Type 2 diabetes in the Hispanic or Latino population: challenges and opportunities
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Purpose of review
To describe how type 2 diabetes affects the Latino or Hispanic population in the United States, and identify the multiple challenges and opportunities to improve diabetes care in this rapidly growing group.

Recent findings
Three compelling reasons justify the work in this area. First, this group has become the largest minority in the country, representing 13.7% of the total population. Based on current growth rates, one in four individuals will be of Hispanic origin by the year 2050. Second, this population suffers from very high rates of type 2 diabetes, obesity, the metabolic syndrome and their multiple vascular complications. A genetic tendency to develop insulin resistance and abdominal obesity, along with multiple nutritional, lifestyle, socio-economic and cultural factors, influence the development and course of type 2 diabetes among Latinos. Third, Hispanics have lagged behind in their diabetes care when compared with the predominant non-Hispanic White population.

Summary
Understanding the challenges and opportunities in Latinos with diabetes is necessary to develop and implement comprehensive culturally oriented diabetes care, education, outreach and research programs. Some of these strategies may also be beneficial for other groups and can contribute to better integrate our societies.

Keywords
culture, diabetes, disparities, Hispanic, Latino

Introduction
Three compelling reasons exist for why understanding how type 2 diabetes affects the Latino/Hispanic population in the United States is of high importance. The first is the evident growth of this group in the country. Latinos now represent the largest minority group, accounting for 13.7% of the total US population [1]. Their growth rate is approximately 5.7% per year – the highest among all ethnic groups. It is estimated that by the year 2050, one in four people will be of Hispanic/Latino origin in this country [1,2]. The second reason is that Latinos develop type 2 diabetes twice as frequently as non-Hispanic Whites (NHW). Furthermore, they also have high rates of obesity, metabolic syndrome and diabetes-related chronic complications, many of which lead to increased mortality rates [3,4,5,6]. Third, Latinos/Hispanics have lagged behind in their healthcare. The Institute of Medicine – a private, nonprofit organization that provides health policy advice under a congressional charter granted to the National Academy of Sciences – reported that clear healthcare disparities exist when comparing a large number of outcomes, including some related to diabetes care between the White population and minority groups, including Hispanics or Latinos [7]. These disparities exist even after controlling for healthcare access and suggest that other factors determine these differences. Some of these factors are related to the population itself, and others are linked to the healthcare providers and our constantly evolving healthcare system.

As we collectively work throughout the world towards improving diabetes care in all populations, regardless of skin color and race, understanding particular diabetes-related characteristics in disadvantaged groups, such as the Latino population, may allow us to better serve this group and recognize effective treatment and prevention strategies that may be applicable to others. Ultimately, I believe that there are more similarities than differences among ourselves, although sometimes we insist on the opposite. The purpose of this review is to describe the Latino or Hispanic population in the United States and our current understanding of how type 2 diabetes develops and affects this group, and identify the multiple challenges and opportunities to improve diabetes care in this rapidly growing group.

The Latino or Hispanic population
The terms ‘Hispanic’ and ‘Latino’ are often used interchangeably in the medical literature but are not identical.
The term ‘Hispanic’ derives from the Latin word for ‘Spain’ [8]. It refers to people born in a country that was ‘conquered’ by Spaniards, mostly during the sixteenth century and for whom Spanish is their primary language. This term applies to most countries in Latin-America, except Brazil, for instance, that was under the influence of Portugal and for whom Portuguese is the primary language. Strictly speaking, there are still some Native Indian groups in various countries in Latin-America who were not ‘conquered’ by Spaniards. They have kept their own roots, traditions, language and beliefs for hundreds of years and, therefore, are not Hispanic. On the other hand, ‘Latino’ is a broader term that refers to people born in a country whose language has evolved from Latin (Romance languages) [8]. This term applies to all countries in Latin-America and even some in Europe, such as Italy, Spain and France. In most cases, both terms refer to people having their roots in a Latin-American country. In this review, both terms will be used interchangeably.

The terms ‘race’ and ‘ethnicity’ also deserve some clarification. Whereas race mainly alludes to those physical characteristics that are genetically determined, ethnicity relates to a perceived cultural distinctiveness, expressed in language, music, values, art, styles, literature, family life, religion, ritual, food, naming, public life and culture [8]. Thus, Hispanic and Latino are ethnicity-based terms. From a racial perspective, there are three possible backgrounds among Latinos: White, Black or Native Indian. Any one of these races or their combinations can be found in this group and speak to the wide genetic heterogeneity among Latino subgroups.

