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STRESS AND DIABETES

A Biomedical and Sociocultural Connection

Institute for Latino Studies | University of Notre Dame | Student Research Briefs

Mission

The purpose of this brief is to make the connection between the biological pathways that associate increased risk for diabetes with high levels of stress and the narratives of patients connecting their stress to causation and poor outcomes in diabetes.

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A Call to Attention

The rates of stress and diabetes are both concerningly high in the United States. Both are intertwined in biomedical discourse as well as sociocultural narratives; diabetes is a disease often attributed to lifestyle and environmental factors and stress is considered a physiological response to a psychological stimulus.

The purpose of this brief is to make the connection between the biological pathways that associate increased risk for diabetes with high levels of stress and the narratives of patients who connect their stress to causation and poor outcomes in diabetes.

Asserting the scientific and anthropological parallels in stress and diabetes has the potential to destigmatize and affirm folk etiologies, which are often dismissed by biomedical approaches. Folk etiologies refer to the cultural explanation of why someone develops a particular disease (Gálvez, 2020). These explanations often cite stressors as sources of imbalance leading to the disease, which is quite similar to how biologists define disease. Bringing this connection to light should fortify the call to improve the inequities and diminish the social determinants of health that cause such stressors.

Introduction - Diabetes

In the United States, 6 in 10 adults have a chronic disease, including heart disease, cancer, chronic lung disease, stroke, Alzheimer's disease, diabetes, and chronic kidney disease (CDC, 2022).

Yet, the burden of these diseases varies across socioeconomic status, race, and ethnicity. Specifically, diabetes is highly prevalent in the Latino population; 16.9% of Latinos are diagnosed with diabetes, relative to 10.2% of the non-Hispanic white population (Baquero et al., 2020). Further, Latino diabetics are twice as likely to require an amputation of the lower extremity and more than three times as likely to have end-stage renal disease as consequences of advanced and poorly managed diabetes (Baquero et al., 2020).

Interestingly, it has been shown that Latino migrants to the United States arrive with better health than European migrants and the United States as a whole (Concha et al., 2021). This pattern of better health in Latinos compared to US-born peers of similar socioeconomic status has been termed the "Latino Immigrant Paradox" (Linton & Gutierrez, 2020, pp. 72-73). The effects of this paradox typically shrinks as Latinos become more acculturated to U.S. culture. Yet, research on the effect of acculturation on the health of Latinos in the United States has yielded mixed conclusions; some argue that acculturated Latinos have healthier exercise and dietary habits, while other research concludes that acculturated Latinos are more likely to be overweight, physically inactive, and engage in unhealthy eating, all increasing the risk for diabetes (Concha et al., 2021).

The structural violence of employment and barriers to healthcare for immigrants are closely associated with the negative effects of acculturation on many Latinos, especially those who immigrate without documentation. For example, low wages and long working hours present a challenge to healthy eating habits. Additionally, increasing data indicates a relationship between the chronic distress many Latinos bear and the development of diabetes, as will be discussed in this brief.

Introduction - Stress

Defining stress is a challenge academically, though the experience is practically ubiquitous. Often, rather than defining stress itself, it can be simpler to define stressors, which are what causes stress, and the stress response, which is how the body reacts to the stressor. Stressors are "events or situations that elicit physical, physiological, or psychosocial reactions" (Morris et al., 2011, p. 71). Stressors can be acute or chronic, exacting distinct effects on the individual, though there are no established universal criteria to classify stressors as chronic or acute (Morris et al., 2011). The difficulty in assessing stress is largely due to its subjective nature, as different experiences are distressing to different people. Unlike other mammals, many stressors for humans are social, rather than based on survival needs. Furthermore, humans are uniquely capable of inciting a stress response by simply thinking about a situation, though they may not presently be in that situation, compounding the effects of chronic stress (Wiley & Allen, 2021).

