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Having a Diagnosis of Diabetes Is Not Associated With General Diabetes Knowledge in Rural Hispanics

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Abstract

Purpose—The prevalence of diabetes among Hispanics in Washington State is 30% greater than it is for non-Hispanic Whites. Hispanics also have higher rates of diabetes-related complication and mortality due to the disease. Although interventions have been developed for the Hispanic community, studies in rural settings are limited. To address this we conducted a study to identify factors associated with general diabetes knowledge in a rural Hispanic population.

Methods—This study was conducted as part of a larger project in partnership with a local community hospital in Washington State's Lower Yakima Valley. Diabetes knowledge was assessed as part of a screening survey using 5-statements selected from the Diabetes Knowledge Questionnaire. Men and women (N=1297) between the ages of 18–92 attending community-oriented events took part in the survey. Gender, education, age, birthplace, diabetic status and family history of diabetes were tested as predictors of diabetes knowledge.

Findings—Overall, general knowledge was high with 71–84% of participants responding correctly to 4 of 5 statements, while only 17% of participants responded correctly to a 5th statement. Although, no variable was associated with all statements, family history, gender and education were most frequently associated with knowledge. Diabetic status, age, and birthplace were less often or not associated with the knowledge statements.

Conclusion—Contrary to expectations having a diagnosis of diabetes was not among the factors most frequently associated with diabetes knowledge. Future research should investigate the roles of family history, gender and diabetic status as conduits of diabetes education among rural Hispanics.

Keywords

diabetes; health promotion; Hispanic; rural; social determinants of health

Diabetes affects 7.8% of the US population—nearly 23.6 million people. Among US Hispanics, however, the prevalence of diabetes exceeds national statistics with 10.4% of the

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population having been diagnosed with diabetes.[1] Compared to non-Hispanic Whites, Hispanics are also more likely to experience complications (ie, retinopathy, end-stage renal disease) and diabetes-related mortality.[2–4] As the population of US Hispanics continues to increase,[5] there is a critical need to provide effective, culturally appropriate interventions to reduce the risk of diabetes and its complications. Interventions to effectively communicate the risks of diabetes and practices to reduce that risk to the underserved Hispanic population are lacking.

According to the Social Ecological Model, behavior change is affected through multidimensional processes that include the physical and social environment and interpersonal and intrapersonal factors. However, when working with Hispanic communities, factors that influence diabetes-related behavior may differ from those identified in other populations. For example, factors such as socioeconomic status (ie, low income and education), as well as cultural traditions (ie, language and health beliefs), may serve as primary barriers to effective implementation of behavior change interventions in the underserved Hispanic population.[6]

Further, implementation of a community-level behavioral intervention often begins by raising awareness and knowledge about the disease of concern. Knowledge, although not an absolute predictor of behavior,[7] is an essential initial step on the path toward behavior change. For example, several intensive intervention studies, focused on diabetes and conducted in Mexican American communities, suggest diabetes knowledge is positively associated with improved self-care as measured by decreases in blood levels of hemoglobin A1c (HbA1c).[8–10] Thus, the need to identify culturally relevant factors associated with diabetes knowledge in order to conduct community-level studies is evident. Awareness of factors that are associated with knowledge can serve as a guide toward the development of culturally appropriate community-level interventions focused on improving diabetes prevention and control in underserved Hispanic populations.

Two studies have been conducted with the goal of identifying factors associated with diabetes knowledge in Hispanics.[11–14] Bautista-Martinez and colleagues[11] investigated factors associated with diabetes knowledge in a group of diabetic outpatients in Mexico City, Mexico. Results of their study revealed low levels of diabetes-related knowledge, with participants providing correct responses only 44% to 61% of the time. Factors associated with levels of diabetes knowledge in this study were higher education, older age, having more diabetes-specific education, better family relationships, higher socioeconomic status, having a family history of diabetes, and experiencing treatment with insulin. In contrast, Firestone and colleagues[14] conducted a study among diabetic patients living in Costa Rica and noted high levels of general diabetes knowledge. In this study participants provided correct responses an average of 70% of the time. However, with regard to the predictors of diabetes knowledge, Firestone and colleagues identified higher levels of education, younger age, time since diabetes diagnosis, and use of glucometer as significant predictors of higher diabetes knowledge.

