characterize each neighborhood type and their potentially different impacts on health.

Ethnic neighborhoods may offer more stability with less residential turnover that often comes with an immigrant population (Burr, Mutchler, & Gerst, 2010; Crowder, Hall, & Tolnay, 2011; Iceland & Scopilliti, 2008; Logan et al., 2002). A more stable neighborhood may have an

established community with more resources, higher levels of community involvement, and more visible leaders that can provide a greater sense of social cohesion or be conducive to strong social networks among residents. The residents of ethnic enclaves may thus report high levels of social networks or a greater sense of community within their neighborhood. They may also have more access to resources and services because of their established community. The neighborhood institutions, such as churches and schools, may provide more support or opportunities in an established neighborhood. Logan et al (2002) distinguishes immigrant enclaves from ethnic enclaves by taking into consideration the reason for their formation. They argue that new immigrants with higher social capital and/or economic resources can form ethnic enclaves that are selected by preference in an attempt to strengthen and maintain ethnic identity (J. R. Logan, 2001; John R. Logan et al., 2002). These ethnic neighborhoods do not necessarily fit the high poverty, limited resources definition of many segregated neighborhoods and many are in the suburbs as opposed to the large cities. On the other hand, a high ethnic neighborhood can be comprised of a high concentration of second, third, or later generations with a resilient ethnic identity (e.g. San Antonio, TX). These ethnic neighborhoods may have a wider distribution of household incomes and education levels, greater resources and social capital, and a stronger sense of social cohesion and ethnic identity (Wen, Lauderdale, & Kandula, 2009; Zhou, 2004). All of these characteristics could lead to better health outcomes for the ethnic neighborhood.

Alternatively a high immigrant neighborhood, which could be ethnically similar to the ethnic enclave, may have fewer tangible resources to provide a healthy environment for its residents or encourage a sense of social cohesion. New immigrants often move to a neighborhood, such as a high immigrant neighborhood, based on the ties they or their family or

friends have, but then leave the enclave once they have established themselves in the new country (Iceland & Scopilliti, 2008; Logan et al., 2002). This high residential turnover in immigrant neighborhoods, along with possibly higher crime rates (Kubrin & Ishizawa, 2012), may result in fewer social networks (Viruell-Fuentes et al., 2013). While it is theorized that immigrant neighborhoods will have more social ties or social cohesion, some studies have found this is not always the case (Almeida et al., 2009; Osypuk et al., 2009; Viruell-Fuentes et al., 2013). In this study I also found that a high immigrant neighborhood resulted in lower social ties and social cohesion scores.

For a high immigrant community, the migration experience can be a major stressor to the individual and the community as a whole. Recent immigrants experience a host of changes, including new language and customs, and stressors caused by financial, employment, and housing issues. There is also a loss of immediate social ties. A general sense of fear, especially among the undocumented, may resonate with all immigrants regardless of their legal status (Carvajal et al., 2013; Sabo & Lee, 2015). While the majority of the respondents in the Hispanic EPESE are not new immigrants themselves (median years in the U.S. for immigrants is 48 years), living in a neighborhood with a high immigrant concentration can influence their health behaviors, access to resources, or decisions. In a study along the U.S.-Mexico border, Sabo and Lee (2015) observed high levels of fear and stress in farmworkers even when most were U.S. citizens or permanent residents. This fear and stress spillover can also impact all members of mixed-status families. Living in an immigrant neighborhood may have deleterious effects on health even when the respondents themselves have lived in the U.S. for a long period of time or are not immigrants at all.

In this study, a high ethnic neighborhood appears to be protective of diabetes and depression risk while a high immigrant neighborhood is a risk for depression and diabetes once I control for social networks. In neighborhoods with both high ethnic and immigrant concentrations, the ethnic neighborhood may compensate for the deleterious effects of the immigrant neighborhood. The mechanisms within the neighborhoods may also operate differently for each health outcome. For example, I found that social networks mediated the ethnic enclave/immigrant neighborhood and depression risk associations, but not the ethnic enclave and diabetes relationship. The factors unique to an immigrant neighborhood may have a larger impact on depression compared to the factors unique to being an ethnic minority. Breslau et al. found that migrants in the U.S. experience higher rates of depression compared to their non-migrant counterparts in Mexico (Breslau et al., 2011). The process of migrating, including the process of acculturating, forming and managing new networks, grief of leaving the home country, all can result in a greater risk of depression. The isolation of being an immigrant, even if living in a neighborhood with other immigrants, can possibly result in higher depression risk. This may be especially true for those who migrate later in life (Angel & Angel, 1992; Mui & Kang, 2006). While many of the study respondents have been in the U.S. for decades, these challenges may re-emerge for elders.

The age of this cohort may also be an important factor when considering the findings if this study. The average age of the sample was 81.9 years. Elder adults will interact with their community and neighborhood resources in different ways than a younger adult population. Neighborhoods will impact the health of older adults through similar mechanisms as with other age groups, however the exposure levels of the neighborhood may be different for older adults. Older adults will have been exposed to neighborhood characteristics for a longer period of time

over the life course, or the neighborhood may play a larger role since older adults may have more interactions within a local area (i.e. no longer leave the neighborhood for work or mobility limitations) (Yen, Michael, & Perdue, 2009). Studies have also found that neighborhood socioeconomic status and the social environment, measured by social cohesion and social support, are important for elderly populations (Cramm, van Dijk, & Nieboer, 2013; Wen, Hawkley, & Cacioppo, 2006; Yen et al., 2009). For this current study, social networks were important in mediating the association between ethnic enclaves and depression risk. Certain neighborhood factors may be more relevant for an older population, however more research is needed to understand how the effects may differ by age groups.

6.3 Implications for Theory

Findings from the current study generally fall in line with previous health and ethnic enclave, social network, and neighborhood research. The impact of ethnic enclaves, social networks, and business concentration on diabetes and depression risk follows much of the theories hypothesized in previous research, however there are a few points that should be further explored and broadened based on the study's findings.

