

DEMYSTIFYING LATINO DIET IN DIABETES

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

Table of Contents

- Mission... 1
- Vocabulary... 1
- Introduction... 2-3
- Background... 4-6
- Methodology and Data... 7
- Discussion... 8
- Conclusions and Future Directions... 9
- Bibliography... 10
- Acknowledgments... 11

Vocabulary

- **Latino/a:** population that immigrated from a Latin American country or the children of immigrants in the U.S.
- **Culture:** customs, values, and beliefs that a social group shares
- **Type 2 diabetes:** a disorder that is developed by insulin resistance and insufficient insulin production in the body.



Objective

This research brief aims to delve into the intricate relationship between diet, food culture, and Type 2 Diabetes, with a focus on how these factors impact health outcomes within the Latino community. Latinos constitute one of the populations with the highest prevalence for Type 2 Diabetes in the United States. Statistical comparisons have revealed disproportionate percentages of lifetime risk for diabetes: 52.5% for Latina Women, compared to 31.2% among Caucasian women, and 45.6% for Latino men, compared to 26.7% for Caucasian men (Mendenhall, 2010). While extensive research exists on this topic, interventions have fallen short on effectively addressing the issue.

Vocabulary

- **Health disparities:** differences in health outcomes between different social groups (due to socioeconomic and environmental factors)
- **Socioeconomic factors:** economic components that affect how people live and thrive in society. This includes socioeconomic status, proper healthcare, and access to other necessary resources.
- **Environmental factors:** elements from the surrounding world that influence daily-life and wellbeing, such as labor conditions, immigration, acculturation.
- **Acculturation:** how individuals adapt and assimilate to a new culture or environment; this typically leads to the blending of cultures.
- **Food insecurity:** the lack of consistent access to adequate food typically because socio-economic factors.

Biomedical and public health research has put forth proposals for dietary modifications for Latinos, suggesting changes in their food choices, cooking methods, and even extreme dietary measures such as cutting out carbohydrates completely. These proposals often overlook the influence of economic and social health disparities faced by this community which contribute significantly to the elevated rates of Diabetes in Latinos in the US. Conversely, other studies have recognized these disparities, yet have failed to suggest potential interventions or changes to address them. This brief identifies an intersection between both of these approaches, with an effort to avoid assigning blame to the traditional foods consumed by Latinos as an integral part of their culture, while simultaneously exploring ways to make healthier meal options more accessible and attainable to them.

The significance of this study is underscored by the life-threatening consequences of undiagnosed and untreated diabetes, including end-stage renal disease, cardiovascular disease, amputations, and blindness. The Centers for Disease Control and Prevention (CDC) has reported that Latinos are 50% more likely to die from diabetes than Caucasians (Baquero and Parra-Medina, 2020). This pictures the urgency of finding ways to reduce Diabetes rates within the Latino community, resulting in an increase of life expectancy. Such effort will benefit not only Latinos, but also other underrepresented groups of the US who may adopt of similar effective measures.



I. INTRODUCTION

Currently, in the United States, 38% of the adult population is diagnosed with pre-diabetes, meaning around 97.6 million people have borderline diabetes (CDC, 2023). In addition, 11.6% of the population has diabetes— 90-95% of which have Type 2 Diabetes (T2D), indicating that over 34 million people currently live with T2D (CDC, 2023). T2D develops from the body’s inability to properly use or produce insulin, impacting blood sugar levels. Insulin is a hormone produced by the pancreas that signals the entry of sugar into cells for use as an energy source. This condition can result in serious health issues such as renal failure, cardiovascular disease, sight problems, blindness, and slow-healing wounds that can lead to amputations (Aguayo-Mazzucato et. Al, 2019).

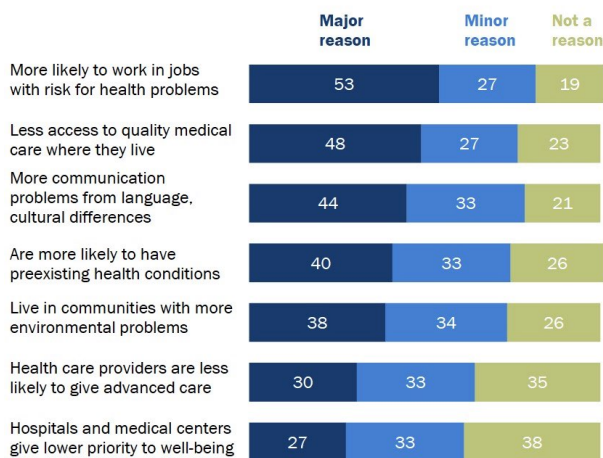
The Latino population in the United States is disproportionately affected by T2D, especially Latino immigrants. Around 50% of immigrants in the US are from Latin American countries (Pew Research Center, 2022). Immigrants are often of low income and, therefore, face greater health disparities compared to non-immigrant Americans. As there is significant variance of T2D within the different non-immigrant Latinx populations in the US, distinctions

must be made when addressing subpopulations of this group. Ethnicities with the highest prevalence include Puerto Ricans (13.3%), Mexicans (11.1%), Dominicans (9.4%), and Cubans (9%). In addition, people from other Central and South American countries showed a prevalence ranging from 5%-7.3% (CDC, 2023).