It is also worth discussing that the term "stress" is relatively new. When discussing the challenges in translating cultural illnesses between Western medicine and traditional Indigenous people, Sanchez pointed out that the "notion of stress is relatively new among Indigenous people in North America" and is a more prominent concept in the United States and Canada than in the rest of the world (Sanchez, 2018, p. 159). Similarly, cultural anthropologist Richard Shweder criticizes the spreading prominence of "stress" across the world. Biomedically, he identifies that the complicated and not well-understood biological stress pathways overlap with both positive and negative physiological experiences. Culturally, he argues that "stress" is popular because it is "exquisitely vague and elusive," making it easy to "keep the peace" (Shweder, 1997). Still, I argue that stress can be a salient bridge between sociocultural narratives and biomedicine, bringing meaning to the social determinants of health. While stress may be vague in conversation, it can be operationalized and studied with valuable insights. In addition, Shweder might not have anticipated in 1997 that the World Health Organization would name stress as the health epidemic of the 21st century in 2016 (Fink, 2016).

Regardless of how one chooses to define stress, the realities of being Latino in the United States - racism, low socioeconomic status and poor working conditions, immigration and immigration status, isolation, and acculturation - result in an increased risk of distress in Latinos (Perez et al., 2015). Higher risk for diabetes and complications compounds this stress in a cyclical fashion: stress about diabetes increases overall stress while high stress is correlated with increased risk for and worsening diabetes.

The Biological Pathway of Stress

First, I will introduce the biological pathways that tie stress and diabetes together, beginning with the stress response pathway. The stress response is the responsibility of the autonomic nervous system, specifically the sympathetic nervous system, best known for the "fight-or-flight" response. The nervous system responds to stressors by secreting norepinephrine from nerve endings and secreting epinephrine from the adrenal gland. These chemicals circulate in the bloodstream and signal the body to increase heart rate, blood pressure, sweating, pupil and airway dilation, blood flow to the muscles, and contraction of the muscles, while decreasing digestion and other parasympathetic responsibilities are typically associated with the resting state when not stressed (Wiley & Allen, 2021). The nervous response is diagrammed in blue in Figure 1.

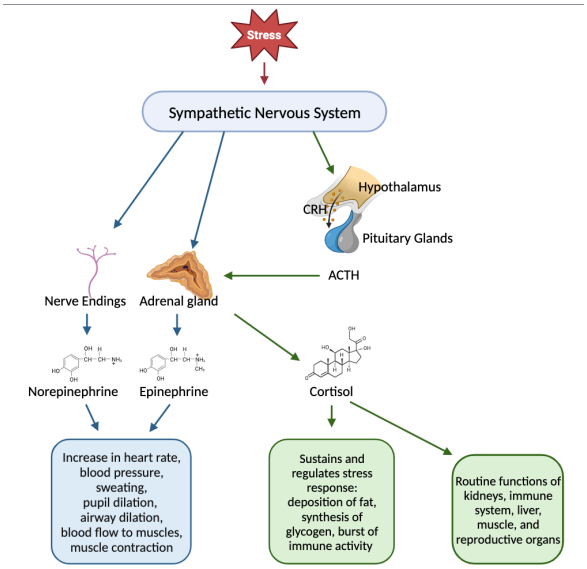

Figure 1. The stress signaling pathways. Nervous system responses are shown in blue and hormonal responses are in green (see Bib. note on Figures 1, 3, & 4).

Meanwhile, the sympathetic nervous system can also activate the hormonal response system, which is slower-acting and longer-lasting than the nervous system. In response to a stressor, the hypothalamus secretes corticotropin releasing hormone (CRH), which stimulates the pituitary gland

to secrete adrenocorticotropic hormone (ACTH). ACTH stimulates the adrenal gland to release cortisol, the hormone responsible for sustaining the stress response begun by norepinephrine and epinephrine. To provide the body with energy while stressed, cortisol triggers the release of glucose from the liver into the bloodstream. In addition to cortisol's role in stress, cortisol has effects on the kidneys, immune system, muscle, reproductive organs, and the synthesis of glycogen and fat deposition, making it a particularly important hormone in the body's general health (Wiley & Allen, 2021). The hormonal response to stress is diagrammed in Figure 1 in green.