The largest Hispanic subgroups in the country are Mexicans (66.9%), Central/South Americans (14.3%), Puerto Ricans (8.6%), Cubans (3.6%) and others (6.6%). It is estimated that two in five Latinos are foreign-born [1,2,9]. Hispanics are more likely than NHW to live inside central cities of metropolitan areas, particularly in the South Central and Southwestern United States, but their number is rapidly growing in many of the states in the North and Northeast. The median age in Hispanics is 26.7 years, contrasting with 39.6 years in NHW. Approximately one-third of Hispanics are under the age of 18, and slightly above 10% under age 5, representing the youngest population in the United States [9]. Some clear indicators of socio-economic disadvantages among Latinos exist. It is estimated that only about 22.5% of Hispanics earn more than US$35,000 per year, only 57% have high-school graduates and only 67.6% have healthcare insurance coverage [9].

**Epidemiology of type 2 diabetes in Latinos/Hispanics**

Type 2, but not type 1, diabetes has been consistently found to be higher among Latinos/Hispanics when compared with NHW. The prevalence of diabetes in Hispanics is twice as high as in NHW, as reported by the National Health and Nutrition Examination Survey (NHANES) [3,4*], conducted by the National Center for Health Statistics of the Centers for Disease Control and Prevention, for the period of 1988–1994 and recently confirmed for the period of 1999–2002. The age and sex-standardized prevalence of diagnosed diabetes in Mexican-Americans was 10.4%, whereas it was 5.2% in NHW [4*]. The standardized prevalence of undiagnosed diabetes among Mexican-Americans was 3% in the same study [4*]. Therefore, a good estimate of the prevalence of total diabetes in adult Mexican-Americans is approximately 13.4% (Fig. 1). In practically every age group, the prevalence of diagnosed diabetes is higher in Hispanics than in NHW. The proportion of the Mexican-American population with diagnosed diabetes rises from 1.3% for those younger than 39 years to as high as almost 25% for people aged 60–74, with a very similar overall rate for men and women (9.9 and 11%, respectively) [4*].

Similar diabetes prevalence data were found in the Behavioral Risk Factor Surveillance System (BRFSS) surveys [5] in six geographical areas in the United States (California, Florida, Illinois, Arizona, New York/New Jersey, and Texas). The age-adjusted self-reported diabetes prevalence among Hispanics was 9.8%, whereas it was 5% in NHW. The prevalence of diabetes in Hispanic men and women was, again, very similar. The six geographical areas included in this survey comprise 84% of all the US Hispanic population. Whereas the NHANES study included primarily Mexican-Americans, the BRFSS assessed a more heterogeneous group of Hispanics in the country.

Unfortunately, the rates of type 2 diabetes are also increasing among Latino children and adolescents [10].

![Figure 1: Prevalence of diagnosed, undiagnosed, total diabetes and impaired fasting glucose in adults aged ≥20 years in Mexican-American men, women and both groups](image-url)
The Centers for Disease Control [11] have recently estimated that the lifetime risk of developing diabetes for a Hispanic child born in 2000 is 45.4% for a man and 52.5% for a woman.

**Impaired glucose tolerance/impaired fasting glucose**
The standardized prevalence of impaired fasting glucose (IFG) was recently estimated [4*] at 31.6% for the Mexican-American group and 26.1% for the NHW population. Mexican-American men had twice as high rates of IFG in comparison with Mexican-American women (42.2 compared with 21.2%) [4*] (Fig. 1). The prevalence of impaired glucose tolerance (IGT), according to the 1980–1985 World Health Organization (WHO) criteria, was 20.2% for Hispanics and 15.3% for NHW in the NHANES III study [3]. IGT rates were not assessed in the most recent study [4*].

**Gestational diabetes**
The prevalence of gestational diabetes in Hispanics is two to three times higher than in the general population [12]. Approximately 12% of Mexican-American women with gestational diabetes progress to type 2 diabetes each year according to a study [13] conducted in Southern California. This figure is approximately four times higher than that in the White population. In a more recent prospective, population-based cohort study [14], 42% of Latina women were overweight or obese when entering pregnancy. Twenty-seven percent had some degree of glucose abnormality and 6.8% had gestational diabetes.

