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Latinas with Elevated Fasting Plasma Glucose: An Analysis Using NHANES 2009–2010 Data

Shiela M. Strauss, PhD* [Associate Professor],

New York University College of Nursing, 726 Broadway, 10th floor, New York, NY 10003; phone: 212.998.5280; FAX: 212.995.3143

Marlena Vega, PhD [Executive Director],

SobreVivir - A Will To Live, Inc., 24 5th Avenue, Suite 225, New York, NY 10011; phone: 201.681.8262

Helene D. Clayton-Jeter, OD [Director],

Cardiovascular and Endocrine Liaison Program, Office of Special Health Issues, Office of the Commissioner, U.S. Food and Drug Administration, 10903 New Hampshire Avenue, Bldg 32, Room 5341, Silver Spring, MD 20993; phone: 301-796-8452; Fax: 301-847-8623

Sherry Deren, PhD [Director],

Center for Drug Use and HIV Research, Senior Research Scientist, New York University College of Nursing, 726 Broadway, 10th Floor, New York, NY 10003; phone: 212-998-9015; FAX: 212-995-3143

Mary Rosedale, PhD, PMHNP-BC, NEA-BC [Assistant Professor], and

New York University College of Nursing, 726 Broadway, 10th floor, New York, NY 10003; phone: 212.998.9007; FAX: 212.995.4679

David M. Rindskopf, PhD [Distinguished Professor]

Department of Educational Psychology, Graduate School and University Center of the City University of New York, 365 Fifth Avenue, New York, NY 10016; phone: 212.817.8287; FAX: 212.817.1516

Abstract

For Latinas with fasting plasma glucose (FPG) levels in the pre-diabetes and diabetes ranges, early detection can support steps to optimize their health. Data collected in 2009–2010 indicate that 36.7% of Latinas in the U.S. had elevated FPG levels. Latinas with elevated FPG who were unaware of their diabetes status were significantly less likely than non-Hispanic White and non-Hispanic Black women to have seen a health care provider in the past year (75.8%, 92.9%, and 90.2%, respectively; $p = .018$). With almost 1 million Latinas in the U.S. with elevated FPG unaware of their diabetes risk, and less likely than other at-risk women to see health care providers, there is an urgent need to establish alternate sites of opportunity for their diabetes screening.

*To whom correspondence should be sent.

Keywords

diabetes; Latinas; screening; racial/ethnic disparities

Introduction

Latinos' limited access and considerable delay in seeking health care often result in unacceptably high rates of avoidable morbidity and mortality due to unrecognized chronic disease (Centers for Disease Control and Prevention [CDC], 2004; Insaf, Jurkowski, & Alomar, 2010; Larkey, Hecht, Miller, & Alatorre, 2001). Among these diseases is diabetes, a condition that has been diagnosed in about 19 million people in the U.S. (CDC, 2011), including a disproportionate number of Latinos and members of other racial and ethnic minority populations (CDC, 2011). A U.S. population-based survey in 2003–2006 also documented a significantly higher proportion of diabetes that is undiagnosed among Mexican American adults (34.6%) as compared with adults who are non-Hispanic white (17.1%) and non-Hispanic black (15.7%; Cowie et al., 2010). Undiagnosed diabetes has been found to be related to lack of health insurance (42.2%; Zhang et al., 2008), a frequent barrier to accessing health care among Latinos (Valdez, Giachello, Rodriguez-Tria, Gomez, & de la Rocha, 1993). It has also been associated with various adverse health consequences, among them, angina, diabetic retinopathy, nephropathy and peripheral neuropathy (American Diabetes Association [ADA], 2012; Harris, 1993; Koopman et al., 2006). In fact, diabetes-related complications may even be present in persons with pre-diabetes (i.e., impaired glucose tolerance or impaired fasting glucose), a frequent diabetes precursor affecting 31.7% of Mexican Americans (ADA, 2012; Cowie et al., 2009). Unfortunately, adults with undiagnosed pre-diabetes and diabetes are denied the opportunity to receive support and treatment to avert the onset and progression of these and other serious diabetes-related complications (ADA, 2012). Thus, timely pre-diabetes and diabetes detection is of paramount importance for Latinos and non-Latinos alike.