The Biological Pathway of Type II Diabetes

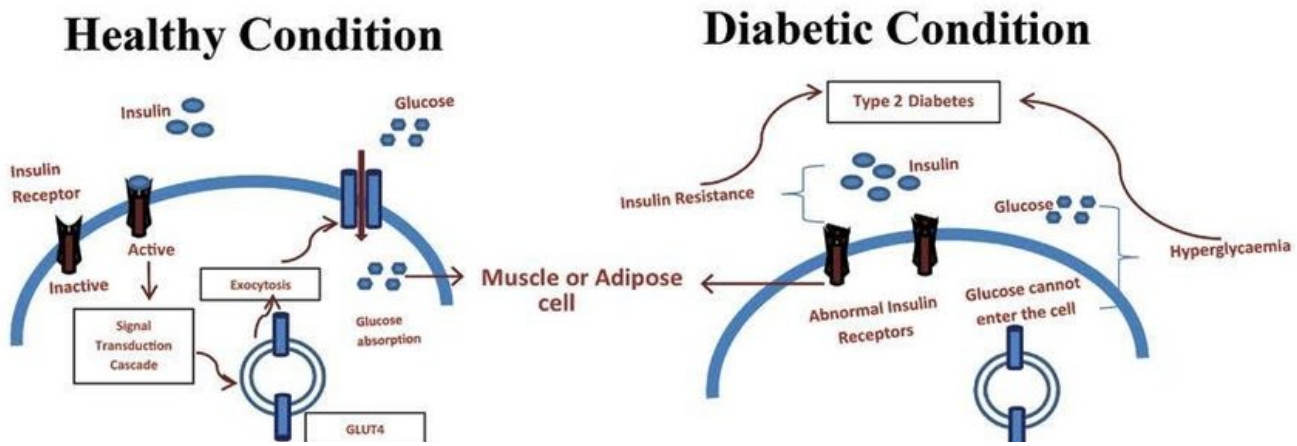

Figure 2. Comparison of the healthy pathway of glucose uptake by muscle or adipose cells (left) and the diabetic insulin resistance and development of hyperglycemia (right) (VSS et al., 2018).

Figure 2 outlines the basic pathway of Type II diabetes. In a normal muscle or adipose fat cell, insulin receptors are bound by insulin released by the pancreas in response to heightened levels of glucose in the blood. Binding of the insulin receptor initiates a signal transduction cascade that causes the GLUT4 glucose transporter to locate to the cell membrane to transport the glucose into the cell. However, if levels of glucose in the blood are regularly heightened and insulin is therefore also continuously high, the insulin receptors can become resistant to insulin, meaning that the signal transduction cascade will never be initiated and the glucose cannot enter the cell and remains in the bloodstream.

The Biomedical Link Between Stress and Diabetes

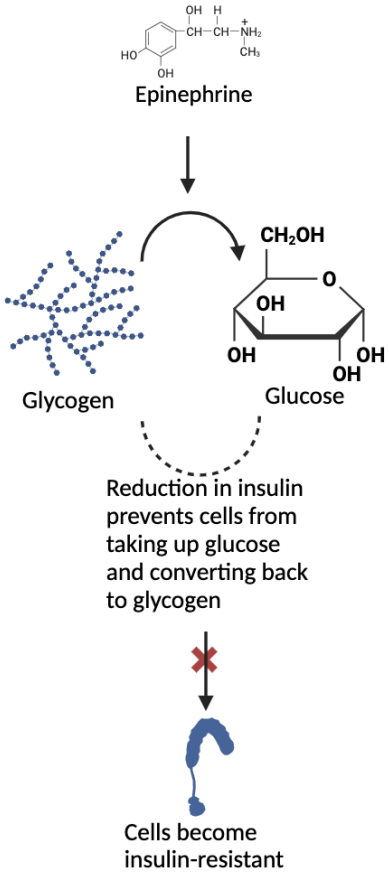

Figure 3. Epinephrine's role in insulin resistance (see Bib. note on Figures 1, 3, & 4).

When considering the biological pathways for diabetes, glucose and insulin are critical players. Both the nervous and hormonal circuits of stress can be linked to glucose and insulin. When epinephrine is stimulated for a stress response, blood glucose levels are increased by triggering glucose synthesis from glycogen stores and decreasing insulin production. The increase in blood glucose is meant to help the stressed individual in sustaining a response against the stressor. In an evolutionary context, this would have been adaptive to provide the body with a rapid energy source to fight off a predator; however, in modern society, chronic and social stressors do not benefit as much from this response. In fact, this stress response results in higher levels of glucose in the blood and can result in cells becoming insulin-resistant, leading to increased risk of diabetes and heart disease, as shown in Figure 3 (Wiley & Allen, 2021).