This study has shown that ethnic enclaves do affect the odds of diabetes and depression risk for older Latinos living in the Southwest, but the mechanisms may not be as clear as is often theorized. I find that living in an ethnic enclave is protective of diabetes and depression risk, with those in the ethnic enclave having lower odds of diabetes and depression risk compared to those in lower ethnic concentration neighborhoods. This is especially noteworthy since few studies have explored the effect of enclaves on diabetes (Christine et al., 2015; Piccolo et al., 2015). However, by including neighborhood immigrant concentration separately from the ethnic

enclave, I found that the protective effect does not extend to high immigrant neighborhoods. Living in a high immigrant neighborhood results in higher odds of diabetes and depression risk, with some mediation by social networks. This finding highlights the intricacy of defining a neighborhood and enclaves in particular, demonstrating that neighborhoods are multi-dimensional and can have varying impacts on health, both negative and positive. While enclave research usually defines the enclave by the level of ethnic concentration, there are other important factors that need to be considered when studying the ways in which an ethnic enclave affects health. High ethnic neighborhoods may also be high immigrant neighborhoods, each of which had varying impacts on health in this study.

In an attempt to further understand the pathways explaining the protective ethnic enclave effect, I found that social networks are important but there may be other mechanisms at work within neighborhoods that influence health. While I was able to show that social networks mediated the relationship between an ethnic enclave and the odds of depression risk, the data did not show the same impact for the odds of diabetes. Social networks may be a key mechanism that explains the protective enclave effect on health; researchers need to consider other potential pathways at work within enclaves. Neighborhood effects research is one source that can inform how researchers conceptualize enclave research, especially in exploring additional ways by which the ethnic enclave can influence health.

In addition to contributing to the ethnic enclave research, this study also addresses social network and health theories, as well as neighborhood and health research. I found that social networks, as measured by social ties and the social cohesion and trust scale, can serve as possible mediators for the ethnic enclave and health association, however it was not definitive relationship. Additionally, the results showed that social networks can have positive and negative

effects on health, in this case dependent on the health outcome. Independently, social ties and social cohesion and trust were risk factors for diabetes but protective of depression risk. Social network theory has shown the potential positive and negative effect of social networks on health (Berkman et al., 2000). This current study notes that social networks within ethnic enclaves may have positive and negative effects on health, thus encouraging the exploration of other possible mechanisms to explain the protective effect of enclaves on health. The negative effects of social networks on diabetes observed in this study may explain why there was no mediation found. Also, social networks are multi-dimensional and can impact health in several ways (Berkman et al., 2000). While I did include two aspects of social networks, social ties and social cohesion and trust, there may be other dimensions of social networks, such as more direct social support, social influence, or coping ability, or other ways to measure social networks, such as at the neighborhood level, that may provide new or interesting findings. Thus, while I found that social networks do play a role in the ethnic enclave and health relationship, there may be other ways of conceptualizing social networks that researchers of ethnic enclaves have not examined.

Lastly, this study supports the neighborhood effects research in providing further evidence that neighborhoods impact health, in this case for an older Mexican-origin population. Several neighborhood level variables are used in this study; the main predictor of interest is ethnic concentration of the census tract and I control for neighborhood poverty and neighborhood immigrant concentration. The measure for social cohesion and trust, while not used at the neighborhood level, does ask about the respondent's views of their community and neighbors. Additionally, the results of this study found significant effects from social networks on health, but not from the business environment. The lack of effect from the business environment may be due to the measure used or the direct impact on health. However, despite

the absence of significance, the business environment may be important to the financial state of the neighborhood, which may then impact health. Although research is limited, studies have examined the relationship between health and neighborhood services available or homeownership, but more research is needed (Dankwa-Mullan & Pérez-Stable, 2016; Ortiz & Zimmerman, 2013; Subramanian et al., 2006).

The current study was able to provide supporting evidence of the protective effect on health for those living in an ethnic enclave. However, the study also highlighted the intricacies of studying ethnic enclaves, in particular in the conceptualization of the enclave and neighborhood characteristics, as well as the potential underlying mechanisms in their association with health outcomes. The social environment does play a role in enclaves and health, however more research is needed to understand how the social and business environment impact ethnic enclaves for various health outcomes.

6.4 Limitations

In studying ethnic enclaves several factors should be considered. As a type of neighborhood, ethnic enclave studies must be cognizant of the issues of selection and causality that afflicts most neighborhood studies (Diez Roux, 2004). How can researchers determine that it is the neighborhood or enclave that impacts health and not some other cause? The issues of establishing causality, as well as considering selection bias of the residents, are common challenges that cannot always be resolved through statistical methods. While this study may not be able to resolve the methodological concerns of selection and causality, I did take into consideration the above issues throughout the conceptualization and interpretation of this study.

Social selection refers to the dilemma that individuals may be "selected" into neighborhoods based on a variety of individual characteristics, such as socioeconomic status, race/ethnicity, being an immigrant, lifestyle behaviors, or health status (Diez Roux, 2004; Oakes, 2004). In other words, individuals are not usually randomly selected into their neighborhood. These individual characteristics may independently be related to the health of the individual, regardless of the neighborhood they live in. Thus, researchers must disentangle the health outcomes of these individuals from the effects of the neighborhood and individual traits. Selection bias is evident in ethnic enclaves because immigrants and ethnic minority groups are more likely to live in enclaves for reasons such as migration flows, residential segregation, socioeconomic status and mobility (Massey & Denton, 1987; Massey & Espinosa, 1997). But in addition to the social selection that may lead Latinos to live in enclaves, there is also the social selection process that may result in immigrants with better health to migrate in the first place. While not all Latinos in enclaves are immigrants, some enclaves may be impacted by a large immigrant population. Immigrant selectivity is often used to explain part of the healthy immigrant effect. Immigrants in general are healthier than their U.S.-born counterparts, with one explanation being that individuals who migrate are in better health than individuals that do not migrate (Singh & Miller, 2004). In order to make the move from one country to another, those with the least health barriers, or the healthiest, are more likely to migrate (Singh & Miller, 2004). As a result, immigrants in the U.S. are healthier than their native born co-ethnics. It has also been documented that the health advantage of immigrants begins to deteriorate as they adopt unhealthy behaviors once in the U.S. Some researchers believe that the process of migrating itself can impact health, with the processes of migration and integration causing stressors that can impact physical and mental health (Finch & Vega, 2003; Kandula et al., 2004). In terms of

studying ethnic enclaves, researchers must thus consider if the positive health effects observed for enclave residents results from living in the enclave, or is it due to the higher than average concentration of already healthy immigrants, and what may be the underlying mechanisms.