Notably, for Latinos and others, women are often more severely affected by the complications of diabetes than men. For example, although both men and women with diabetes together account for 44% of new cases of kidney failure in the U.S., have heart disease death rates about 2 to 4 times higher than adults without diabetes, and account for many new cases of blindness among U.S. adults 20–74 years old (CDC, 2011), women with diabetes are significantly more likely to develop depression and have a 50% greater risk of death from coronary heart disease than men with diabetes (Global Alliance for Women's Health, 2009; Huxley, Barzi, & Woodward, 2006).

Unfortunately, many Latinas do not receive the health care they need in order to support the early identification of elevated glucose values. A large number of Latinas practice limited self-care, seek medical help only when symptoms appear or when they are in crisis, and many do not know their risk for diabetes (National Alliance for Hispanic Health, 2010). In addition, there is much culturally enforced misperception and fear about diabetes among Latinas. Many believe that emotional stressors, intense anger, and sadness or depression play a major role in diabetes onset, as does lack of self-care; that their contracting diabetes, like

other illnesses, is determined by fate and cannot be altered; and that insulin injections are often harmful (Alcozer, 2000; Coronado, Thompson, Tejeda, & Godina, 2004; Jezewski & Poss, 2002; Kieffer, Willis, Arellano, & Guzman, 2002; Schwab, Meyer, & Merrell, 1994). A critical first step in addressing the potentially harmful effects of pre-diabetes and diabetes that are responsible for reduced quality of life and increased morbidity and mortality (ADA, 2012; Toobert et al., 2011) is for Latinas to avail themselves of opportunities to have their blood glucose measured. If this measurement indicates that they have pre-diabetes, participating in moderate exercise and achieving weight loss presents a wellness opportunity that could significantly reduce their risk of developing diabetes (US Department of Health and Human Services, 2012). For Latinas with diabetes, various self-care strategies and activities can be implemented to avoid or delay diabetes complications. Some of these include making healthy food choices, reducing portion size when appropriate for weight reduction, being physically active, taking prescribed medications, and seeking help and support for smoking cessation and stress reduction (National Diabetes Education Program, 2009). Little is known, however, about the extent to which Latinas with undiagnosed pre-diabetes and diabetes visit a health care provider to have their blood glucose measured in order to establish their diabetes status, thereby enabling them to take important steps to best preserve their health.

In this paper, data from a nationally representative sample of Hispanic, non-Hispanic White, and non-Hispanic Black women at least 18 years of age in the U.S. in 2009–2010 were used to examine the proportion of women with elevated fasting plasma glucose (FPG) levels in the pre-diabetes and diabetes ranges. The extent to which these women report that they were never told by a health provider that they had diabetes, pre-diabetes or were borderline for diabetes was then determined. Finally, among those with elevated FPG levels in the pre-diabetes and diabetes ranges who were never told that they had diabetes or pre-diabetes, a determination was made of (1) the extent to which they were told they were at risk for diabetes, and (2) the proportion who did not see a health care provider in the past year, thus eliminating a potential opportunity to learn that they had diabetes or were at risk.

Methods

Data were analyzed from the National Health and Nutrition Examination Survey (NHANES) 2009–2010. NHANES, conducted by the National Center for Health Statistics, Centers for Disease Control and Prevention, is intended to assess the health and nutritional status of a representative sample of civilian, non-institutionalized adults and children in the U.S. NHANES combines interviews (involving demographic, socioeconomic, dietary, and health-related questions) and physical examinations (consisting of medical, dental, and physiological measurements, as well as laboratory tests administered by highly trained medical personnel). The NHANES sample is intended to represent all ages in the U.S. population and oversamples persons 60 and older, African Americans, and Hispanics. In the case of Hispanics, NHANES distinguishes only between Mexicans and non-Mexicans. Due to prior findings indicating important Hispanic subgroup differences in regard to diabetes and other health issues (e.g., the need for attention to subgroup cultural differences in developing treatment strategies for Hispanics with diabetes; Caban & Walker, 2006; Mainous, Diaz, Saxena, & Geesey, 2007), and lower health care utilization for Mexicans

compared to other Hispanics (Vargas Bustamante, Fang, Rizzo, & Ortega, 2009), we performed sub-analyses comparing the Hispanic subgroups available. Extensive information about NHANES and its design and analytic guidelines is available on the NHANES website: <http://www.cdc.gov/nchs/data/nhanes>. A total of 988 Hispanic women (624 Mexicans and 364 non-Mexicans), 1,567 non-Hispanic White women, and 603 non-Hispanic Black women, 18 years of age or older, were included in NHANES 2009–2010 ($N = 3,158$).