Meanwhile, the primary stress hormone, cortisol, also contributes to insulin resistance. Cortisol stimulates insulin levels to rise, causing visceral fat cells in the abdominal region to take up excess glucose and store it. However, when cortisol is chronically elevated by stress, the insulin level remains continually high, causing cells

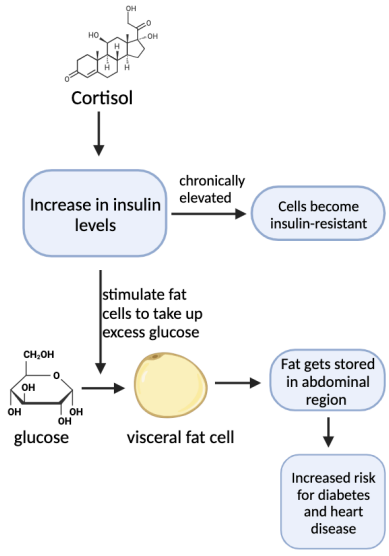

Figure 4. Effect of cortisol on the glucose-insulin pathways (see Bib. note on Figures 1, 3, & 4).

to become insulin resistant and require more insulin to be released from the pancreas in order to generate a response. Thus, high levels of stress can be biologically linked to the development of diabetes, as shown in Figure 4 (Wiley & Allen, 2021).

Anthropological Approaches to Narratives of Stress and Diabetes

Idioms, Illness, and Distress

Modern biomedicine is increasingly becoming aware of the importance of distress in disease, articulated as the illness narrative. In contrast to the physiological focus of a disease, an illness refers to the subjective experience of the symptoms caused by the disease (Wiley & Allen, 2021). The integration of social phenomena in disease experiences is inherent to the human experience and has long been integrated into folk etiologies and indigenous knowledge systems. Arthur Kleinman's *The Illness Narratives* are considered a hallmark in the push to encourage practitioners of biomedicine to embrace the lived experience of illness, rather than focusing only on the disease. Kleinman emphasizes that the "illness experience includes […] the forms of distress caused by those pathophysiological processes," asserting that the distress that is experienced is meaningful and significant for the patient (Kleinman, 1988, p. 4). Kleinman discusses the role distress plays in the illness idioms across cultures, as will be noted in this brief.

While illness idioms typically include distress, they can also function as methods of *expressing* distress, as Mendenhall elaborates in her ethnography of diabetic Mexican Americans seeking care at a public hospital in Chicago (Mendenhall et al., 2010). From her observations, she argues that diabetes functions as both an expression and a product of social suffering and distress. The patients she talked with used diabetes narratives as a space in which to express other abuses in their lives, such as domestic violence, that they may otherwise avoid discussing. Women shared their beliefs that childhood abuse and domestic abuse - topics that even their close family members did not know the extent of - produced the chronic

rage and depression that ultimately caused their diabetes (Mendenhall et al, 2010). These connections reflect how, at the same time as providing a framework to discuss abuse, the distress provoked by abuse is narratively related to the cause of diabetes. This ethnography provides abundant evidence that diabetes and distress are intertwined in complex and dynamic networks, synthesizing the physiological with the psychosocial.

Susto and Coraje

Patients of low socioeconomic status in the United States from all races and ethnicities emphasize social distress as a cause of their diabetes, highlighting the role of structural violence in health outcomes and narratives. Still, Mexican Americans' "powerful culturally elaborated idioms," such as s*usto* and *coraje,* stand out among these stressors (Mendenhall et al., 2010, p. 224). Simply put, *susto* refers to more acute stressors while *coraje* refers to more chronic, prolonged stressors. Interestingly, Mendenhall noted that the Mexican American men in her sample more frequently cited *susto* or acute stressors in their diabetes narratives while women more frequently cited *coraje* or chronic stressors. In fact, as discussed previously, women commonly conceptualized their diabetes as an idiom of distress upon which to discuss chronic domestic abuse (Mendenhall et al., 2010).

Rather than dismissing these idioms as merely sociocultural, Gálvez calls on medical professionals and politicians to begin "taking *susto* seriously" and listening to the experiences of Latinos who cite their stressors as causing their disease (Gálvez, 2020). A priest she interviewed in Puebla poignantly remarked that "diabetes is the disease of the migrant. Not just because migrants change the way they eat, but because it is the somatization of pain, trauma, and depression" (Gálvez, 2020, p. 648). For first generation Latino migrants, stress is interwoven in the experience of migration, along with and within pain, trauma, and depression (Gálvez, 2020). For Latinos whose families have lived in the United States for many generations, stressors continue in the forms of racism, cycles of poverty, and identity challenges.