With selectivity concerns from the migration networks and residential segregation that can result in Latinos living in enclaves, to the possible selectivity of immigrants being healthier, the issue of determining causality in the association between enclaves and health becomes quite complex. Another barrier in determining causality is the study design and limitations of a cross-sectional study. This study uses data from the Hispanic EPESE 2004-2005 wave, which has the necessary variables to test for mediation by social networks, but is then limited in establishing causality between the predictors and health outcomes. Use of a cross-sectional database for a neighborhood study is not ideal because I am unable to determine if the neighborhood environment is a direct cause of the illness, and I am unable to consider the previous neighborhoods the respondent has lived in that may also play a part in onset of disease. Confounding variables are also a threat to determining causality. Many of the individual characteristics that mediate the association between living in an enclave and health outcomes may also serve as confounding variables. Diez Roux and Mair provide the example of socioeconomic status as both a mediator, where neighborhoods can determine socioeconomic status in the early stages of life, and as a confounder, where socioeconomic status can predict neighborhood poverty later in life (Diez Roux & Mair, 2010). While I attempt to control for neighborhood poverty and individual socioeconomic status, the age of the sample potentially means that certain older adults, the healthier, end up living in enclaves because they remained in the same residence or returned to an ethnic enclave with old age.

In addition to the challenges of social selection and determining causality, several other factors are important to consider in enclave research. Focusing on the ethnic enclave can result in the exclusion of other outside influences that affect health, such as factors in the workplace, school, or daily life (Sampson et al., 2002), however this limitation is minimized by studying an older population who may spend more time at home and in the local neighborhood. For immigrants living in an enclave, transnational networks present an example of influences outside the enclave that can impact social and health outcomes but which are not usually measured (Menjivar, 2002; Portes, Guarnizo, & Haller, 2002).

There are also measurement limitations specific to this study and data. Measuring an enclave by census tracts can present challenges, even though many studies base their enclave definition on census tracts (Eschbach et al., 2004; Osypuk et al., 2009; Patel et al., 2003; Reyes-Ortiz et al., 2009; Wen & Maloney, 2011). Census tracts are easy to use because of the availability of the data, as well as comparability across studies and disciplines. Most agree that while census tracts are not perfect representations of neighborhoods, they are good approximations that give a general understanding of a geographic area. However, because they are based on population numbers, approximately 4,000 individuals in a census tract, census tracts will vary in size and area covered (Census, 2000a; Iceland & Scopilliti, 2008). Another drawback is that census tracts do not necessarily correspond to proximity of resources, especially for residents that may live at the edges or near another important census tract that serves as an enclave. For these residents their census tract may not represent where they interact and live their daily lives. These residents may not be living in the enclave census tract, but benefit from the enclave because of its proximity or time spent there. However the potential inaccuracy of the

neighborhood measurement may weaken the specificity of the enclave variable, thus any findings are likely not an artifact of neighborhood/census measurement.

Diabetes as defined in this study presents another measurement limitation. Diabetes is a self-reported measure, which relies on the respondent's memory and interpretation. While the question asks if a doctor has said the individual has diabetes, the dataset does not confirm an actual medical diagnosis. With diabetes there is also the concern that a considerable proportion of the population has diabetes but has not been diagnosed with the illness. The National Center for Health Statistics found that in 2010 7 million people in the U.S. had diabetes but were undiagnosed (CDC, 2011). Similarly the CDC finds that 32% of older Mexican Americans have diagnosed diabetes and 15% are undiagnosed but have high blood glucose levels (CDC, 2013a). For this study, an enclave can result in greater services for residents with health care tailored to the community. This could result in higher sensitivity to diabetes because being Latino is a risk factor, which would lead to higher screening rates and potentially higher levels of diagnosed diabetes in enclaves. On the other hand, residents living in enclaves may lack access to care, which would result in higher rates of undiagnosed diabetes.

The other health outcome, depression risk, is a measure called the Center for Epidemiological Studies-Depression (CES-D) scale, a 20-item scale with an established cut-off score of 16 or greater indicating depression risk (CES-D, Accessed April 2016). The questions are scored on a 4-item Likert scale asking about sleep, appetite, loneliness, and feelings of sadness, depression, happiness, and hopefulness, among other similar topics. The cut-off score of 16 or greater identifies individuals at risk for clinical depression, however this is not necessarily a clinical diagnosis. Thus all findings have limited generalization to the risk of depression and may not coincide with clinical depression. However this is a widely used measurement that has

been in a variety of age groups and across racial and ethnic groups (Roth, Acherman, Okonkwo, & Burgio, 2008).

The business measures are limited in several ways. Infogroup data bases their ethnicity information on self-reports and last names, which may undercount the Latino population or may also over count by including other racial/ethnic groups that are not Latino, such as Filipinos. The business information will also undercount unofficial businesses, such as fruit and food street vendors, that may provide important dietary options but are not captured by the Infogroup data. The types of businesses are generally identified by their NAICS codes, but further refinement is needed to understand what service or product is being provided, in particular if they are culturally relevant to the neighborhood and who the businesses serve overall. As mentioned earlier, Latino ownership does necessarily correlate with serving a Latino population, and vice versa.

There are additional limitations specific to the data used in this study. The sample consists of respondents who identify as Mexican or Mexican-American and are over the age of 65. My findings cannot be generalized to the larger Latino population and will be limited by Latino subgroup and age. However, Latinos of Mexican-descent make up the largest proportion of Latinos living in the U.S. (Motel & Patten, 2013) and the data is collected across five states with large Mexican populations.

The age of the sample also presents limitations in the interpretation of the findings since the study is focused on an older population. The mechanisms within an enclave may function differently for an older population than for a younger group, especially since their time in the neighborhood and their social networks may vary, with older adults having different needs fulfilled by their neighborhood. Additionally, an older population means that some will have

died from diabetes or another illness, thus the sample may be healthier because they have outlived other residents their same age, resulting in a selection bias. Also, while older age is not a risk factor for depression, many of the risk factors for depression may occur in an aging population, such as poorer health, disability, or bereavement. While I control for some of these risk factors there will be confounders that I cannot account for.

An additional limitation of this study and analysis is inherent in the data collection. This study incorporates neighborhood level variables and multilevel analyses, however the data was not collected at the same geographic level in which the analysis will be done. The Hispanic EPESE survey design began identifying respondents at the county level, but analysis is done at the census tract level. Thus census tracts have a wide range of respondents, from one to 43 observations. Interpretation of the results should be reviewed with caution since 39% of the level-2 units have only one observation. While the level-2 sample is large enough to balance problems resulting from the limited sample size of the clusters (Bell et al., 2010), in analyses I was unable to account for the random effect of more than one neighborhood level variable due to instability of the model.