While these studies may offer some insight into factors associated with diabetes knowledge in diabetic patients, neither was conducted among US Hispanics and to date, no published

study has attempted to identify factors associated with diabetes knowledge in the US Hispanic population. Given the projected increase in the number of Hispanics living in the US, community-level assessment of general diabetes knowledge and factors associated with diabetes knowledge would contribute to the construction of appropriate behavioral intervention programs as a means of diabetes prevention in this high-risk group.

In Washington State's Lower Yakima Valley, over 60% of the population is Hispanic-American.[15] Health surveillance data published for Washington State indicate that the age- and gender-adjusted prevalence for diabetes among Hispanics is 30% greater than it is for non-Hispanic Whites.[16] Nevertheless, assessment of general diabetes knowledge and the factors associated with diabetes knowledge have not yet been completed in this community. To address this gap, we conducted a community-level evaluation of general diabetes knowledge in Hispanics living in Washington State's Lower Yakima Valley.

METHODS

This study was conducted as part of a larger community-based participatory research project taking place in the region, The Partnership for a Hispanic Diabetes Prevention Program. Working with local community representatives, the goal of this parent project was to create a durable infrastructure of community partners to promote diabetes awareness and to develop diabetes-related research activities to address the needs of the community. The data for this study were collected by researchers at the Seattle-based Fred Hutchinson Cancer Research Center (FHCRC) in partnership with Sunnyside Community Hospital (SCH) in the Yakima Valley.

Setting

The Lower Yakima Valley, located in Washington State's Yakima County, is a rural, primarily agricultural, and medically underserved region.[17–19] The Office of Rural Health Policy (ORHP) has designated the 7 communities in which the data were collected as rural sub-regions of a metropolitan county.[20,21] Rural-Urban Commuting Area (RUCA) codes were 4.2 for 3 communities and 6, 7.3, 7.4, and 10.5 for the remaining communities.[22] The county encompasses 4296 square miles and has a population estimated at 234, 564 persons. The population density of the county is 54.5 (persons/square mile).[23]

Over 50% of Washington State's Hispanic population is concentrated in Yakima County. The Hispanic population in this area, primarily Mexican Americans (95%),[24] is the fastest growing in the Lower Valley, having increased by 75% between the 1990 and 2000 census. With its 2620 square miles of farmland, Yakima County is a leader in Washington State's production of apples, pears, peaches, cherries, grapes, and hops.[19,20] Many members of the Hispanic population are involved in agricultural work: specifically in harvesting, pruning, thinning, and other care of the many crops grown in the area.

Procedures

Participants were recruited at local community events between May 2007 and December 2008. Events, which were the result of multi-organizational collaborations, were advertised on local radio stations (including Spanish radio), via posting of fliers at various community

locations (ie, grocery stores, restaurants, and health and human service centers), and by word of mouth. At each event SCH staff maintained an information booth and provided free glucose testing to all event attendees who requested a spot glucose test. Research staff were on hand at the SCH booth to introduce the study and assess attendee interest in participation in the study. However, access to the free spot glucose test was not dependent on agreement to participate in the study.

Attendees who volunteered to participate in the study, and met the eligibility criteria, were asked to complete a consent form and screening survey. Eligibility requirements included being at least 18 years of age, Hispanic, and a current resident of the Yakima Valley. Because of low literacy in a portion of the population, staff were authorized to read the consent form and survey to participants and record their responses. Participants provided their own signature on the consent form. Data collected on the screening survey were used to determine eligibility for the larger research project. The screening survey assessed participants' nutritional habits, non-identifying family diabetes history, demographic information, and general diabetes knowledge. The diabetes knowledge statements utilized in the current study were collected as part of this screening survey. Identifying information collected by the trained research staff was not shared with the SCH medical staff that administered the glucose tests.