NHANES obtained fasting plasma glucose measures from persons 12 years of age and older who were randomly assigned to a morning (rather than an afternoon/evening) session for the physical examination component of their NHANES participation, all of whom were told not to eat before the examination. Among those from whom glucose measures were not obtained were NHANES participants who fasted less than 9 hours, who were taking insulin or oral medicines for diabetes, who refused phlebotomy, and for whom there were hemophilia or chemotherapy safety concerns. A total of 1,467 of the 3,158 women (496 Hispanic – 314 Mexicans and 182 non-Mexicans; 718 non-Hispanic White; and 253 non-Hispanic Black) had their FPG measured. These 1,467 women constitute the study sample. We categorized the FPG levels according to American Diabetes Association criteria (ADA, 2012): (1) values <100 mg/dL were in the normal range, (2) values ≥ 100 mg/dL and < 126 mg/dL were in the pre-diabetes range, and (3) values ≥ 126 mg/dL were in the diabetes range.

Of special relevance to our analyses, participants also completed a questionnaire that assessed their socio-demographic characteristics and asked, 1) other than during pregnancy, if they had ever been told by a doctor or health professional that they had diabetes, pre-diabetes, or were borderline for diabetes; 2) whether they were ever told by a doctor or other health professional that they had health conditions or a medical or family history that increased their risk for diabetes; and 3) whether they had seen a doctor or other health care professional in the past 12 months about their health at a doctor's office, a clinic, hospital emergency room, at home or some other place.

Because NHANES is a complex sample survey, analyses of NHANES data require the use of sampling weights to produce unbiased national estimates. These weights reflect the unequal probabilities of selection, non-response adjustments, and adjustments to independent population controls. The use of complex survey sampling software from IBM PASW, together with sampling weights provided in the public use NHANES 2009–2010 dataset, enabled extrapolation of findings to the entire U.S. population of Hispanic, non-Hispanic White, and non-Hispanic Black women 18 years of age or older. Our analyses were both descriptive (i.e., frequencies) and inferential. The latter involved chi-square tests for categorical data, examined for statistical significance using Likelihood Ratio tests involving an adjusted F statistic and its degrees of freedom, with the adjusted F a variant of the second-order Rao-Scott adjusted chi-square statistic (Rao & Scott, 1981). We also used regression analysis (and Wald F statistics) for continuous variables (Korn & Graubard, 1990), consistent with the analytic approach of the IBM PASW complex survey sampling software. All results are reported as extrapolations to the U.S. population of Hispanic, non-Hispanic White, and non-Hispanic Black women at least 18 years of age in 2009–2010. We also separately examined differences among Hispanic women by comparing results for Mexican and non-Mexican Latinas.

Results

Socio-demographic Characteristics

As can be seen in Table 1, Hispanic women (*mean age = 40.7 years*) were significantly younger than non-Hispanic White women (49.2 years; $p = .001$) and non-Hispanic Black women (43.9 years; $p = .024$). Hispanic women were significantly less likely than non-Hispanic White women and non-Hispanic Black women to have graduated from high school or have a high school equivalency diploma (55.0% vs. 85.7% and 77.5%, respectively; $p = .001$). Hispanic women also differed from non-Hispanic White women and non-Hispanic Black women regarding their marital status ($p = .001$). This was especially the case when comparing Hispanic women with non-Hispanic Black women: more than twice the proportion of Hispanic women were married or living with a partner than either were never married or were widowed, divorced or separated (56.5%, 19.2%, and 24.3%, respectively), while the proportion of non-Hispanic Black women was much more evenly divided according to whether they were married or living with a partner, never married, or were widowed, divorced or separated (39.5%, 32.0%, and 28.5%, respectively; $p = .001$). There were no statistically significant differences between Mexican and non-Mexican Latinas according to age or marital status. However, Mexican Latinas were significantly less likely than non-Mexican Latinas to have graduated from high school or have a high school equivalency diploma (46.6% vs. 68.6%, respectively; $p = .001$).