No study is without its limitations, and neighborhood research is no exception. However understanding the challenges associated with enclave and neighborhood research can help me make appropriate interpretations of my data in relation to previous research.

6.5 Strengths

Research on Latino enclaves has established a consistent positive relationship between living in ethnic enclaves and health. While the enclave research offers several reasons as to why living in high ethnic concentrations provides a protective effect on health, few studies investigate

the underlying potential pathways. Also, few enclave studies have examined diabetes, a disease that greatly afflicts the Latino and Mexican-American population.

To address some of the limitations of previous enclave research, this study focused on the mechanisms of ethnic enclaves, examining the social and structural characteristics that may explain the protective effect on the health and behaviors of those living in the enclave. In addition to exploring the mechanisms at work within an enclave, this study contributed to the enclave research by considering both social and structural characteristics of the enclave. Much of the enclave literature focuses on the social aspects of enclaves, the social networks, but few examine the role of the physical environment and institutions. An ethnic enclave may be defined by social networks and facilitate their proliferation, but there are other aspects that may play a role in protecting the health of its residents. The structural aspects of the enclave, or the built environment, and the institutions within the enclave can influence the social networks and health of the enclave residents. This study attempted to explore more than one dimension of ethnic enclaves, in hopes of providing a broader understanding to the complexities of ethnic enclaves and their effect on health.

In this study I also attempt to capture the multiple dimensions of a neighborhood by including measures of ethnic concentration and immigrant concentration separately. While these characteristics often overlap in a neighborhood, isolating each factor allowed me to explore the effect of each on health. This may be important in understanding the needs of a neighborhood and identifying ways to support aspects of a community that are protective.

Furthermore, this study provided a macro-level understanding of diabetes prevalence among Mexican-Americans, moving beyond the individual determinants associated with high diabetes rates and risk factors. This study explores how the social and physical environment can

affect diabetes rates within the context of an ethnic neighborhood. Understanding the social and structural factors that can impact diabetes may provide other areas of intervention beyond individual-level interventions, such as community focused policies and interventions for the neighborhood.

Using multilevel analyses, findings from this study will begin to establish a model for the mechanisms through which ethnic enclaves may be impacting diabetes and depression rates for older Mexican-origin adults. Using data of older Mexican-Americans in five Southwestern states provides a broad understanding of diabetes among the largest Latino subgroup that is affected by high rates of this disease. By identifying social and structural factors that may offer health benefits to this population, policies and programs can be designed to support the protective characteristics of enclaves and other Latino or immigrant neighborhoods.

6.6 Future research

This study set out to test the potential mechanisms within ethnic enclaves and enhance the body of enclave research by providing an explanation for the protective effect on health. Using two different social measures, I observed mediation by social ties and social cohesion and trust for ethnic enclaves and depression risk but not for ethnic enclaves and diabetes. As discussed in earlier chapters, there may be several reasons why I did not detect a mediating effect by the social network measures for diabetes: 1) the measures tested may have not been sensitive to the type of social support that links neighborhood characteristics with diabetes; 2) the measures may not be capturing the concept, in particular social ties is a general measure of family and friends in the neighborhood; 3) neighborhoods with high ethnic or immigrant concentrations may not result in higher social ties or social cohesion and trust, as another study

has found (Viruell-Fuentes et al., 2013); or 4) for diabetes there may be other mediators not measured in this study that explain the ethnic enclave and diabetes association.

Future research should continue to examine the underlying mechanisms of ethnic enclaves and health, in particular testing a variety of social network measures at the individual and neighborhood level that will capture various aspects of social support. There may be different types of social networks within ethnic enclaves with some impacting one type of disease more than another. More research on depression risk in another population, for example another location or age group than the Hispanic EPESE, can confirm the results of this study or further describe the pathway by which ethnic enclaves protect residents of depression risk.

Furthermore, there are other measures of the social and structural environment that may be important to the ethnic enclave and health relationship. For diabetes, for example, measures of community dietary behaviors, availability of certain types of foods, and access to gyms, parks, and recreation centers all would be important to examine. For depression, more refined measures of social networks could be beneficial to better understand the level of integration with family, friends, and neighbors. Other measures of respondents, such as civic participation or level of community involvement, may also be potential mediating variables. More measures of the structural environment, such as the number of churches or the walkability of a community, can help to establish stability of a neighborhood or the availability of services and resources that can in turn have an effect on the social support and overall social trust that residents perceive in their neighborhood.

The business measures used in this study could be greatly improved upon. While I had data on the ethnicity of the business owners, I had limited information on the type of business, who they served, and their time in the neighborhood. Because businesses are not always in the

same area as residences, future research should also consider a different measure of geography in addition to the census tract. Census tracts can also cover varying geographic areas and may be too large to properly approximate a neighborhood and the businesses within the neighborhood. Some options to more accurately capture the impact of the business environment on health would be to use a measure of businesses in an x-mile radius, or to survey the respondents directly about their business community and use. While there is little data on businesses and health, similar neighborhood studies have used alternative measures of the built environment beyond census tracts (Kruger, Reischl, & Gee, 2007; Subramanian et al., 2006).

Additionally, research on ethnic enclaves would greatly benefit from the use of longitudinal data to better capture the time of residence in the neighborhood, as well as the time of incidence of the disease. This study had a very crude measure of time living in the current home, with a broad range of years for those that had recently moved. Time in residence proved to be important for the depression risk analysis, and thus a more developed measure of time in home could be important. A longitudinal study may also improve the measure of when the illness began, which would serve to better determine the causality between exposure and illness that a cross-sectional study like this one cannot establish. Understanding the type of neighborhood respondents reside in throughout their life span would also improve our analysis of neighborhood exposure and its impact on health status in late-life.

Overall, research often focuses on individual risk factors of a disease. While individual factors are important in preventing illness, there are larger contextual factors that can impact the individual risk factors. The study of neighborhoods and the larger social environment may improve our understanding of how diseases impact individuals and reveal other ways in which we can improve interventions and support protective characteristics of a group.