Upon a participant's completion of the consent form and screening survey, the laboratory technician from the local hospital administered the blood glucose screening using a finger-stick blood sample. Fasting or non-fasting criteria was used, as appropriate, to interpret the blood glucose reading based on participants' self-report of food intake in the last 8 hours. Blood glucose readings were recorded by research staff; hospital laboratory staff maintained no identifying information. Event attendees who presented with abnormal glucose results received referrals to the local hospital for free fasting blood glucose and HbA1c tests, as well as to their primary physician—regardless of their agreement to participate in the study. Once participants completed their fasting blood glucose they were contacted by research staff to determine eligibility and willingness to participate in the intervention portion of the study (data not presented). The entire study's protocol was reviewed and approved by the Internal Review Board of the Fred Hutchinson Cancer Research Center.

Community Events—In total, research and hosptial staff attended 210 community events throughout Washington State's Lower Yakima Valley. The number of events held per month was slightly higher during the spring and summer months (an average of 12 events per month) compared to the fall and winter months (an average of 9 events per month) due to weather constraints, as events are often held outdoors. All events were the result of collaborations with local health organizations and businesses to promote available community services. Health-related organizations were the primary representatives at approximatley 70% of the community events and included organizations such as the Farmworkers Health Clinic, Department of Social and Health Services, and Early Childhood Education and Family Services (EPIC). However, regular non-health related organizations that partipated in events included Yakima Valley Community College, Washington State Migrant Council, local food banks, warehouse retail chains, insurance companies, local radio stations, and other local vendors. Only 13 events, held at the request of local

businesses, were diabetes-specific. During these events, SCH provided glucose testing while the research team approached potential participants in a manner consistent with the protocol maintained at larger multi-organizational events.

Measurement—Data analyzed in this study to assess diabetes knowledge were extracted from a 20-item eligibility screening survey that included a series of 5 statements selected from the Diabetes Knowledge Questionnaire.[25] The 5 statements served as the outcome variables for these analyses. The statements reflected 5 constructs: cause of diabetes, influence of family history, ability to cure diabetes, diagnosing diabetes, and primary types of diabetes. The specific knowledge statements associated with these constructs is provided in Table 1. Possible responses to each statement were "correct," "incorrect" or "don't know." Independent variables were gender (women vs men), education (4th grade education or lower, 5th–8th grade, 9th–12th grade, and received high school diploma or higher), age (18–34, 35–49, 50–64, and 65+), birthplace (US vs Mexico), whether a person had been told by a professional health care worker that they had diabetes (yes vs no), and family history of diabetes (yes vs no).

Analysis Plan

Responses to each statement were coded as either correct or incorrect. Responses that were left blank (missing) were not included in the analyses and the response "don't know" was coded as incorrect. Logistic regressions and multiple logistic regressions were used to analyze unadjusted and adjusted effects, respectively, of each independent variable. Cross-tabulations were used to calculate the frequency (n, %) of correct and incorrect responses. Statistical significance was determined at $P \leq .05$.

RESULTS

Overview

Overall, a high percentage of participants provided correct responses to the knowledge statements. For 4 of 5 statements the percentage of correct responses ranged from 71% to 84%. However, for the statement that reflected the cause of diabetes, only 17% of the sample responded correctly. Interestingly, no factors were significantly associated with the cause of diabetes statement. This was true of both the independent and adjusted analyses.

Demographic Characteristics

Of the 1517 participants screened at the community events, 1297 were eligible for inclusion in the analyses. The remaining participants were not eligible due to ethnicity, age, or residence. The study sample consisted of 458 men and 839 women between the ages of 18 and 92 with a mean age of 39.35 (±12.90) years. The majority (76%) were under the age of 49, 81% were born in Mexico and 76% requested that the interview take place in Spanish. Because of the high association between language preference and place of birth (93%), only place of birth was included in the analyses. The level of education for the sample was representatively distributed across a wide spectrum with 22% of the sample having less than a 4th-grade education and 23% having attained at least a high school diploma. Descriptive participant data are provided in Table 2.

Factors Associated With Diabetes Knowledge

Gender—In unadjusted analyses, gender was independently associated with knowledge of the *influence of family history* ($P = .01$), *ability to cure diabetes* ($P = .03$), *diagnosing diabetes* ($P = .001$), and *primary types of diabetes* ($P = .001$). In the multivariate adjusted analyses gender remained significantly associated with 3 of the statements: *influence of family history* ($P = .01$), *diagnosing diabetes* ($P = .001$), and *primary types of diabetes* ($P = .001$). In both the unadjusted and adjusted analyses, women were more likely to respond correctly to each statement compared to men (Tables 3a and 3b).