The three groups of women differed according to their country of birth ($p = .001$): while the great majority of non-Hispanic White women and non-Hispanic Black women were born in the U.S. (95.2% and 84.4%, respectively), this was the case for only 34.8% of the Hispanic women. Almost two-thirds of the Hispanic women (64.5%) were born in a Spanish-speaking country outside of the U.S., and 15.0% of the non-Hispanic Black women were born in a non-Spanish speaking country outside of the U.S. A significantly smaller proportion of Hispanic women were U.S. citizens than non-Hispanic White and non-Hispanic Black women (55.5%, vs. 98.2% and 93.4%, respectively; $p = .001$). With regard to their family size, Hispanic women were significantly more likely than non-Hispanic White women or non-Hispanic Black women to have 7 or more people in their families (14.5% vs. 1.7% and 4.0%, respectively; $p = .001$). They were also significantly more likely to have low family income as measured by the poverty income ratio (PIR), an index calculated by dividing family income by a poverty threshold that is specific for family size (United States Census Bureau, 2012; $p = .001$). This was especially the case when comparing Hispanic women with non-Hispanic White women regarding low family income (65.1% vs. 27.2%, respectively; $p = .001$). Here, low income was defined as $PIR < 1.85$, reflecting the cut-off point at which a person qualifies for a special supplemental food program for Women Infants and Children (WIC; USDA Food and Nutrition Service, 2007).

There were no statistically significant differences between Mexican and non-Mexican Latinas according to their place of birth (i.e., in the U.S., in a Spanish speaking country outside of the U.S., and a non-Spanish speaking country outside of the U.S.), the proportion who were U.S. citizens, or the proportion having 7 or more people in their families.

However, Mexican Latinas were significantly more likely to have a PIR < 1.85 (69.4% vs. 57.6%, respectively; $p = .008$).

Relationship between Race/Ethnicity and FPG Levels

When extrapolated to the population of 108,560,666 Hispanic, non-Hispanic White, and non-Hispanic Black women in the U.S. 18 years of age or older, 36.3% had FPG levels in the pre-diabetes or diabetes range (30.0% and 6.3%, respectively). As can be seen in Table 2, there were no statistically significant differences between the three groups of women concerning the proportion whose FPG levels were in the normal, pre-diabetes, and diabetes ranges. Nor were there statistically significant differences in the proportion of Mexican and non-Mexican Latinas whose FPG levels were in these 3 glucose ranges.

Relationship between Race/Ethnicity and Unrecognized Pre-Diabetes and Diabetes

The majority of Hispanic, non-Hispanic White, and non-Hispanic Black women whose FPG levels were in the pre-diabetes and diabetes ranges were never told by a health care provider that they had diabetes, pre-diabetes, or were borderline for diabetes (70.5%, 73.2%, and 62.7%, respectively), and differences in these proportions were not statistically significant. Nor were there statistically significant differences in the proportion of Mexican and non-Mexican Latinas whose FPG levels were elevated but who were never told by a health care provider that they had diabetes, pre-diabetes, or were borderline for diabetes.

For Women with Unrecognized Pre-Diabetes and Diabetes, Relationship between Race/Ethnicity and Diabetes Risk Advisement and Past Year Receipt of Healthcare

Analyses were conducted among women with elevated FPG levels who reported never being told by a health care provider that they *had* diabetes, pre-diabetes, or were borderline for diabetes. Among these women, there were no statistically significant differences in the proportion of Hispanic, non-Hispanic White, and non-Hispanic Black women who indicated that they had never even been told that they were *at risk* for diabetes (84.0%, 86.1%, and 79.1%, respectively). Nor were there differences between Mexican Latinas and non-Mexican Latinas in this regard. However, there were statistically significant differences in the proportion of these Hispanic, non-Hispanic White, and non-Hispanic Black women who indicated past year contact with a health care provider (75.8%, 92.9%, and 90.2%, respectively; $p = .018$; with no significant differences in Mexican and non-Mexican Latina subgroups). Thus almost one fourth of Latinas with elevated FPG levels in the pre-diabetes and diabetes ranges who had never been told by a health care provider that they had diabetes, pre-diabetes, or were borderline for diabetes, ($N = 956,673$) were likely to remain unaware of their out-of-range glucose values as a result of their lack of contact with a health care provider.