Latinos have a genetic predisposition to diabetes, an increased likelihood to develop the condition due to inherited factors from one or both parents; however, environmental factors, including labor conditions, immigration status, and acculturation, exacerbate the chances of developing this disease. Socioeconomic factors, such as socioeconomic status (SES), access to healthcare, food security, and education, also play a role in the rates of diabetes within the Latino community.

53% of Hispanic adults say health risks in jobs are major reason for generally worse health outcomes

% of Hispanic adults who say each is a ___ reason why Hispanic people generally have worse health outcomes than other adults in the U.S.



Note: Respondents who did not give an answer are not shown.
Source: Survey conducted Nov. 30-Dec. 12, 2021.
"Hispanic Americans' Trust in and Engagement With Science"

PEW RESEARCH CENTER

Fig. 1. Statistics on major reasons for worse health outcomes reported by Latino workers in the United States in 2021.

The Pew Research Center conducted a survey which asked Latino workers in the US what they believed were major determinants of health disparities affecting this population. The majority of responses pointed to occupation and labor conditions (Figure 1). Additional research suggests that stress, social inequity, and race and ethnicity also lead to health disparities and health-related diseases, such as diabetes (Wiley, 2017).

As mentioned, T2D prevalence is affected by both biological factors and external factors within the Latinx population such as genetics, metabolism, nutrition, health and wellbeing. Physicians and other scientists have advocated for consuming a balanced diet, exercising regularly, and sleeping properly in an effort to prevent and manage T2D in all populations. In addition, research has pointed to the Latino diet and food choices as significant factors influencing blood sugar levels. Interventions promoting healthier choices, involving reducing carbohydrates and fats, have been implemented across health care settings. However, healthier food options, such as fresh meats, vegetables, and fruits, tend to be more expensive, consequently limiting their accessibility to people of lower income (Baquero and Parra-Medina, 2020). Fast food alternatives, which are typically higher in calories and lower in nutritional value, are more accessible to people of lower incomes. This reality is termed “Food deserts” (USDA, 2022).

Overall, more than one factor contributes to the development and rate of T2D among Latinos (Figure 2). Identifying these factors leading to health disparities helps create successful preventative measures in an effort to prevent further health issues from developing and even reducing death rates among the population. Additionally, studying these factors develops cultural competency for healthcare providers and allows for the understanding of prominent stressors that impact health. This will allow for improved medical practices which align with and complement the culture of individual patients to create realistic, long-standing changes.

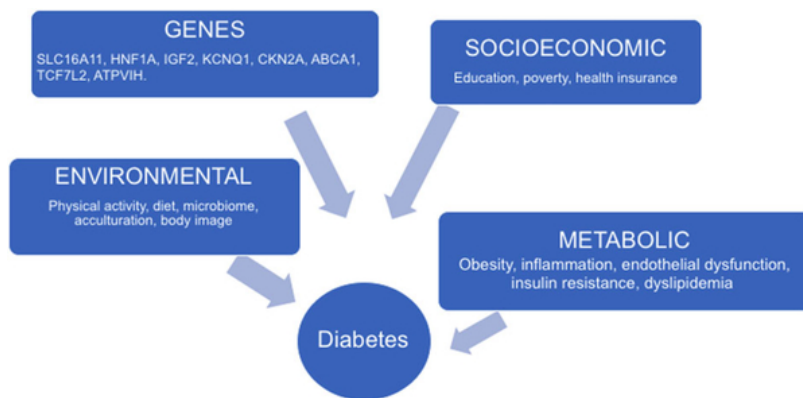


Fig. 2. Significant socioeconomic and biological factors that increase the rate of the development of type 2 diabetes in Latinos in the US.

In this study, the specific effects of external and biological factors on food and diet are evaluated, allowing for the synthesis of interventions which may delay or terminate the effects of T2D in Latinos while reducing relapsing patterns. From an anthropological perspective, diabetes is a disease of modernization. This means that as modern societies developed,

disparities between the wealthy and the impoverished increased. This is an important perspective for the aim of implementing solutions that are based on a medical anthropology approach. How food and diet play a role in the expression of this distress experienced by Latinos who live lower-income realities will be evaluated for this purpose. Improving diet through enhanced access to healthy food will be a key intervention for addressing T2D and reducing its prevalence within the Latino community in the US.

2. BACKGROUND

2.1 Genetics and other biological factors of T2D

Multiple theories have been developed to explain why Latinos have a higher prevalence of T2D compared to other populations. To identify current trends in the rate of the disease and its growth within the Latino community, statistical studies reveal disproportionate percentages of lifetime risk for diabetes. As stated previously, data has shown that Latina women and men have an elevated risk for diabetes in comparison to their Non-Hispanic White counterparts (Mendenhall, 2010). Anthropological studies have identified structural determinants which also greatly impact the overall health and healthcare for Latinos. However, in order to understand those broader contextual factors, the biological factors must be studied and well understood.

Latinos have been found to be genetically predisposed to developing T2D. Genetic studies have shown that more than 100 loci are associated with T2D trait, and influence an individual's risk of developing it (Mercader & Florez, et al., 2017). For years, Latinos were underrepresented in research and it wasn't until 2014 that geneticists concluded the first locus specific to Latinos: *SLCA16A11*. This marked a monumental step forward, as determining a genetic predisposition for diabetes in Latinos can be significant in the search for prevention and management interventions.