6.7 Practice implications

As disease risk increases for certain illnesses or certain populations, researchers seek new ways in which to understand disease patterns. While establishing individual risk factors is important, there are larger social and environmental factors that have been shown to influence disease in populations. For Latinos, while their general health patterns are positive, there are specific aspects that result in poorer health outcomes. It is also important to understand why this group may have better health outcomes in order to further strengthen those characteristics among Latinos and potentially other populations.

This study was able to establish the importance of social networks for depression risk in older Mexican-origin adults. If social networks are protective of health, interventions and programs can be implemented to integrate strategies that will improve social supports between individuals and in the community as a whole. Results from this study provide additional support to the protective enclave effect theory. Latinos not living in an ethnic enclave may be at greater risk for illness, thus this group can also be targeted to provide assistance and supports that the enclave would provide. Enclaves themselves are usually very disadvantaged neighborhoods and this study is not advocating for the depravity of neighborhoods to continue. On the contrary, ethnic enclaves and all disadvantaged neighborhoods would benefit from policies that improve the financial prospects and institutions in the community to provide more services and opportunities for residents. As this study found, living in a high immigrant enclave can increase your odds of diabetes or depression risk, and for depression risk it is the social networks that appear to mediate an ethnic enclave effect on lower depression odds. Neighborhood characteristics, such as social networks, the availability of food selection, the safety of a

community, or the availability of parks and recreation, can be supported in Latino enclaves and neighborhoods in general to improve health. For example, interventions that focus on fostering relationships in small groups while also providing health education or those that improve social support from family and friends have been shown to improve weight and physical activity levels (Gesell, Barkin, Sommer, Thompson, & Valente, 2016; Marquez et al., 2016; Suglia et al., 2016). Focusing on the concept of building strong social networks, interventions can improve health outcomes and behaviors for Latinos.

Also important are interventions at the policy level, however this takes much larger coordination at a local and state level. Addressing housing, finances, and poverty are ways to improve communities as a whole (CSSP, 2011; Wallace & Padilla-Frausto, 2016), even within clinical settings (Pediatrics, 2016). The impact of place on health continues to show that where you live does play a role in health. While we may not always be able to control where we live, we can improve certain aspects of neighborhoods to improve health and ensure that all individuals, regardless of where they live, have similar opportunities to good health.

6.8 Conclusion

While previous research has established the protective effect of living in an ethnic enclave for Latinos, few studies have been able to assess possible reasons for the effect. This study focused on establishing the impact of ethnic enclaves on diabetes and depression risk, but more importantly examining the mechanisms that may explain the protective effect. There were several main findings in this study. First, while I did find a protective effect between ethnic enclave and diabetes, I could not confirm mediation by social ties, social cohesion and trust, or concentration of Latino-owned businesses, meaning that the effect occurs through some other

mechanism(s). Secondly, there may be varying mechanisms operating between enclaves and diabetes versus enclaves and depression. I observed a protective effect of ethnic enclaves on depression risk, but this was partially mediated by social ties and social cohesion and trust. Additionally, the analysis showed that there may be different effects by high ethnic neighborhoods and high immigrant neighborhoods. Results indicated that living in a high immigrant neighborhood was a risk factor for depression, but social networks mediated this association. By contrast, accounting for social networks resulted in high immigrant neighborhoods to be a risk for diabetes. Thus, while mediation by social networks was not found for diabetes, social networks do play an important role in understanding the impact an ethnic or immigrant neighborhood has on health. Furthermore, this study highlights the importance of understanding that neighborhoods have several intersecting characteristics that can impact health, with some that may be beneficial and some that may increase risk. For Latinos, an ethnic enclave is not a definitive protective factor to health, there are intricacies within the neighborhood characteristics and other contextual factors that must be considered if research is to understand the health of Latinos and identify areas for intervention.

Appendix A: Social Network Measures and Mediation/Moderation Analyses

Measures:

I used two measures in an attempt to capture different aspects of social networks: social ties and social cohesion and trust. Below I present the questions for each measure and the mean and standard deviation for each scale.

Social ties is a scale created as a sum of two questions. Table A.1 details the two social ties questions with their mean scores and range. Responses range from 1-4, four representing more social ties. I sum both questions to create a scale. Table A.2 describes the social ties scale with a mean score of 3.6, out of a maximum score of eight, with eight corresponding to more social ties in the neighborhood.

Table A.1 Social ties questions

Individual items	n	Mean score	Standard Deviation
Family lives in neighborhood	1,939	1.53	0.62
Friends live in neighborhood	1,929	2.05	0.77

All questions have response of: none, a few, many, and most.
Range 1-4, with a higher value corresponding to more social ties.

Table A.2 Social ties scale

	n	Mean score	Standard Deviation
Social ties scale[a]	1,926	3.57	1.11

[a] Maximum score of 8 equal to highest level of social ties (range 2-8)
Cases with any missing response to the two social tie questions were dropped from the variable.

The Social Cohesion and Trust Scale is the sum of five questions. Table A.3 presents the five questions with their mean score and standard deviation. Responses range from 1-5 with five indicating higher social cohesion. Table A.4 provides the mean score for the five questions. For this sample the social cohesion and trust scale has a mean score of 18.4, with a possible maximum score of 25.

Table A.3 Social cohesion and trust questions

Individual items	n	Mean score	Standard Deviation
This is a close-knit neighborhood.*	1,933	3.81	0.93
People around here are willing to help their neighbors.*	1,934	3.92	0.81
People in this neighborhood generally don't get along with each other.	1,933	3.55	1.01
People in this neighborhood do not share the same values.	1,931	3.29	0.94
People in this neighborhood can be trusted.*	1,937	3.81	0.82

All questions have response of: strongly disagree, disagree, neutral, agree, strongly agree.
*Question is reverse-coded so a value of 5 is equal to strongly agree, or high social cohesion.

Table A.4 Social cohesion and trust scale

	n	Mean score	Standard Deviation
Social cohesion and trust scale*	1,927	18.38	3.04

*Maximum score of 25 equal to highest level of social cohesion (minimum of 7)

Cases with any missing response to the five social cohesion and trust questions were dropped from the variable.

Based on Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. Science, 277(5328), 918-924.

Mediation and Moderation Analysis for Diabetes:

A mediating variable is determined by the addition of the variable in question to the model and observing the change in the coefficient for the original relationship, in this case if neighborhood ethnic concentration predicts diabetes. Also an import part of the mediation test is examining the bivariate relationships between the predictor and the mediation variable, then the mediation variable and the outcome. Moderation looks to see if a variable, in this case the social ties scale, will strengthen or change the effect of the main association between the predictor and outcome observed, such as ethnic enclaves and diabetes.