Education—Education, in both the unadjusted and adjusted analyses, was significantly associated with knowledge about the *ability to cure diabetes* (unadjusted, $P = .05$; adjusted, $P = .01$) and *primary types of diabetes* (unadjusted, $P = .001$; adjusted, $P = .001$) (Tables 3a and 3b). Responses based on education were consistent in that those with at least a high school diploma were more likely to respond correctly to each statement compared to those with a 5th- to 8th-grade education (*ability to cure:* unadjusted, $P = .03$, adjusted, $P = .001$; *primary types of diabetes:* unadjusted and adjusted, $P = .001$) or with a 4th grade education or lower (*ability to cure:* unadjusted, $P = .01$, adjusted, $P = .001$; *primary types of diabetes:* unadjusted and adjusted, $P = .001$) (Tables 3a and 3b). The group with a 9th- to 12th-grade education was not significantly different compared to those with at least a high school diploma. It should be noted, however, that in the *influence of family history* statement, overall education was not statistically significant ($P = .07$) but 2 levels within the education variable were significant (Table 3a). Participants with at least a high school education were more likely to correctly respond to the statement than those with a 9th- to 12th-grade or 4th-grade education or less. However, the observed percent correct and larger sample size (weighting) of the 5th–8th grade group may explain the lack of overall significance of age.

Age—Unadjusted and adjusted analyses indicated age was significantly associated with knowledge about the *ability to cure diabetes* (unadjusted, $P = .01$; adjusted, $P = .001$). In this statement the 35- to 49-year-old group (unadjusted, $P = .001$; adjusted, $P = .001$) was more likely to provide a correct response to the statement compared to the 18–34 referent group (Table 3a). However, in the adjusted analyses participants in the 50–64 age group ($P = .001$) also were more likely to respond correctly to the statements compared to the 18–34 age referent group. When adjusted for all other factors, age was also associated with *primary types of diabetes* ($P = .01$) and was consistent with the adjusted *cure* statement, in that the 35- to 49-year-old ($P = .001$) and 50- to 64-year-old ($P = .001$) groups were more likely to provide a correct response to the statement compared to the 18–34 referent group (Table 3b).

Birthplace—Independent unadjusted analyses for birthplace revealed no significant association with any statement (Tables 3a and 3b). In the multivariate adjusted analyses, birthplace was statistically associated with *influence of family history* ($P = .01$); however, the observed difference between participants born in the US (82%) vs Mexico (84%) is negligible and ostensibly insignificant.

Diabetic Status—In unadjusted analyses, diabetic status was associated with knowledge about the *ability to cure diabetes* ($P = .01$) and *diagnosing diabetes* ($P = .001$). When

multivariate analyses were conducted and diabetic status was adjusted for all other factors, only *diagnosing diabetes* ($P = .001$) remained statistically significant, although *ability to cure diabetes* ($P = .052$) approached significance. Response to all statements was consistent, in that diabetic participants were more likely to respond correctly compared to non-diabetics (Tables 3a and 3b).

Family History—In unadjusted and adjusted analyses, family history was significantly associated with *influence of family history* (unadjusted, $P = .001$; adjusted, $P = .001$), *ability to cure diabetes* (unadjusted, $P = .01$; adjusted, $P = .04$), *primary types of diabetes* (unadjusted, $P = .001$; adjusted, $P = .02$). Additionally, in the unadjusted analyses, family history was associated with *diagnosing diabetes* ($P = .01$); however, when adjusted for all other factors this association was not significant. In all statements, participants with a positive family history of diabetes were more likely to correctly respond to each statement compared to those with no family history of diabetes (Tables 3a and 3b).

DISCUSSION

The goal of this study was to use a community-level assessment to identify factors that may be associated with diabetes knowledge among rural Hispanics as a method of informing the development of future community-level diabetes interventions. Although no factors were associated with all statements, gender, education and family history were associated with 3 of the 5 statements and, thus, were the factors most frequently associated with diabetes knowledge in this study. Contrary to expectations, having been diagnosed by a health care provider as having diabetes was not among the most frequently associated factors. Instead, adjusted for all other factors, diabetic status was significantly associated with 1 statement.