Disruptive changes in the expression of this *SLC16A11* can lead to consequences associated with

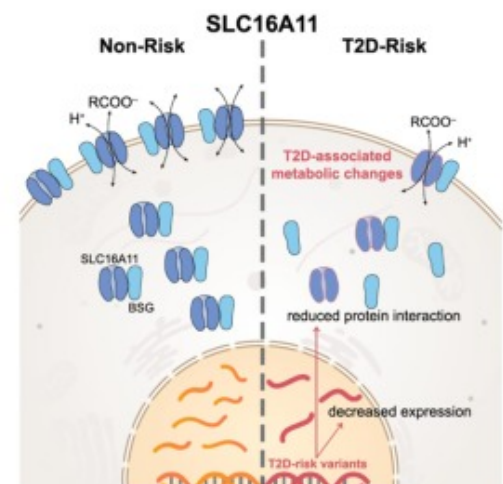


Fig. 3. Lower *SLC16A11* expression in the liver. Reduced *SLC16A11* expression was shown to induce metabolic changes associated with T2D.

T2D, like changes in fatty acids and lipid metabolism. Similarly, studies found another Latino specific locus named Insulin-like Growth Factor 2 (IGF2), which is a damaging alternative form of this gene against T2D. Essentially, increasing the expression and functionality of SLC16A11, while reducing the expression of IGF2 in individuals would be helpful in treating and preventing T2D within this population (Mercader & Florez, et. Al 2017).

Why is it that Latinos seem to have a different genetic composition than American and European Caucasians? It has been theorized that this is due to the diverse genetic ancestry, which encompasses Spaniards, Native Americans, and Africans (Mercader & Florez, et. Al 2017). Therefore, this is also a factor to take into consideration when evaluating different Latinos that may have different proportions of ancestry, and therefore, diverse genetic compositions. For example, Mexican and Central Americans have higher Native ancestry compared to South Americans that have higher European ancestry. Taking these diverse genetic backgrounds into account in healthcare can enhance the understanding of their diagnosis and guide appropriate interventions.

In addition to the genetics behind T2D in Latinos, other common diseases within this population, such as hypothyroidism, hypertension, obesity, and metabolic syndrome can increase their risk of developing T2D. Due to this, chances for comorbid conditions, the presence of two or more conditions, within the Latino population is also dangerously high. Ethnic disparities in BMI and waist circumference, suggesting body-fat percentages, have grown in the US. Likewise, prevalence of obesity has been found to be higher in Latinos (Heiss & Snyder et. Al, 2014). This growth is worrisome due to an existing linear correlation between BMI and prevalence of diabetes (Schneiderman et. Al, 2014).

2.2 Structural determinants: socioeconomic and environmental factors

Overall, a low socioeconomic status (SES) will limit an individual's access to necessary resources that affect quality of life, through education, food security, living conditions, and access to healthcare. Studies have shown that an income lower than \$20,000 a year is related to a higher prevalence of diabetes (Mazzucate et. Al, 2019). A significant percentage of Latinos in the US are immigrants—many of which have lower education levels and are undocumented, preventing them from working legally in the US and leading them into low-paying occupations with little to no benefits. Lack of income hinders them from accessing necessary resources that improve their quality of life, including healthier food options. Additionally, due to lack of healthcare, low income Latinos suffer from more serious diseases because they are not

regularly seen by physicians. Therefore, these individuals are diagnosed with chronic diseases in their later, more developed stages. This is significant as it causes higher rates of mortality due to the difficulty of treating a disease once it has already advanced. Other determinants like citizenship and immigration status deter Latinos from treating diseases.

Recently, advancements in health insurance policies for low income populations have been developing. Usually, individuals seek jobs that will provide health benefits to access healthcare. However, when this isn't possible, the US government has designed federally funded coverage options like Medicaid, the Children's Health Insurance Program (CHIP), the Affordable Care Act (ACA), Marketplace coverage, and Medicare for people who are unable to afford private insurance (Konchak et. Al, 2017). Because these programs have eligibility restrictions on either age and citizenship status, undocumented Latinos cannot access these funded coverage options and instead must rely on inexpensive service based healthcare clinics. Moreover, state funded coverage programs are not always available or accessible even to documented Latinos because state-level governments have the option to opt out of expanding, or even implementing these programs (Konchak et. Al, 2017).

Low income Latinos in the US exhibit some of the highest rates of health risk caused by stressors from dangerous labor conditions, long work hours, and little-to-no access to healthcare. Stressors cause elevated blood-sugar levels and in turn increase susceptibility to diseases, like T2D. Additionally, diet and lifestyle are major inhibiting factors for adequate prevention and management of this disease (Chaufan, 2011). Working long hours, can lead to little-to-no time for cooking and physical activity, which can cause disordered eating times, periods of fasting or binge eating, and sedentary lifestyles. Structural determinants and environmental factors highly increase the likelihood of developing T2D, especially if genetically predisposed.