Discussion

Our results demonstrate that 36.7% of Latinas in the United States in 2009–2010, approximately 5.5 million women, had FPG levels in the pre-diabetes or diabetes range. Of these women, other than possibly when pregnant, 70.5% (or almost 4 million Latinas) were never told by a health care provider that they had diabetes, pre-diabetes, or were borderline

for diabetes. This, coupled with (1) their increased risk for diabetes and its complications (including among Latinas who develop gestational diabetes; CDC, 2011), and (2) culturally enforced misperceptions that may delay their use of health care, which could identify and enable treatment of metabolic disorders before serious complications develop, is of great concern as it potentially jeopardizes their health. In fact only 16.0% (633,000) of these 4 million Latinas were ever told by a doctor or other health professional that they had health conditions or a medical or family history that increased their risk for diabetes. In addition 24.2% (or almost 1 million) of these 4 million Latinas had not seen a doctor or other health care professional in the past 12 months, a proportion that is significantly greater than the proportion of non-Hispanic White and non-Hispanic Black women who were not seen by a health care professional in the past year. Consistent with other research among Latinas that demonstrates limited access and delays in seeking health care (CDC, 2004; Insaf et al., 2010; Larkey et al., 2001), this latter finding is of particular concern, as it eliminates a potential opportunity for them to learn about their diabetes risk and their elevated FPG before it causes serious avoidable harm.

Our results suggest the importance of finding alternate sites of opportunity for diabetes screening for Latinas. In view of the effectiveness of nurse practitioners in supporting patients' needs in diabetes education and health promotion, including among Latino patients (Conlon, 2010), one such important diabetes screening site is that in which the nurse practitioner has a lead role. Other potential sites for diabetes screening include pharmacies and optometry venues (Howse, Jones, & Hungin, 2011; Snella et al., 2006) and other places where Latinas and other women seek support for their health and well-being. Given the importance of religion in Latino culture (Musgrave, Allen, & Allen, 2002), churches may also be especially opportune sites for diabetes screening, especially those that have parish nurses (Mendelson, McNeese-Smith, Koniak-Griffin, Nyamathi, & Lu, 2008). For Latinas in rural areas, screening may be most accessible when using a mobile delivery approach tailored to their needs (Diaz-Perez, Farley, & Cabanis, 2004). In addition, there are many Latinas and other adult women who visit a dentist during a given year, including many who do not visit a general health care provider (Strauss, Alfano, Shelley, & Fulmer, 2012). Several studies have demonstrated that the dental visit offers a feasible and acceptable diabetes screening opportunity from the perspective of both patients and providers (Barasch, Gilbert et al., 2012; Barasch, Safford et al., 2012; Greenberg, Glick, Frantsve-Hawley, & Kantor, 2010; Greenberg, Kantor, Jiang, & Glick, 2012; Laurence, 2012; Rosedale & Strauss, 2012). Also needed are targeted programs to encourage Latinas to get screened for diabetes, such as that between the National Latina Health Network and the popular blogger SoLatina that collaborated to encourage Latinas with a history of gestational diabetes to get this screening (National Diabetes Education Program, 2012). However, such screening is only the first step in addressing Latinas' diabetes-related needs. Culturally sensitive diabetes prevention efforts need to be implemented for Latinas with pre-diabetes, and feasible diabetes self-management programs must be culturally targeted for Latinas with diabetes (Adams, 2003; Ockene et al., 2012; Parikh et al., 2010; Toobert et al., 2011).