Overall, participant responses to statements were largely accurate, demonstrating a high degree of general knowledge about diabetes in this rural Hispanic community. This finding of a high level of diabetes knowledge is consistent with 2 intervention studies that, using the full Diabetes Knowledge Questionnaire, also observed high levels of general diabetes knowledge at baseline among Mexican Americans living in a rural area of southern Texas.[25,26] We propose 2 reasons why participants in our study demonstrated a high level of general knowledge and why having been diagnosed with diabetes was not associated with diabetes knowledge. First, there was a significant portion of the community that had at least peripheral exposure to diabetes, as 58% of the sample reported having a family history of the disease. In the Latino community, family and friends are frequently resources for medical information.[27] In fact, 1 report found 70% of participants received medical information from networks such as family and friends, including those from church and community organizations.[27,28]

The presence of traditional values may also contribute to the high general knowledge among women, compared to men. As noted above and by a number of qualitative studies, including those conducted by our group, traditionally the need to care for one's family takes precedence over caring for oneself, particularly among women.[27,29–31] Although family can serve as both a facilitator and barrier to self care (ie, seeking out health information or dietary change), the fact that family history and gender were significantly associated with

knowledge more often than was diabetic status suggests a portion of these findings may be due to such traditional family values.[31] However, further investigation is necessary.

Second, although a high number of participants provided correct responses to the knowledge statements, this was limited to 4 of the 5 statements. The *cause of diabetes* statement proved difficult for many participants as noted by the low number of participants (18%) that responded correctly. It is possible that the number of participants that responded correctly to this statement was low because it required a greater depth of diabetes knowledge compared to that of the other 4 statements. Specifically, knowledge about the biological underpinnings of diabetes would be necessary to provide a correct response, a feature not present in the other statements. This distinction suggests community members may be limited to a superficial understanding of diabetes.

Education and gender also were significantly associated with 3 diabetes knowledge statements. Education has been associated with knowledge in numerous other studies.[11,13,14] For example, in a study by Bautista-Martinez and colleagues[11] education appeared to be the strongest predictor of knowledge and, similar to the findings in our study, higher levels of education were associated with a greater likelihood of providing a correct answer. Previous research findings on gender and diabetes knowledge, however, have been inconsistent. While several studies have found that women have greater diabetes knowledge,[32,33] others have shown women to have lower levels of knowledge.[34] In this study women were more likely to provide a correct answer to each statement, a finding that may be due again to the traditional value of women as caregivers.

The contrast of high general diabetes knowledge with a lack of association between knowledge and diabetic status, however, is not completely without explanation. The mixture of traditional and non-traditional influences on diabetes knowledge is consistent with previous research conducted in the Hispanic community. For instance, in a study by Arcury and colleagues[35] non-diabetic immigrant Hispanics identified diabetes as a serious disease associated with heredity but also believed diabetes could result from factors such as strong emotions ("*sustos*"). *Sustos* has been noted by several studies as being strongly associated with the onset of diabetes among Hispanics.[36–38] The findings of the current study, which indicate the presence of high levels of diabetes knowledge but no association of having diabetes with knowledge, support this idea of mixed influences.

Strengths and Limitations

To the best of our knowledge, this study was the first to evaluate factors associated with general diabetes knowledge at a community level in US Hispanics. Study participants represented a wide range of educational attainment and age, increasing the generalizability of the study findings to other rural, primarily Mexican American communities. The study provided preliminary evidence that family history and gender are factors that future studies should investigate as a pathway for community-level education about diabetes prevention and control.