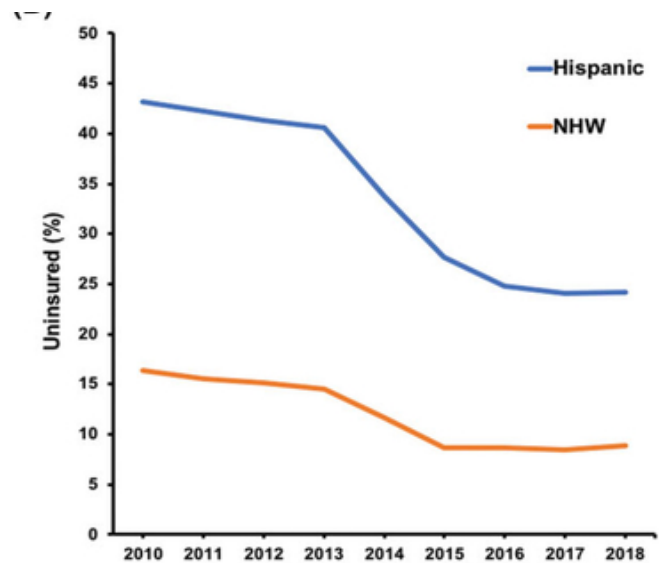


Fig. 4. Rates of un insurance among Hispanics and non-Hispanic white (NHW).

2.3 Cultural determinants

Culture is one of the most important determinants to consider for diabetes because of cultural eating habits and the different lifestyles. Diets in Latino culture vary significantly, however they typically contain meals that are high in carbohydrates and sugars (Chaufan et. Al, 2011). This can be detrimental to the health of prediabetic or diabetic people as it causes blood glucose to rise and the body is unable to regulate it. Moreover, as mentioned, Latino diets within subpopulations vary greatly, which contradicts the previous misconception that generalizes diet interventions across Latin American cuisines.

One thing in common across mostly all Latin American cultures though is that food holds a special value, creating a sense of identity that, in turn, fosters a deep sense of community. Food plays a big role in family functions, and in Latino culture, family most times is a person's biggest support system. This is because of the concept of *Familismo*, which means the central role of family in an individual's life (Aguayo-Mazzucato et. Al, 2019). A big consequence of this value is that an individual is expected to prioritize their relatives above all else, building a very strong sense of loyalty. However, this can be both beneficial and detrimental to Latinos with diabetes. Although this means these subjects can count with the support of their family members for disease-management purposes, this would also mean that making independent decisions can be a challenge for them. Therefore, at family functions they might feel the pressure to overeat and they might find it difficult to choose different meal options more apt for their condition (Aguayo-Mazzucato et. Al, 2019).

Another relevant influential factor is acculturation of Latinos to the American lifestyle. Acculturation has impacts on healthy lifestyle habits (Mainous et. Al, 2008) and increases risk of diabetes among Latinos (CDC, 2022). It is correlated with adoption of some less desirable dietary habits. More acculturated individuals were less likely to have a higher fiber intake diets and less likely to have lower saturated fat intake. These two dietary factors have shown to contribute to the development of diabetes in patients. Although Latino diets can be improved, they are overall mostly affected by the difficulty in maintaining a balance between healthy traditional habits while adapting to mainstream US culture.

Additionally, local food stores of neighborhoods where predominantly Latinos live offer a limited variety of healthy food at unaffordable prices. This creates disparity between the diets of affluent and low income populations (primarily Latinos). Diets of Latinos in the US contain higher levels of fats and carbohydrates compared to their countries of origin due to high-caloric meals from cheaper and more accessible foods. It has been proven that poor regions often

experience higher risk factors including high-fat diets, obesity, stress, and physical inactivity, which heightens likelihood for diabetes (Mendenhall, 2010). This is due to existing *food deserts*. As mentioned in the introduction, food deserts are areas where people have very limited access to healthy affordable foods. The US Department of Agriculture (USDA) defines two types of food deserts: first, urban areas where people live farther than a mile away from the nearest grocery store; second, rural areas where people live more than 10 miles away from the nearest grocery store (USDA, 2022). Currently, there are over 6,500 food deserts in the US (Figure 5). These are areas where predominantly underrepresented groups can afford to live, including Latinos.

Stress is another factor that highly influences diabetes rates. In the case of many Latino immigrants, adjusting to a completely new environment, including the need to find work opportunities, learning a new language, and leaving some of their family behind can cause significant stress. It can be especially stressful to adapt to American diet, food availability, and lifestyle. Immigrants who arrive at younger ages are more likely to be obese than those who arrive later (Aguayo-Mazzucato et. Al, 2019). It has also been found that diet quality decreases with nativity and duration of residence in the United States. For example, adults born in Mexico have a higher consumption of fruit and vegetables, fruit juices, grains, and legumes. In contrast, Latinos acculturated to the US have lower fruit and vegetable consumption and a higher intake of sugar, added fats, and sodium (Aguayo-Mazzucato et. Al, 2019).

To further elaborate on the importance of considering culture, it is crucial to evaluate the customs and traditions within Latino culture. In various Latino cultures, traditional medicine is practiced and often preferred over modern biomedical interventions. This traditional folk practice of medicine is referred to as *Curanderismo* (Sánchez, et. Al, 2018). Unlike biomedicine, Curanderismo addresses not only physical health but also social and emotional well-being. The Curandero, the healer, establishes a relationship of trust and open communication with the individual. This is likely why Latinos in the US choose to receive their medical care from these healers. More acculturated Latinos tend to seek biomedical attention in addition to, and as a complement to, traditional medicine (Sánchez, et. Al, 2018).