In this analysis I would expect social networks to mediate the relationship between ethnic enclaves and diabetes because the literature often highlights social networks as an explanatory factor for the protective effect of ethnic enclaves. Mediation would also make sense if we consider ethnic enclaves to be conducive of social networks. However moderation may also be relevant since ethnic enclaves and social networks may have a reciprocal relationship and social networks can serve as a moderating effect on the ethnic enclave and diabetes association.

Mediation analysis for diabetes: Social Ties

I begin with Table A.5, which presents the bivariate regression model of ethnic enclaves and the social ties scale, followed by Table A.6, the bivariate logistic regression model of the social ties scale and diabetes.

I find that living in an enclave compared to a low ethnic concentration neighborhood does not result in increasing social ties, as shown in Table A.5. Similarly, the social ties scale is not predictive of diabetes, although a one-point increase in the social ties scale results in a 9% increase in the odds of diabetes with a p-value 0.079, see Table A.6. There is no clear association between ethnic enclaves and social ties, or for social ties and diabetes.

Table A.5 Regression model of ethnic enclave predicting social ties scale.[a] Unweighted.

	Bivariate Model (n=1,926)		
Neighborhood-level Variables [b]	**β**	**P-value**	**95% CI**
Mexican-origin Concentration			
Low (≤60%) (reference)	1.00		
Mid (61-77%)	0.08	0.141	(-0.03-0.19)
Enclave (> 77%)	-0.08	0.141	(-0.19-0.03)

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Social ties scale is a combination of 2 items, scored 1-3 each (scale scored from 2-6, high=more social ties): How many of your relatives/family members live in your neighborhood? How many friends live in your neighborhood?

[b] Neighborhood level data from 2000 Census.

Table A.6 Multilevel logistic regression model of social ties scale predicting diabetes. Unweighted.

	Bivariate Model (n=1,926)		
Individual-level Variables[a]	**OR**	**P-value**	**95% CI**
Social Ties Scale (range 2-6)[b]	1.09	0.079	(0.99-1.21)
Log likelihood statistic	-1219.89		
Variance at Level 1	0.23		
Variance at Level 2	0.03		

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Individual variable data from 2004-2005 HEPESE.

[b] Social ties scale is a combination of 2 items, scored 1-3 each (scale scored from 2-6, high=more social ties): How many of your relatives/family members live in your neighborhood? How many friends live in your neighborhood?

The bivariate associations indicate there is no mediation by social ties, confirming what I observed in the full model with social ties, Table 4.2 Model 2. It does appear that increased social ties may be a risk for diabetes, with the bivariate approaching significance. In the full model, Table 4.2, Model 2, controlling for neighborhood and individual characteristics, a one-point increase in the social ties scale is associated with an 11% increased odds of diabetes.

Moderation analysis for diabetes: Social Ties

To test for moderation I included an interaction variable between the neighborhood ethnic concentration measure and the social ties scale. As mentioned in Chapter 4, the interaction variable was not statistically significant and the main effects were not significant.

Mediation analysis for diabetes: Social Cohesion and Trust Scale

To fully confirm the lack of mediation I also examined the association between neighborhood ethnic concentration and the social cohesion and trust scale, Table A.7, as well as the bivariate relationship between social cohesion and diabetes, Table A.8. I hypothesized that an increase in neighborhood Mexican-origin concentration would result in higher social cohesion levels. Results show that the ethnic concentration of the neighborhood is not statistically predictive of social cohesion, Table A.7, although there is a pattern of increased social cohesion for neighborhoods with higher ethnic concentration. In Table A.8 I find a statistically significant association between increased levels of social cohesion and increased odds of diabetes.

While social cohesion is associated with diabetes, the relationship with ethnic enclaves is not definitive. Social cohesion and trust partially mediates the ethnic enclave and diabetes

relationship, although the effect appears to be minimal based on the change in the coefficient in Table 4.2, Model 3 and the non-significant bivariate association between ethnic neighborhood concentration and social cohesion and trust.

Table A.7 Regression model of ethnic enclave predicting social cohesion and trust scale.[a] Unweighted.

	Bivariate Model		
	(n=1,927)		
Neighborhood-level Variables [b]	**β**	**P-value**	**95% CI**
Mexican-origin Concentration			
Low (≤60%) (reference)			
Mid (61-77%)	0.58	0.001	(0.25-0.91)
Enclave (> 77%)	0.29	0.081	(-0.04-0.62)

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Social cohesion and trust scale is a combination of 5 items, scored 1-5 each (scale scored from 5-25, high=more social cohesion). Based on Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. Science, 277(5328), 918-924.

[b] Neighborhood level data from 2000 Census.

Table A.8 Multilevel logistic regression model of social cohesion and trust scale predicting diabetes. Unweighted.

	Bivariate Model		
	(n=1,927)		
Individual-level Variables[a]	**OR**	**P-value**	**95% CI**
Social Cohesion and Trust Scale (range 2-6)[b]	**1.04**	**0.009**	**(1.01-1.08)**
Log likelihood statistic	-1221.05		
Variance at Level 1	0.25		
Variance at Level 2	0.04		

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Individual variable data from 2004-2005 HEPESE.

[b] Social cohesion and trust scale is a combination of 5 items, scored 1-5 each (scale scored from 5-25, high=more social cohesion). Based on Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. Science, 277(5328), 918-924.

Moderation analysis for diabetes: Social Cohesion and Trust Scale

To test for moderation I included an interaction variable between the neighborhood ethnic concentration measure and the social cohesion and ties scale. The interaction variable was not statistically significant and the main effects were not significant (data not shown).

Bivariate Associations for depression risk

Mediation analysis for depression risk: Social ties

Since I have already examined the bivariate association between ethnic enclaves and social ties in Table A.5 above, I also present the bivariate between immigrant neighborhood and social ties in Table A.9, and the bivariate association between social ties and depression risk in Table A.10.

For the ethnic enclave and depression risk relationship, there appears to be mediation by social ties as observed in the full model, Table 5.3, Model 2. Adding the social ties variable to the full model results in the ethnic enclave coefficient to be no longer significant. The bivariate analysis, Table A.5 does not show a statistically significant relationship between ethnic neighborhoods and social ties. Social ties, the mediator, is significantly associated with a decrease in depression risk. Thus the mediation pathways are not definitive, but there appears to be some relationship between, social ties, the ethnic enclave, and depression risk association.