While this study provided insight into the knowledge base of a rural Hispanic community, data regarding diabetic status were acquired using self-report. In some instances such data

can be largely inaccurate; however, there are several studies which have shown that self-reporting of diabetic status is highly correlated with clinical documentation.[39–41] Also, because this study was conducted as a secondary analysis and diabetes knowledge was not a primary specific aim of the larger project, only selected items from a larger questionnaire validated in a Hispanic population[25] were used to assess diabetes knowledge. Use of the full questionnaire in future studies will allow for more detailed measurement of specific aspects of diabetes knowledge to be assessed. Future studies should assess the demographics of participants that refuse to participate versus those that do participate to determine if there are demographic biases that might contribute to the high diabetes knowledge in the community. Finally, we collected no information about family affiliation of respondents and therefore did not control for intra-class correlations, which may account for some of the variance found in our analyses.

Conclusion

According to the objectives of The National Diabetes Education Program (NDEP), educational community-based interventions are required to reduce the risk and complications of diabetes. To achieve this the NDEP's objectives include improving the public's general understanding of diabetes and its control, and increasing awareness of risk factors and strategies for prevention of diabetes.[42] The goal of this study was to assess factors that contribute to diabetes knowledge in a largely agricultural, Hispanic community in eastern Washington State as a step in the process of developing and expanding a community-level intervention. No variable emerged as being associated with all of the general knowledge statements, but family history, gender and education were most often associated with diabetes knowledge and may provide a starting point for developing a culturally appropriate diabetes intervention program among rural Hispanics. Interestingly, having a diagnosis of diabetes, age, and birthplace had limited or no significant relationship with knowledge. Based on this study's findings, future studies might consider including unaffected relatives of diabetic patients in the development of diabetes intervention programs. We believe this strategy may provide a means of strengthening the impact of community-based interventions and contribute to diabetes prevention and control in the rural Hispanic population.

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Table 1

Knowledge statements associated with each construct

Construct	Knowledge statement
Cause of diabetes	Eating too much sugar and other sweets is a cause of diabetes
Family history as a risk factor	If I have diabetes my children have a greater chance of being diabetic
Ability to cure diabetes	Diabetes can be cured
Diagnosing diabetes	A fasting blood sugar level of 210 is high
Types of diabetes	There are two types of diabetes

Table 2

Distribution of sample gender, age, highest level of education, birthplace, language the interview was conducted in, self-reported family history of diabetes, and self-reported diabetic status of participant.

	N (%)
Gender	
Men	458 (35)
Women	839 (65)
Age	
18–34	308 (24)
35–49	715 (55)
50–64	248 (19)
65+	26 (2)
Highest level of education	
≤ 4th grade	285 (22)
5th–8th grade	387 (30)
9th–12th grade	325 (25)
Received diploma (high school, college or graduate school)	300 (23)
Birthplace	
U.S.	251 (19)
Mexico	1046 (81)
Been told by a professional health care provider they have diabetes	
No	1154 (89)
Yes	143 (11)
Family History of Diabetes	
No	549 (42)
Yes	748 (58)

Table 3

a. Frequency of correct response, unadjusted and adjusted odds ratios, and 95% confidence intervals for each factor across the statements: "Too much sugar and other sweet foods cause diabetes," "If I am diabetic, my children have a higher chance of being diabetic," and "Diabetes can be cured."