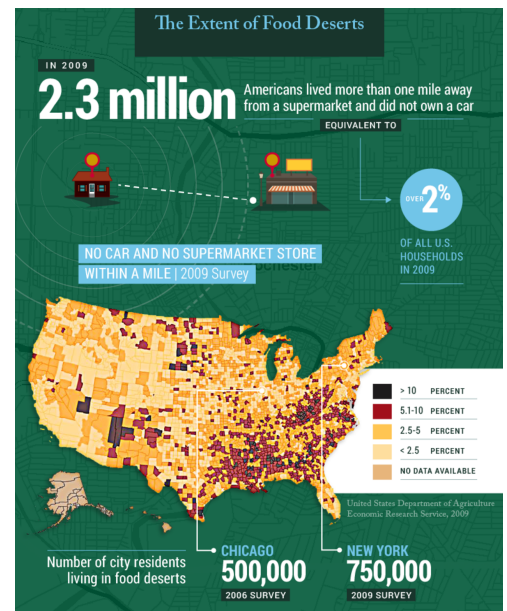


Fig. 5. Extent of food deserts in the US.

2.4 Current Approaches and Interventions

Interventions encompass general diabetes care, glycemic control, blood pressure care, and cholesterol control. The Diabetes Prevention Program Research (DPPR) group conducted a clinical study that showed that high-risk individuals can delay or prevent the onset of T2D by changing their diet and exercise habits in order to lose weight (Knowler et. Al, 2002). The weight loss didn't have to be drastic, only a small amount (at least 7% of initial body weight). However, the individuals in the study that showed most adherence to a weight loss plan, which meant changing their diet and physical activity, were a part of a lifestyle intervention group with intense counseling and follow ups (Knowler et. Al, 2002). Interestingly, the lifestyle intervention group showed in a 10 year follow up study a permanence of the habits learned and the reduction of T2D prevalence within the group. This and multiple other studies have proposed then that individuals use lifestyle changes for weight loss as a measure to prevent or delay the effects of T2D.

Another intervention that has been used is the employment of drug medication. These come in the form of oral diabetes medication and insulin. The common medications prescribed by physicians to T2D patients include biguanides or glucagon-like peptide-1 (GLP-1R) receptor agonists (Carter, 2023). Biguanides are in charge of reducing the glucose that the liver produces, as well as making the body more sensitive to insulin intake. GLP-1R medicines are meant to increase the use of insulin in the body and the production of pancreatic beta cells (the cells in charge of producing insulin). There is rising popularity of using GLP-1R drug medications for diabetic patients, such as Ozempic and Trulicity, which contain semaglutide, a hormone that suppresses hunger and reduces food cravings helping maintain and lose weight (Douceff et. Al, 2023). Although shown to be effective, these expensive medications are not be accessible or affordable to all populations.

In light of this reality, a specific approach, focusing back on diet, that has been attempted is substituting certain foods. Examples of suggestions that have been made are using greek yogurt instead of sour cream, swapping white rice for brown rice, and avoiding unhealthy fats (Care Path, 2017). However, these changes don't account for differences in foods within Latino subpopulations, for the cultural value of traditional foods for Latinos, and are not taking into consideration food accessibility.

Other relevant interventions have been the implementation of educational programs for T2D care. The goal is that if patients seem to not have any previous knowledge, these programs would increase their health literacy and ability to self-manage. These sessions are



Fig. 6. Example of the main topics of a DSME program.

termed Diabetes Self-Management Education (DSME). These take period over a course of time and are usually at no cost, but they seem to have no other common regulations across them. Each program seems to choose the time and the teaching model, as well as who teaches it (physician, diabetes expert, or a community health worker) which also established which language is being used (Figure 6). Some examples of these programs are Project Dulce, Starr County Initiative, Tomando Control de su Salud, Rosal et al, Tomando Control, Banister et al, and El Camino a la Salud (Milan-Ferro et. Al, 2007).

3. METHODOLOGY AND DATA

Data were gathered through literature review and interviewees. Research focused on biological and social determinants of T2D in Latinos in the US for the analysis of its prominent causal factors, primarily including income, policy, and access to healthcare. Data on the importance of food and diet in the management of individuals already diagnosed with T2D were compiled from biological, anthropological, and medical research articles, government websites, news articles, and other media providing a multidisciplinary approach. Interviews conducted with doctors, other healthcare workers, and a diabetes patient provided first-hand insight and diverse perspectives. The interviews conducted include a medical assistant from the Sister Maura Brannick Health Center in South Bend, a pediatrician and diabetes specialist from the American Care Center in Miami, and a 40 year old Latino diabetic patient. These interviews were selected with the purpose to contrast care in a free clinic with private care. Other observations that were done were the ways of communicating with the patients, the amount of times that they saw and followed up with a patient, and overall strategies in diabetes care.

The first interview was with a Latino medical assistant working in the Sister Maura Brannick Health Center in South Bend. All questions pertained to the diabetes care of patients, both within the clinic and outside of it. The interview was conducted in a manner not designed

to elicit specific answers but rather to capture their honest perspectives, free from guidance inherent in the questions. All questions are listed in Appendix 1 at the end of this article.

From this interview, one of the initial findings is that the majority of their patients are Latinos, comprising approximately 98% of the total. Moreover, to qualify for care in the clinic, individuals must be in the poverty line and be ineligible for Medicaid. Consequently, a significant portion of the patients are undocumented immigrants. Once accepted into the clinic through a thorough application process, they are eligible for a substantial amount of free care. The interviewee also highlighted that almost all of their patients are diabetic.