For the immigrant neighborhood and depression risk association, social ties partially mediates the relationship as there is some decrease in the coefficient in the full model, Table 5.3 Model 2. The bivariate analyses in Table A.9 and A.10 support the partial mediation, however the direction is not as I would expect in the immigrant neighborhood and social ties association. While I would predict a high immigrant neighborhood to result in a greater social ties score, the opposite is observed.

Table A.9 Regression model of neighborhood immigrant concentration predicting social ties scale.[a] Unweighted.

	Bivariate Model		
	(n=1,926)		
Neighborhood-level Variables [b]	**β**	**P-value**	**95% CI**
Foreign-born Concentration of census tract[c]			
Low (≤30%) (reference)			
High (>30%)	-0.26	<0.001	(-0.33- -0.16)

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Social ties scale is a combination of 2 items, scored 1-3 each (scale scored from 2-6, high=more social ties): How many of your relatives/family members live in your neighborhood? How many friends live in your neighborhood?

[b] Neighborhood level data from 2000 Census.

Table A.10. Multilevel logistic regression model of social ties scale predicting depression risk. Unweighted.

	Bivariate Model		
	(n=1,861)		
Individual-level Variables[a]	**OR**	**P-value**	**95% CI**
Social Ties Scale (range 2-6)[b]	0.84	0.007	(0.74-0.95)
Log likelihood statistic	-921.81		
Variance at Level 1	0.48		
Variance at Level 2	0.24		

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Individual variable data from 2004-2005 HEPESE.

[b] Social ties scale is a combination of 2 items, scored 1-3 each (scale scored from 2-6, high=more social ties): How many of your relatives/family members live in your neighborhood? How many friends live in your neighborhood?

Mediation analysis for depression risk: Social Cohesion and Trust Scale

In Table 5.3, I tested for mediation by the social cohesion and trust score. I find that the social cohesion and trust scale appears to mediate both the ethnic enclave and depression risk relationship, as well as the immigrant neighborhood and depression risk association. Here I examine the bivariate relationships to further support the results from the mediation analyses in Chapter 5.

In Table A.7 I examined the bivariate association between ethnic neighborhoods and the social cohesion and trust scale. While the relationship is not significant at p-value=0.08, there is a pattern of increased social cohesion with increasing ethnic concentration of a neighborhood. In examining the association between social cohesion and depression risk, Table A.12 presents lower odds of depression risk with increasing social cohesion. Thus the partial mediation by social cohesion and trust for the ethnic enclave and depression risk relationship appears correspond with the bivariate regressions.

Next I examined mediation for the immigrant neighborhood and depression risk association. In Table A.11 I observe a significant negative association between a high immigrant neighborhood and social cohesion. A high immigrant neighborhood results in lower social cohesion scores. Table A.12 shows that a one-point increase in the social cohesion and trust scale results in 8% lower odds of depression risk. The bivariate analysis supports the observed mediation by social cohesion and trust in the immigrant neighborhood and depression risk. Interestingly, for immigrant neighborhoods the level of social cohesion is important in

determining the effect on depression risk. While I would expect higher immigrant neighborhood to have higher social cohesion scores, this was not the case.

Table A.11. Regression model of neighborhood immigrant concentration predicting social cohesion and trust scale.[a] Unweighted.

	Bivariate Model		
	(n=1,927)		
Neighborhood-level Variables [b]	**β**	**P-value**	**95% CI**
Foreign-born Concentration of census tract[c]			
Low (≤30%) (reference)			
High (>30%)	-0.62	<0.001	(-0.89- -0.35)

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Social cohesion and trust scale is a combination of 5 items, scored 1-5 each (scale scored from 5-25, high=more social cohesion). Based on Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. Science, 277(5328), 918-924.

[b] Neighborhood level data from 2000 Census.

Table A.12. Multilevel logistic regression model of social cohesion and trust scale predicting depression risk. Unweighted.

	Bivariate Model		
	(n=1,865)		
Individual-level Variables[a]	**OR**	**P-value**	**95% CI**
Social Cohesion and Trust Scale (range 2-6)[b]	0.92	<0.001	(0.89-0.96)
Log likelihood statistic	-921.72		
Variance at Level 1	0.46		
Variance at Level 2	0.77		

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

Bold p < 0.05

[a] Individual variable data from 2004-2005 HEPESE.

[b] Social cohesion and trust scale is a combination of 5 items, scored 1-5 each (scale scored from 5-25, high=more social cohesion). Based on Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. Science, 277(5328), 918-924.

Moderation analysis for depression risk: Social ties and Social cohesion and trust scale

To test for moderation I included an interaction variable between the neighborhood ethnic concentration measure and the social ties scale, as well as between the neighborhood ethnic concentration and the social cohesion and trust scale. I also repeated this with the neighborhood immigrant concentration since it was significant for the depression models. As mentioned in Chapter 5, none of these interaction variables were statistically significant and the main effects were not significant.

Appendix B: Ethnic Business Measures and Mediation/Moderation Analyses

Measures:

In order to measure the Latino-owned businesses in a census tract, I created a count and a proportion measure. The data from Infogroup provided the number of Latino-owned businesses per census tract using the 2000 Census tract identifiers. They were also able to provide the number of Latino-owned businesses and total number of businesses per census tract using the 2010 Census tract identifiers. I used this data to create several variations of the Latino-owned variables, see Table B.1.

Table B.1 Alternative Variables of Latino-owned Businesses by Census Tract

Business variable version	**Census year**	**Mean (SD)**	**OR (95% CI) in full model predicting diabetes**	**OR (95% CI) in full model predicting depression risk**
Count of Latino-owned businesses / Total businesses per census tract	2010	0.26 (0.18)	1.42 (0.73-2.74)	0.76 (0.29-1.96)
Count of Latino-owned businesses	2000	31.63 (35.32)	0.99 (0.99-1.00)	1.00 (0.99-1.00)
Log of Count of Latino-owned businesses / Total census tract population	2000	-5.23 (1.10)	1.00 (0.89-1.12)	0.98 (0.84-1.14)
Count of Latino-owned businesses / Census tract square miles	2000	35.53 (52.15)	0.99 (0.99-1.00)	1.00 (0.99-1.00)

Further review of the business variables included in the analyses is available in Chapter 2, section 2.2. The business variable used in the final analysis presented in Tables 4.3 and 5.4 is the first variable on Table B.1, the count of Latino-owned business over total businesses per census

tract. As mentioned earlier, this business data used the 2010 census tract identifiers, but the Hispanic EPESE based their census tract information from the 2000 Census. Because there were changes in the census tracts between the 2000 and 2010 Census, I wanted to make sure that the results and patterns did not change because of the census tract year. Thus the next three variables shown in Table B.1 use the business data that correspond to the 2000 Census tract identifiers.