**Overweight/obesity/metabolic syndrome**
The age-adjusted prevalence of combined overweight and obesity (body mass index >25) in Mexican-Americans above the age of 20 was 65.9% in women and 63.9% in men in the NHANES III [15]. This figure is higher than in NHW. An alarming increase in the prevalence of overweight in Hispanic youth has also been appreciated [16]. The age-adjusted prevalence of the metabolic syndrome, according to the National Cholesterol Education Panel criteria, in the Hispanic population in the United States is 31.9% – the highest among all studied groups [17].

Thus, not only is the prevalence of type 2 diabetes alarmingly high in Hispanics, but also that of various categories at risk for type 2 diabetes, imposing a high risk for the development of cardiovascular disease.

**The development of type 2 diabetes: biological factors**
Type 2 diabetes is a heterogeneous disease that results from the combination of a genetic predisposition and environmental factors. The ‘thrifty gene’ hypothesis has emerged as a possible explanation for the increased genetic tendency to type 2 diabetes among some minority groups, including Latinos. This theory, first proposed in 1962, suggests that populations of indigenous people who experienced alternating periods of feast and famine gradually adapted by developing a way to store fat more efficiently during periods of plenty to better survive famine. This genetic adaptation has now become detrimental, however, as food supplies are more constant and abundant, leading to an increased prevalence of obesity and type 2 diabetes in certain populations [18].

This genetic tendency to type 2 diabetes may be related to the frequent development of obesity and insulin resistance among some racial/ethnic groups [19]. In fact, Hispanics have been found to be more insulin-resistant than their White counterparts [20,21]. This pattern was also found in apparently healthy young Mexican-Americans (as well as African-Americans and Asian-Americans), suggesting that genetic factors truly influence insulin sensitivity [22]. A higher level of insulin resistance has also been appreciated in Hispanic-American (and African-American) children than in NHW children, even after adjustment for differences in body fat [23]. The precise nature of the genetic factors leading to insulin resistance in Latinos is far from clear. In general, it is believed that a reduction in the expression of genes of oxidative metabolism is an important abnormality, not only in those with diabetes, but also in people at risk for the disease [24].

In addition, Latinos have a tendency to develop abdominal obesity – an important determinant of insulin resistance, insulin secretion, endothelial dysfunction and vascular inflammation [25,26]. It seems that some specific genetic factors may directly influence fat deposition and body size in some groups [27*].

Ultimately, beta cell dysfunction is required for the development of type 2 diabetes. At this point, it is uncertain whether a particular defect in beta-cell function exists in Hispanics/Latinos. As in other groups, an initial robust increase in insulin production serves as a compensatory mechanism to insulin resistance, but, in a subgroup of people, beta cell function is not able to permanently compensate and hyperglycemia ensues [21,28].

Further research is required to fully understand the nature of the genetic defects that lead to insulin resistance, beta cell dysfunction and adiposity in Latinos. It will also be of crucial importance to study the distinct Hispanic subgroups, as biological abnormalities may vary among them.

**Lifestyle/social/cultural factors**
Lifestyle may ultimately determine the full expression of multiple genes [29]. A healthy diet is inversely associated with the development of type 2 diabetes [30]. This association seems to be even stronger in genetically predisposed individuals, as in the Latino population [31]. Although there is a wide variation in food preferences among Hispanic subgroups, the consumption of carbohydrate and saturated fat-rich foods is very common.
Interestingly, some traditional Hispanic foods (e.g., ‘nopales’) may have some beneficial effects in diabetes [33]. Physical activity is another determinant of type 2 diabetes. It was found to be inversely predictive of the incidence of type 2 diabetes in Mexican-American men [34]. The NHANES III survey [35] reported that as many as 65% of Mexican-American men and 74% of Mexican-American women had little or no leisure-time physical activity. Unfortunately, most people in the Latino population, as happens with other groups, do not routinely exercise [36]. In combination, an inadequate meal plan and the general lack of regular physical activity have contributed to the very high rates of obesity and type 2 diabetes in this group in the United States. As an example, the prevalence of type 2 diabetes is significantly higher in Mexican-Americans living in San Antonio, Texas, when compared with Mexicans living in Mexico City [37].