When asked about how they explain diabetes to these patients, the interviewee indicated that most patients have some familiarity with the condition, often due to family members, especially their parents, experiencing it. However, they aim to briefly explain that it is related to elevated sugar levels in the blood. To ensure comprehension, they strive to use simplified vocabulary and follow up with questions to confirm the individual's understanding. This specific assistant is in charge of providing direct translation from English to Spanish for the doctor and the patient.

One of the primary reasons they explain for individuals developing diabetes is improper eating habits. They provide specific examples of foods high in carbohydrates that are commonly consumed within the community.

"We also have a diabetes class in the clinic where they get their education".

In an effort to improve their health literacy, they provide a DSME program. Patients choose to participate, classes are conducted at times by a non-Spanish speaking individual, and there is no established system to ensure their engagement, aside from a described reminder phone call.

"When you tell them what other organs of the body get affected, they rethink things more. It goes back to the food too. For the most part, I know what the population here eats. You have to tell them to to cut down the tortillas, the potatoes, the sodas, the juices. [...] The doctors are good at explaining how to start a basic exercise routine of at least 15 to 30 minute walking. We even offer them to use the gym here. However, sometimes they have expressed that transportation is an issue. We try to explain then what they can do at home".

When comparing the care provided to uninsured patients versus insured ones, the interviewee noted that even if it's government-funded insurance, insured patients have numerous care options. In the clinic, they rely on financial assistance and volunteers to offer free care. Which is why specialists only come once a month. Therefore, this dependence on external support implies resources within the clinic are limited.

"Patients are often non-compliant with our recommendations and their medications. They either hear things from other people and they decide to follow that. Sometimes you prescribe them a medication and they make their own changes. At times they figure it's a one time thing and don't come in for refills. [...] Another thing that affects our population is that they have to apply for financial assistance every six months, and some people don't. When they are on medications for that period of time, because they haven't reapplied to the clinic, they can't follow up with their medicine. [...] However, they only have to pay a one time fee of 10 dollars for a glucometer. Once in the system, the rest of their care is for free. All their medications, including insulin, are for free".

After highlighting some challenges in maintaining patients' care, the interviewee emphasized that one of the most significant challenges contributing to the high diabetes rates is the limited availability of food options since access to healthier foods is minimal to nonexistent.

"They cook and eat what's available. People have told us that they eat what they get at the food pantries around the area. Those foods often contribute to their high diabetes and cholesterol. [...] It's a lot of canned food, pastas, just high carb foods".

When asked whether the interviewee believed that one of the main reasons for the disparity was specifically the Latino diet, they expressed that, due to their limited food resources, it couldn't be the sole factor. However, they did stress the significance of the genetic factor within the Latino community and how it plays a substantial role in their high risk for diabetes.

A second interview with a pediatrician and diabetes specialist from the American Care Center in Miami was conducted where the same questions were asked. A significant insight from this interview was the extensive care required for diabetes.

"It's very important to treat all other risk factors in order to reduce complications of diabetes. Meaning one needs to have their blood pressure well-controlled, as well as have their cholesterol reduced".

Additionally, the interviewee highlighted some key differences that uninsured patients face in comparison to insured patients:

“Patients from volunteer clinics have less access to some of the more expensive new medications and to the different new gadgets used to monitor their glucose levels. For example access to the freestyle machine which monitors the glucose levels without sticking your fingers”.

This was a specific difference emphasized by the interviewee, as monitoring blood levels is a crucial aspect of diabetes self-management. Patients without access to newer technologies must continue using glucometers, requiring them to prick themselves to assess a drop of blood with the device. This process might increase the likelihood of non-compliance.

When asked about patients’ self-management and the influence of Latino culture and diet on diabetes care, the interviewee expressed:

“They don’t want to exercise. They don’t want to stick themselves. They don’t want to take a lot of medications at the same time. In conclusion, they don’t want to change their lifestyle. [...] The traditional diet in Hispanic population is high in carbohydrates such as rice, bread/tortillas, etc. leads to a high BMI, which makes them more prone to develop diabetes. Other broader contextual factors including poor income, lack of exercise, lower educational level have been shown them to be less compliant with their treatment”.

Lastly, an interview with an approximately 40 year old Latino diabetic patient was conducted. Although the questions were similar, some were added based on their responses.

“To my understanding, diabetes is a resistance to sugar. Once one has eaten too many sugars, the body can’t process it properly. I was told my diabetes was caused by bad habits like a bad diet and lack of exercise. [...] They briefly mentioned a genetic component, which made sense because my mom, my grandma, my aunts... they all have diabetes too”.

As a follow up to the patient's response, a question regarding why they thought they developed diabetes was asked.

"I think when people have a lack of love in their lives, they carry an emotional burden, and that's why they develop diabetes. That is why diabetes has been passed down generation to generation from maybe a grandma that was unhappy or felt unloved. [...] I think when people get upset or stressed easily, they develop diabetes easier".

The interviewee provided a different perspective with this answer regarding the influence of other factors like emotions and stress to the development of diabetes. When asked about the influence Latino culture on their diet, they mentioned knowing that the typical foods in their country are very high in carbohydrates. Not only that, but festivities and holidays are common and often involve celebrations that revolve around food.