Patient Narratives

The Vital Topics Forum on "Chronic Disaster: Reimagining Noncommunicable Chronic Disease" features various perspectives emphasizing the effects of structural violence and stressors on marginalized and racialized groups, highlighting how stress permeates into risk for and experience of disease (Gálvez, 2020). In "Unending Work and Diabetes," the narrative of a working woman with diabetes highlights the influence of her diet, stress, and living situation in her explanatory model of the disease (Chard, 2020).

Additionally, a 2023 interview with a community health worker at a free health clinic in the Minneapolis-St. Paul metro area reveals the story of a patient for whom stress was interfering with her diabetes self-care (see endnote for further study details). At this clinic, 85% of the patients are Mexican and 13% are Ecuadorian, and the quoted patient is Latina. The community health worker's recollection of their conversation shows the extent that stress can affect a diabetic's management of her disease:

> And then once the doctor and the nurse stepped out, she let me know of five different stories of stress that are currently going on in her life and then I'm like, "Do you think that the stress is like stopping you from fully taking care of yourself?" and she said, "Yes, you know, this stress is consuming me. I don't have the power or the time to think about my health at this moment […] I completely let go of my health." [So we] started to focus on trying to fix some of the stressors that were going on with her life with family back home in Mexico. She's got to provide money and so she's been working extra hours. So I kind of just sat down with her and I said, you know, "Thank you for sharing, but if you don't take care of yourself, you're not going to be able to continue taking care of other people and she kind of just stayed quiet for a long time and she said, "I know and I have adult children." I said, "You're a great person. You want to help everyone […] but when is anybody gonna help you? You're here alone, so you need to take care of yourself and that's what we're here for you". And you know, after that she's like, "Yes, thank you". So we've kind of been just talking and it seems like things are getting better…

This story is narrative evidence of the association of stress and poor self-care for diabetics. This patient illuminates the role of family and responsibility as an immigrant to the United States that have resulted in stressful working hours, limiting time and energy to take care of herself.

Strikingly, the patient describes feeling so "consumed" by her stress that she feels without "power" or "time," and has "completely let go" of her health. Her testimony reflects how stress can lead a person to feel that they have no energy to devote to their own health, leading to poor management of symptoms and poor compliance to medications, worsening the disease.

Models Suggest...

In addition to the biological pathways' intersection and the narrative and ethnographic evidence, associative studies have also made connections between high rates of stress and diabetes.

The multi-site Hispanic Community Health Study/Study of Latinos data was originally collected to describe the prevalence of chronic diseases and to establish risk factors and relationships for such chronic diseases in Latinos (Hispanic Community Health Study/Study of Latinos (HCHS/SOL) NHLBI, NIH, 2006-2018). Gallo et al. analyzed HCHS/SOL to assess whether stress indicators are associated with coronary heart disease, stroke, and major cardiovascular disease risk factors, including diabetes (Gallo et al., 2014). This analysis revealed that chronic stress is connected to a higher prevalence of diabetes, as well as coronary heart disease and hypertension. Using adjustments for demographic and behavioral indicators, the models showed that each additional chronic stressor in a person's life was associated with a 30% increased chance of diabetes. Chronic stress was defined in this study based on current ongoing problems of at least 6 months duration in major life domains including financial, relationship, health problems, drug or alcohol issues, and others. Additionally, recent stress was assessed using the Perceived Stress Scale (PSS-10) and traumatic life stressors were measured with the Traumatic Stress Screener (TSS). Though the chronic stress results showed the expected increase in risk, the results for traumatic stress and recent stress were both surprising; traumatic stress showed an inverse relationship with diabetes and recent perceived stress showed no association with diabetes (Gallo et al., 2014).