Of special concern is our finding regarding lower health care utilization for Latinas with elevated FPG levels who were never told by a health care provider that they had diabetes, pre-diabetes, or were borderline for diabetes. Failure to visit a health care provider is a major

barrier to the receipt of pertinent health information, important diagnostic tests, and appropriate care. Limited access to health care may be related to immigration status (only one-third of Latinas were born in the U.S., and 55.5% reported they were U.S. citizens). Many studies have found that migration is related to poorer health status with many possible influences posited including language barriers in accessing care, concern about immigration status if undocumented, and acculturative stress (Derose, Bahney, Lurie, & Escarce, 2009). Physical and social environment changes that accompany immigration also exacerbate diabetes risks, especially by affecting diet and physical activity (Kieffer et al., 2002). Lower health care utilization among women has also been associated with less education and lower income (Taylor, Larson, & Correa-de-Araujo, 2005), and our results indicate that these are characteristics of Latinas as compared with non-Hispanic Black and non-Hispanic White women. As there were no statistically significant differences in terms of past year health care utilization between Mexican and non-Mexican Latinas with elevated FPG levels who were never told by a health care provider that they had diabetes, pre-diabetes, or were borderline for diabetes, efforts to increase utilization of health care services by both Mexican and non-Mexican Latinas are especially needed.

In addition to our finding regarding lower health care utilization for Latina women, the finding that the majority of women with elevated FPG levels had not been told they were at risk of diabetes, even among those with higher levels of contact with a health care provider (i.e., non-Hispanic White and non-Hispanic Black women), indicates the need to incorporate diabetes screening and culturally competent care – including appropriate communication and information dissemination - across a broader range of health care visits. Incorporating this assessment as part of most (if not all) health care visits is likely to increase the early identification of women who are at risk for diabetes.

We acknowledge some limitations in the research. Although FPG levels were obtained for analysis in the laboratory, a diagnosis of diabetes should be made on the basis of more than one test (ADA, 2012). Thus, the single plasma glucose measure obtained, if in the pre-diabetes or diabetes range, should generally not be considered as a definitive diagnosis of diabetes or pre-diabetes. In addition, many of the variables we used in our analysis are self-report measures. Regarding self-report in seeing a health provider in the past year, social desirability and lack of understanding of who is considered a health care professional may have generated an inaccurate proportion of individuals who received this health care. In spite of the study's limitations, our analyses suggest that there are many at-risk Latinas who need to be screened for diabetes and supported in limiting the harms of pre-diabetes and diabetes.

Conclusions

With the proportion of Latinas with diabetes expected to rise dramatically (Mainous, Baker et al., 2007), there is an urgent need for increased efforts to enhance use of traditional health services by Latinas, and to develop alternate sites for diabetes screening. There is also a critical need for effective and sensitive strategies, including case management, extended follow up care, and a team approach (Clayton-Jeter, 2012) for supporting Latinas and others with pre-diabetes and diabetes in order to respond to an increasingly serious public health threat.

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Table 1

Socio-demographic Characteristics According to Race/Ethnicity for Women in the U.S. 18 Years of Age (mean or %)

Characteristic	Hispanic Women	Non-Hisp. White Women	Non-Hisp. Black Women
Age (mean) **	40.7	49.2	43.9
High school graduate or GED (%) ***	55.0	85.7	77.5
Marital status (%) ***			
Married/living with partner	56.5	62.4	39.5
Widowed/divorced/separated	24.3	23.4	28.5
Never married	19.2	14.3	32.0
Country of birth (%) ***			
U.S.	34.8	95.2	84.4
Spanish speaking country outside U.S.	64.5	0.1	0.6
Non-Spanish speaking country outside U.S.	0.7	4.7	15.0
United States citizen (%) ***	55.5	98.2	93.4
7 or more people in family (%) ***	14.5	1.7	4.0
Low income: Ratio of family income to poverty < 1.85 (%) ***	65.1	27.2	57.4

Note.

**
p .01

p .001

Table 2

Relationship between Women's Race/Ethnicity and Fasting Plasma Glucose Measures for Women in the U.S.
18 Years of Age (%)

Fasting Plasma Glucose Level	Hispanic Women	Non-Hispanic White Women	Non-Hispanic Black Women
Normal Range (<100 mg/dL)	63.3	64.3	61.2
Pre-Diabetes Range (100 mg/dL and <126mg/dL)	28.2	30.2	30.5
Diabetes Range (126 mg/dL)	8.5	5.5	8.3