"We always do big gatherings. Everyone brings different foods, mostly desserts or breads. It's very hard in those moments to say no to eating those things. I enjoy eating them. [...] It can also be seen as disrespectful to not eat food that was prepared for you by someone else. After all, they took the time to cook it, so you should eat it".

At the end, the patient was asked about what interventions they have been told to do in order to manage their diabetes. In addition to that, what are some feelings or views they have about these.

"They initially prescribed me Metformin. Over the years they have changed the amount of pills I take in a day. Most recently, they changed some of my pills to a new one that makes me really thirsty. I just feel like my mouth is dry all day. I still take it though. [...] I was told by the doctor that T2D is reversible to a degree, and that if I don't want to have to inject insulin I should stick to my medications, a healthy diet, and exercises. [...] I do it because I'm scared of the needles, and fear getting blind to having to get an amputation".

4. DISCUSSION

Many critical considerations must be addressed before formulating a proposal for effective food and diet interventions tailored to Latino patients; this discussion will depict the complex web of factors influencing food and diet that impact diabetes within the Latino community.

Understanding why Latinos are affected by T2D is not only crucial for the community, but also for the country as a whole as Latinos constitute a significant and expanding part of America's future. The rapid growth of this population has a profound impact on the US as Latinos partake in vital societal roles, influencing the economy, politics, and other social structures that significantly affect the overall development of the nation. Additionally, immigration notably contributes toward the growth rate of the Latino population in the United States; this brings new cultures, values, languages, and forms of communicating into communities. Understanding this demographic shift is crucial for crafting diabetes interventions that resonate with the community's needs and values.

In an effort to create suitable interventions, a key step is identifying and diminishing the gaps in existing studies, which seem fall short in integrating culture and biology. Overall, not only is research in diabetes on Latinos limited, but they also pose inadequate interventions as they often lack sufficient data, contain limitations, and are not culturally awareness. Insufficient data for beneficial interventions may be attributed to the lack of Latino representation in research and health studies. One of the main issues identified is regarding different Latino cultures as one, leading to a "one-size-fits-all" approach, when in-fact each nationality has its own cultural practices and lifestyles. Numerous studies may be proven futile to many populations as they focus primarily on Mexican patients, meaning that the conclusions drawn may not be applicable to all other Latinos living in the United States.

Additional proposals are problematic as they often suggest changing cultural recipes, which is insensitive and may be ineffective as Latinos will likely be unwilling to change their generational recipes. Proposals that fail to create inclusive solutions cannot garner greater acceptance among Latinos and therefore are unable to be further implemented into the community.

When it comes to physician care, the only way to effectively assess a Latino patient is by knowing how to effectively communicate, connect, and have an understanding of their culture because building trust between a patient and his or her doctors is essential. In fostering proper relationships, patient care can be highly improved in terms of both assessment and resolution. In a culture surrounded by values of *familismo* and loyalty, trust is essential between the

physician and the patient. Patients are more inclined to share concerns regarding their health, as well as thorough descriptions of broader contextual factors in their life, and this can in turn lead to better differential diagnoses and a more adequate intervention for them.

As mentioned, the use of medicine is a primary solution when dealing with T2D patients. However, rates of noncompliance are usually high and are influenced by both a sense of mistrust in their doctors and a lack of desire to deal with potential side effects of the medications. Dietary adjustments are more accessible to Latinos, but formulating lasting diets can be quite difficult.

5. CONCLUSIONS

This research brief offers an opportunity to assess the factors influencing the prevalence of T2D within the Latino community in the US. Delving into both biological and environmental factors provides a comprehensive picture for reflection. This chronic disease is significantly prominent, and therefore may seem difficult to find an ideal solution for its impact on people's lives. However, action can be taken little by little by a wide range of individuals.

Firstly, it is essential to understand that a chronic disease, unlike other illnesses, demands constant monitoring and care. Disorganized physical assessments of diabetic patients, lacking a timeline or concrete plan, will not yield a solution. It is evident that proper care, involving personalized intervention for each diabetic individual requiring time and resources, is currently unattainable due to limiting factors. Whether these factors be biological, structural, or cultural, the initial steps that can be taken involve preventing the onset of T2D or delaying it as much as possible. This implies implementing preventive measures with prediabetic patients early on. The CDC recommends that prediabetic patients prevent T2D by losing a small amount of weight. Similarly, results from the DPPR study have shown that a loss of approximately 7% of body weight resulted in health improvements for T2D patients. Therefore, the initial preventive measure for prediabetics can involve pursuing this weight loss through engaging in at least 150 minutes of exercise each week (CDC, 2023). Another preventative measure to consider is implementing education programs in schools. It is challenging to persuade older adults to alter long-established eating habits and lifestyles.

However, a long-term goal of enhancing population health can be realized by offering health literacy education from elementary school onward. During the developmental stages where individuals are forming their dietary and exercise habits, children can be instructed on how to eat, what foods to choose, and why selecting nutritious options is important. Additionally, educating them about engaging in physical activity, whether in the community or at home, can be beneficial.

The effective management of T2D for individuals already diagnosed with the disease should encompass a holistic understanding, considering not only what people eat but also the broader contextual factors shaping their choices. While it may be straightforward to convey to these individuals that their diets should be enhanced in conjunction with increased physical activity, altering societal and environmental factors influencing their lifestyle habits and overall ways of living is not as easily accomplished.