Like any racial or ethnic group, the Hispanic culture is rich in fascinating values, traditions, beliefs, practices and attitudes. Many of them influence the perception and understanding of disease processes as well as their treatment and may be relevant in the field of diabetes. Some of the factors that have been associated in one way or another to the development and course of type 2 diabetes are acculturation, body image, depression, stress, education attainment, family and social support, health beliefs, faith and religion, socio-economic status and healthcare access [38–46]. Figure 2 presents a general view of the participation of biological, socio-economic and cultural aspects in the development and course of type 2 diabetes in the Latino population. Genetic factors (thrifty genes) in combination with an inadequate lifestyle, particularly in the form of improper nutrition and physical activity, lead to increased insulin resistance or abdominal obesity and possibly to beta-cell dysfunction as well. Multiple socio-economic and cultural factors influence lifestyle. In people with type 2 diabetes, the frequent appearance of chronic complications that often lead to increased mortality rates is influenced again by multiple socio-economic and cultural factors and biological factors, many of which may have not been identified yet.

**Diabetes-related chronic complications**

In general, the prevalence of most diabetes-related chronic vascular complications is higher in Latinos with diabetes when compared with the NHW population, particularly chronic kidney disease and retinopathy [38,47]. Interestingly, various studies [48–50] have reported equal or lower prevalence rates of cardiovascular disease morbidity and mortality in Hispanics when compared with NHW. This would constitute an apparent paradox because, as previously described, Hispanics tend to have more severe insulin resistance, abdominal obesity and type 2 diabetes. Multiple factors may influence the reported lower rates of CVD, however, including the definition of CVD, the accuracy of the reported events and differences in the health status of the compared populations (migration effects), among others [6,51]. In fact, after taking into consideration some of these factors, cardiovascular mortality appears to be higher in Hispanics in the United States [6,51,52]. Therefore, there is no conclusive evidence on the existence of a protective mechanism for the development of CVD in the Hispanic population and, thus, aggressive management of cardiovascular risk factors is warranted, as in any other group. In fact, worse glycemic control in Latinos than in Whites has been reported and may be a contributing factor to the high rates of diabetes-related complications [53]. In this population-based study, the mean A1c for Hispanic patients with diabetes was 8.2%, 8.1% for Blacks and 7.6% for Whites. The percentage of Hispanics with diabetes with an A1c equal or higher than 11% was 10.4%, whereas it was only 1.7% for Whites. Hispanics with undiagnosed diabetes were also more likely to have an A1c above 7% (60.5%) than Blacks (39.3%) and Whites (37.8%). A prior study [54] from the same NHANES survey had reported higher A1c levels among Hispanics, even after controlling for factors such as education, income, health insurance coverage, and number of physician visits per year. Certainly, other cardiovascular risk factors and even suboptimal preventive risk reduction strategies may also contribute to elevate the high risk of complications among Latinos [55,56]. It is still unclear whether specific genetically determined factors increase the risk of complications (Fig. 2). More research in this area is urgently needed.

**Many opportunities**

As previously discussed, multiple lifestyle, social and cultural aspects influence the development and course...
of diabetes among Latinos. Understanding these circumstances is an important task for those who wish to have a positive impact on this population. Whereas healthcare professionals should not create stereotypes about patients from a particular cultural group, it is important to be aware of some factors that may be relevant for diabetes care. Here are some examples. From the socio-economic perspective, it is known that a third of Hispanics have no healthcare coverage – the highest rate in the country [9]. In addition, only 22.5% of Hispanics make more than US$35,000 per year [9]. These aspects alone create a big challenge to properly integrate a good diabetes care plan [9]. On a more cultural note, food preferences also need to be taken into consideration.

First of all, there is no such thing as a general ‘Latino food’. Whereas there may be common basic ingredients among various traditional dishes from Latin-America, significant differences exist with regard to food preferences, ways of preparation and even different names to refer to them among Hispanics. For instance, some names used to refer to beans are frijoles, habichuelas, caraotas and granos, among others. In general, it would be unfair to ask patients to completely abandon their preferred foods. Rather, the healthcare provider needs to get familiar with them to integrate a sustainable nutritional plan [57]. National organizations such as the American Diabetes Association, the National Diabetes Education Program, the National Institutes of Health and the American Dietetics Association have integrated general information on some practical recommendations, although a comprehensive list of foods from each country in Latin-America and their corresponding descriptions is currently lacking.