Count of Latino-owned businesses / Total businesses per census tract

This variable represents the ratio of Latino-owned businesses over the total number of businesses for each census tract. As previously mentioned, this version is based on the 2010 Census tract identifiers.

Count of Latino-owned businesses

In this version I use a continuous count of the number of Latino-owned businesses, based on the 2000 Census tract identifiers.

Count of Latino-owned businesses / Total census tract population

Following the strategy of a similar study (Subramanian et al., 2006), I created a version in which the number of Latino owned businesses is divided by the total population of a census tract. This version is based on the 2000 Census tract identifiers. Because of the many zeros, this proportion is right skewed. Taking the log of this variable results in a normal distribution, which is the version used in Table B.1.

Count of Latino-owned businesses / Census tract square miles

This version examines the number of Latino-owned businesses by land area. Using the 2000 Census tract identifiers, I divide the number of Latino-owned businesses over the square miles of each census tract.

Mediation and Moderation Analysis for Diabetes:

Mediation analysis for diabetes: ratio of Latino-owned businesses per census tract

In Chapter 4 results, I did not observe mediation of the enclave-diabetes relationship by the ratio of Latino-owned businesses when the variable was added to the full model. Here I present each bivariate association to further confirm there is no mediation. I begin with Table B.2, which presents the bivariate regression model of ethnic enclaves and the ratio of Latino-owned businesses, followed by Table B.3, the bivariate logistic regression model of the ratio of Latino-owned businesses and diabetes.

Table B.2 Regression model of ethnic enclave predicting ratio of Latino-owned businesses.[a] Unweighted.

	Bivariate Model		
	(n=2,069)		
Neighborhood-level Variables [b]	**β**	**P-value**	**95% CI**
Mexican-origin Concentration			
Low (≤60%) (reference)			
Mid (61-77%)	0.08	0.000	(0.06-0.09)
Enclave (> 77%)	0.15	0.000	(0.14-0.17)

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

[a]Business data uses the 2010 Census tract identifiers. Number of Latino-owned businesses over the total number of businesses in a census tract.

[b]Neighborhood level data from 2000 Census.

I find that living in an enclave compared to a low ethnic concentration neighborhood does result in increasing Latino-owned businesses. The pattern observed is as expected, increasing ethnic concentration in a census tract is associated with an increasing ratio of Latino-owned businesses. Thus there is an association between ethnic enclaves and Latino-owned businesses in

a neighborhood. However in Table B.3, there is no association between Latino-owned businesses and diabetes. Using the other versions of the business variable presented in Table B.1, further confirms the lack of association.

Table B.3 Multilevel logistic regression model of ratio of Latino-owned businesses predicting diabetes. Unweighted.

	Bivariate Model		
	(n=2,069)		
Individual Level Variables[a]	**OR**	**P-value**	**95% CI**
Ratio of Latino-owned businesses in census tract[b]	0.94	0.836	(0.53-1.68)
Log likelihood statistic	-1313.15		
Variance at Level 1	0.19		
Variance at Level 2	0.05		

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

[a] Individual variable data from 2004-2005 HEPESE.

[b] Business data uses the 2010 Census tract identifiers. Number of Latino-owned businesses over the total number of businesses in a census tract.

These results show that there is no mediation by Latino-owned businesses in the ethnic enclave and diabetes relationship. The bivariate models confirm the findings from Chapter 4 where adding the Latino business ownership variable had no impact on the full model. Interestingly, there is an association between ethnic enclaves and Latino-owned businesses, however I was not able to show that relationship translating to health, specifically diabetes rates.

Moderation analysis for diabetes: ratio of Latino-owned businesses per census tract

To test for moderation I include an interaction variable between the neighborhood ethnic concentration measure and the ratio of Latino-owned businesses to the full model. As mentioned in Chapter 4, the interaction variable is not statistically significant and the main effects are not significant. Thus, this analysis did not find mediation or moderation by the ratio of Latino-owned businesses in a neighborhood on the ethnic enclave and diabetes relationship.

Mediation and Moderation Analysis for Depression risk:

Mediation analysis for depression risk: ratio of Latino-owned businesses per census tract

As Table B.2 demonstrates, increasing concentration of Mexican-origin residents in a neighborhood is associated with an increasing ratio of Latino-owned businesses. However it appears that the link to health may not be present in this analysis. Based on Table 5.4 in Chapter 5, there does not appear to be mediation by the Latino-owned business variable for the ethnic enclave and depression risk relationship. Table B.4. presents the bivariate association between the ratio of Latino-owned businesses and depression risk. There is no significant association between Latino-owned businesses in a neighborhood and depression risk, although the pattern appears to be protective.

Table B.4 Multilevel logistic regression model of ratio of Latino-owned businesses predicting depression risk. Unweighted.

	Bivariate Model		
	(n=1,902)		
Individual Level Variables[a]	**OR**	**P-value**	**95% CI**
Ratio of Latino-owned businesses in census tract[b]	0.61	0.215	(0.27-1.34)
Log likelihood statistic	-950.37		

Variance at Level 1	0.74
Variance at Level 2	0.29

Source: Wave 5 Hispanic Established Populations for the Epidemiologic Study of the Elderly (HEPESE), 2004-2005.

[a] Individual variable data from 2004-2005 HEPESE.

[b] Business data uses the 2010 Census tract identifiers. Number of Latino-owned businesses over the total number of businesses in a census tract.

Moderation analysis for depression risk: ratio of Latino-owned businesses per census tract

To test for moderation I include an interaction variable between the neighborhood ethnic concentration measure and the ratio of Latino-owned businesses to the full model. As mentioned in Chapter 5, the interaction variable is not statistically significant and the main effects are not significant. Thus, this analysis did not find mediation or moderation by the ratio of Latino-owned businesses in a neighborhood on the ethnic enclave and depression risk relationship.

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