Within diabetics, psychological distress is also strongly associated with poorer diabetes self-care, exacerbating an already vicious cycle (Hoogendoorn et al., 2020). Hoogendoorn's study showed that individuals experiencing high levels of stress are more likely to fail to adhere to medications, self-monitor glucose levels, or adhere to recommended diets, reflecting similar findings as the interview testimonial discussed above. These self-care tasks are often referenced when diabetes is considered as a "lifestyle disease." Often, when diabetes is considered to be a failure of one's lifestyle, blame is allocated to the individual for not taking good enough of care of their health. Yet, Hoogendoorn's analysis aptly suggests that it is not the individual who should be blamed for their struggle to manage their disease, but rather the stressors and the system that produces them. In a system of structural violence in which many Latinos work inconsistent, low-paying jobs, often reside in violent, crime ridden areas, and face other distressing concerns daily, it is surely short-sighted to blame the victims. Structural changes including increased accountability for working conditions and sustainable compensation for work are necessary to target the ultimate causes of the disparate effects of diabetes on Latinos.

Conclusions, Recommendations, and Interventions

The goal of this brief is to call to attention the agreement between biomedicine and sociocultural perspectives on the inextricability of stress and diabetes. Although neither approach claims that this connection is linear or simple, both acknowledge the complex and dynamic connections between stress, diabetes, and diabetes care. Thus, I implore experts on both sides to acknowledge their similarities. In particular, I seek to empower the folk etiologies and understandings of diabetes, as they astutely make the connection between stress and diabetes, just as the biomedical model also links these signaling pathways. Rather than look down upon these narratives as unscientific, I call upon medical providers to acknowledge narratives and re-frame their care to make space for such interpretations.

Physicians in particular ought to be cognizant of the importance of stress in disease narratives of patients. While an idealized cultural competency is not the goal, as this presupposes that an awareness of a few facts about diverse groups can be applied to all individuals of that group, it is critical that clinicians are attentive to stressors in all patients' lives (Kleinman & Benson, 2006). This is particularly true for Latinos, an extremely diverse group in the United States, a majority of which face increased chronic stressors.

In addition to stress-informed doctors, this brief identifies the need for community health workers in the care model. In the narrative that is quoted above, the patient only felt comfortable sharing the influence stress was having on her diabetes management to a community health worker and did not discuss her stress until the doctor left the room. The value of community health workers in providing a trusted person to discuss health issues, connecting biomedicine and social determinants, is well-developed in prior literature (Wagner et al., 2015). Additionally, stress management and diabetes education administered by community health workers has been shown to improve psychological symptoms and self-rated health among Latinos with Type 2 diabetes (Wagner et al., 2016).

Ultimately, stress and diabetes are intimately entangled in a cyclic fashion. As the prevalence of chronic diseases like diabetes increases nationwide, it is critical that public health professionals and providers acknowledge the stressors behind the worsening health of the population, especially those who have been marginalized and those of low socioeconomic status. It is crucial to target the social determinants of health to work towards an ultimate lessening of the rates of diabetes and chronic disease, shifting the burden from inefficient and incomplete proximate treatments to ultimate causes. Medical professionals ought to act as advocates for their patients and call attention to the effects of structural and societal health disparities. On a large scale, politicians must receive and act on this call by enacting policies that creatively and dynamically deconstruct the systems that maintain damaging cycles of poverty and disease. Though a life completely absent of stress is impossible, it is certain that structural stressors that produce constant stress in certain populations, like the Latino population, must be targeted for the benefit of the health of all.

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Note on Figures 1, 3, & 4: Figures were created by the author of this brief using BioRender software and descriptions from Wiley and Allen, 2016.

Note on testimony: The quote from the community health worker was gathered in an interview for the author's senior thesis with approval from the Notre Dame Institutional Review Board under IRB Protocol ID 23-04-7807 in October 2023. The clinic described is St. Mary's Health Clinics in St. Paul, MN, which serves uninsured patients (85% are Mexican, 13% are Ecuadorian) at six clinics across the Twin Cities metropolitan area. The clinic's model includes employed Latina community health workers and nursing supervisors and volunteer nurses, doctors, and interpreters. The majority of patients at the clinic receive care for diabetes, other chronic disease management, or women's health management.

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Professors Karen Richman and Nydia Morales-Soto, Institute for Latino Studies; Thesis Advisor Dr. Vania Smith-Oka, Department of Anthropology

Institute for Latino Studies

230 McKenna Hall

Notre Dame, IN 46556

572-631-4440

latinostudies.nd.edu

Brief Produced by:

Julia Ruelle

Professors Karen Richman and Nydia Morales-Soto

Latino Health: Social Cultural and Scientific Perspectives