Another example of a cultural aspect that may influence diabetes care is the perception of ideal body weight. For some Latinos, being slightly overweight or robust may be a sign of being in good health and well nourished [57]. On the other hand, there are common myths that may affect diabetes care. An example is the common idea that insulin causes blindness among Latinos. This is a very popular belief, developed as the result of the frequent identification of eye disease (and other complications) in people with type 2 diabetes that have been recently started on insulin. Obviously, this is the result of insulin being started very late in many patients, at a time at which they have already developed chronic complications from sustained hyperglycemia. Upon entry into our Latino program [58], as many as 47% of patients believed that insulin causes blindness. Unfortunately, there is a general lack of awareness about these factors among healthcare professionals – an aspect that may also contribute to provide suboptimal patient care.

Our society is constantly changing and, as a consequence, our healthcare system needs to adapt to the emerging needs. By living in a multicultural society, healthcare professionals ought to develop the knowledge and interpersonal skills to understand, appreciate and work with individuals from cultures other than their own. An awareness and acceptance of cultural differences, self-awareness, knowledge of a patient’s culture and adaptation of skills are required. This is the area of cultural competence that has slowly started to receive attention [57,59]. Professional education at multiple levels is necessary. As of today, the states of New Jersey and California have made it mandatory for physicians to obtain continuing medical education credits on programs that address healthcare issues related to healthcare disparities and cultural issues. At the same time, several medical schools throughout the country have incorporated a curriculum on culturally competent healthcare. Several organizations at national, regional and local levels have identified the need to improve cultural awareness among their members. The importance of cultural competence in healthcare professionals to properly treat Latinos with diabetes has begun to be recognized [60]. Furthermore, several programs have emerged to improve the lives of Latinos with diabetes and their families. Our own group [61] has developed a comprehensive initiative that includes clinical care, patient education, research, outreach and professional education activities. Other programs in the Latino population have already demonstrated the positive impact of culturally oriented strategies in diabetes care [62]. Diabetes prevention strategies have also been proven to be as successful in Hispanics as in other minority groups in the country [63].

Ultimately, more culturally oriented clinical and research programs are needed throughout this country and at a worldwide level to fully integrate our societies. Figure 3 presents the areas in which challenges and opportunities reside to improve the lives of Latinos with diabetes and

**Figure 3 Proposed model to explain healthcare disparities in diabetes care in the Latino population**

- **The patient:**
  - Medical, socio-economic, cultural factors
  - Time and support with patients

- **The health care provider:**
  - Lack of cultural competence

- **The health care system:**
  - Insufficient:
    - Culturally oriented programs
    - Professional education
    - Cultural diversity
    - Health care access
  - Time and support with patients
their families. Three main factors contribute to a sub-optimal quality of diabetes care in this population: many aspects related to the patient, those related to the healthcare provider and others related to the structure of our current healthcare system. Challenges and opportunities can be identified in each of these components. Collective efforts at all these fronts may allow us to better serve this community and many others.

Conclusion
The Latino or Hispanic population represents the largest minority group in the United States. Multiple biological, social and cultural aspects have contributed to the tremendous increase in the prevalence of type 2 diabetes in this group. Latinos have lagged behind in their healthcare, exhibiting unacceptable glycemic control and particularly high rates of diabetes-related chronic complications. The development of comprehensive culturally oriented diabetes care, education, outreach and research programs for this rapidly evolving population is urgently needed. The understanding of the multiple challenges in the prevention and treatment of diabetes in this group may not only allow us to implement more effective strategies to help this population, but could also be relevant for other groups and our society as a whole.

References and recommended reading
Papers of particular interest, published within the annual period of review, have been highlighted as:
• of special interest
•• of outstanding interest
Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 178).


An updated review of the prevalence of end-stage complications and mortality rates among minority groups in the United States and United Kingdom.


Most recent study demonstrating worse glycemic control among minorities when compared with the White population.


Comprehensive review of multiple cardiovascular risk factors in main minority groups in the United States.


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