One crucial aspect to consider in dietary interventions is respecting the value of food in Latino culture. Efforts should be made to design targeted interventions, allocate resources, and implement strategies to reduce the burden of diabetes within these communities, aiming for more equitable health outcomes. This could be achieved through dietary changes that don't necessitate complete elimination of certain foods but rather a reorganization of what a plate of food looks like. For instance, incorporating only one carbohydrate of their choice per meal, along with a good protein source and greens, could be beneficial. Another example is for patients with T2D to transition to food choices that would lower their blood sugar levels and enhance insulin sensitivity in their bodies (Douceff, 2023). Dietary changes can involve increasing the production of GLP-1, a "hunger hormone" that stimulates insulin release after a meal and regulates hunger and satiety in the body, by incorporating more fiber-rich foods. These fibers, found in barley, oats, and rye, can contribute to weight loss, improved insulin sensitivity, lower blood pressure, and increased satiety between meals.

In addition to this, it is important to recognize food as an indicator of distress among low-income and immigrant Latinos. Since food security is not always guaranteed, as mentioned in some interviews, individuals must rely on what is provided to them at food pantries. Often, the food distributed at these places is canned, which means it is high in sodium, or contains a significant amount of carbohydrates to ensure longer shelf life. One intervention to consider is implementing programs to enhance the availability of healthy food in low-income areas, which could also address the issue of food deserts. The food accessible to low-income Latino communities should be transformed to include a variety of affordable fruits and vegetables. Whether achieved through constructing community greenhouses or collaborating with major

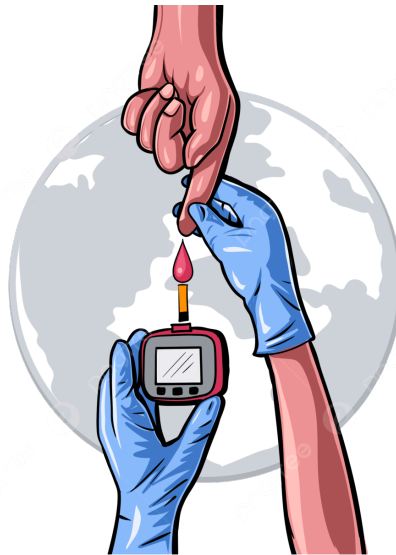
farm owners to establish donations, such initiatives could bring about a significant change in addressing the prevalence of T2D in the community.

Referring more directly to biomedicine approaches, a significant change that needs to be made is for future research studies to explore the long-term effects of interventions through longitudinal studies, assessing the sustainability and outcomes of health interventions. Additionally, diversifying research fields to include more Latinos or other minorities who can offer different perspectives is essential for building scientific knowledge that is useful to all populations.

Additionally, effective efforts at medical interventions may include regular sustained human interaction through promotoras or community health workers who serve in healthcare and are part of the Latino community. Although some of these already exist, there has to be an exponential growth in these programs in both staff and monetary resources. These are efforts the public health department should be working towards. This would enable culturally competent workers to advocate for their community, facilitating access to healthcare. Additionally, promoting education on nutrition and diabetes management through community outreach programs will empower Latinos to learn how to manage and enhance their health. Although Diabetes Self-Management Education (DSME) programs exist, they are still a long way from being fully established. These programs should be taught in both English and Spanish to address language barriers. In addition to lectures, individuals should receive incentives for attending these sessions and engaging in DSME program activities. This can instill a sense of agency over their health and further motivate them to adjust their lifestyles. The reward need not be monetary but could be something as simple as a stamp system or a motivation tailored to individuals' community preferences. A final suggestion for DSME programs is to structure them similarly to language classes, organized by levels of understanding. This way, individuals will find it easier to comprehend and feel more comfortable participating in lectures and activities without experiencing shame about their background.

Understanding the underlying functions of Curanderismo can also prove helpful in addressing the high prevalence of T2D within the Latino community. Deconstructing the image of white-coat physicians and striving to build a trusting relationship between the health provider and the patient could exponentially increase patients' compliance with their prescriptions. Additionally, medical education should strive to provide future physicians with lectures on cultural competency, compassionate care, and traditional medicine. There should also be a push for bilingual proficiency to become the norm among physicians, as the population in the US grows increasingly diverse day by day.

Finally, the current population should strive to build and select leaders who will implement policy changes to ensure access to healthcare for all populations within the US. However, the policies that need to be changed are not limited to healthcare but also include labor rights, urban planning, access to education, and immigration.



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Appendix I. Interview questions

1. How do you articulate or describe or explain diabetes to your patients? Specifically, what language do you use, and how do you ensure their comprehension?
2. How important is it to consider all other health factors in conjunction with diabetes? Do certain factors take precedence over others?
3. Have you volunteered at clinics, and how does your experience with diabetic patients there compare to your experience in paid healthcare?
4. What is the primary reason for patients' non-compliance with doctors' instructions regarding diabetes, if they is any non-compliance at all?
5. How costly is it to effectively manage diabetes?
6. If patients are unable to read, how have you found it impacts their ability to take medications properly?
7. In your opinion, what role does food and diet play in diabetes rates among Latinos? Additionally, how do broader contextual factors influence their choices?

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