	Too much sugar & other sweet foods cause diabetes (Correct answer = No)					If I am diabetic, my children have a higher chance of being diabetic (Correct Answer = Yes)					Diabetes can be cured (Correct Answer = No)				
		Unadjusted		Adjusted			Unadjusted		Adjusted		Correct	Unadjusted		Adjusted	
	Correct	OR	(CI)	OR	(CI)	Correct	OR	(CI)	OR	(CI)	n (%)	OR	(CI)	OR	(CI)
Gender															
Men	66 (14)	0.74	0.54, 1.01	0.75	0.55, 1.04	369 (81)	0.66**	0.49, 0.89	0.67*	0.49, 0.92	279 (61)	0.76*	0.60, 9.68	0.80	0.62, 1.01
Women	156 (19)	ref		ref		725 (86)	ref		ref		563 (67)	ref		ref	
Education															
≤ 4th grade	43 (15)	0.76	0.49, 1.17	0.72	0.43, 1.21	232 (81)	0.58*	0.36, 0.92	0.52*	0.29, 0.92	172 (60)	0.63**	0.45, 0.89	0.49**	0.32, 0.75
5th–8th grade	57 (15)	0.74	0.49, 1.10	0.70	0.45, 1.10	328 (85)	0.73	0.47, 1.15	0.61	0.37, 1.03	243 (63)	0.70*	0.51, 0.97	0.56**	0.38, 0.81
9th–12th grade	65 (20)	1.07	0.72, 1.58	1.04	0.69, 1.57	268 (83)	0.62*	0.39, 0.98	0.54*	0.33, 0.87	215 (66)	0.81	0.58, 1.14	0.71	0.50, 1.02
≥ High School Diploma	57 (19)	ref		ref		265 (88)	ref		ref		212 (71)	ref*		ref**	
Age															
18–34 years	53 (17)	ref		ref		257 (83)	ref		ref		179 (58)	ref*		ref**	
35–49 years	125 (18)	1.02	0.72, 1.45	1.09	0.75, 1.58	612 (86)	1.18	0.82, 1.70	1.25	0.85, 1.85	486 (68)	1.53**	1.16, 2.02	1.73**	1.29, 2.32
50–64 years	39 (16)	0.90	0.57, 1.41	1.06	0.64, 1.74	206 (83)	0.97	0.62, 1.52	1.14	0.69, 1.88	163 (66)	1.38	0.98, 1.95	1.77**	1.20, 2.61
65+ years	5 (19)	1.15	0.41, 3.17	1.50	0.52, 5.33	18 (69)	0.45	0.18, 1.08	0.67	0.26, 1.73	14 (54)	0.84	0.38, 1.88	1.22	0.52, 2.84
Birthplace															
U.S.	45 (18)	0.93	0.65, 1.34	0.86	0.57, 1.31	207 (83)	0.18	0.82, 1.70	0.57*	0.36, 0.89	164 (65)	0.98	0.73, 1.31	0.78	0.55, 1.11
Mexico	177 (17)	ref		ref		886 (85)	ref		ref		678 (65)	ref		ref	
Diagnosed with Diabetes															
No	193 (17)	0.79	0.51, 1.22	0.84	0.54, 1.31	969 (84)	0.80	0.48, 1.33	0.94	0.56, 1.60	735 (64)	0.59**	0.40, 0.88	0.67	0.44, 1.00
Yes	29 (23)	ref		ref		124 (87)	ref		ref		107 (75)	ref		ref	
Family History															
No	86 (16)	0.84	0.62, 1.12	0.88	0.64, 1.19	438 (80)	0.56**	0.42, 0.76	0.54**	0.40, 0.75	333 (61)	0.72**	0.58, 0.91	0.77*	0.61, 0.98
Yes	136 (18)	ref		ref		655 (88)	ref		ref		509 (68)	ref		ref	

b. Frequency of correct response, unadjusted and adjusted odds ratios, and 95% confidence intervals for each factor across the statements: "A fasting blood sugar level of 210 is too high," "There are two main types of diabetes: Type 1 and Type 2.

	A fasting blood sugar level of 210 is too high (Correct Answer = Yes)					There are two main types of diabetes: Type 1 and 2 (Correct Answer = Yes)				
		Unadjusted		Adjusted			Unadjusted		Adjusted	
	Correct	OR	(CI)	OR	(CI)	Correct	OR	(CI)	OR	(CI)
Gender										
Men	286 (62)	0.56**	0.44, 0.71	0.60**	0.47, 0.77	313 (68)	0.54**	0.41, 0.70	0.55**	0.42, 0.72
Women	628 (75)	ref		ref		672 (80)	ref		ref	
Education										
≤ 4th grade	202 (71)	0.87	0.61, 1.25	0.91	0.58, 1.42	201 (71)	0.49**	0.33, 0.73	0.38**	0.23, 0.62
5th–8th grade	266 (69)	0.79	0.56, 1.10	0.80	0.54, 1.17	278 (72)	0.52**	0.36, 0.76	0.42**	0.27, 0.65
9th–12th grade	225 (69)	0.80	0.57, 1.14	0.82	0.56, 1.18	257 (79)	0.77	0.52, 1.16	0.69	0.45, 1.06
≥ High School Diploma	221 (74)	ref		ref		249 (83)	ref**		ref**	
Age										
18–34 years	201 (65)	ref		ref		219 (71)	ref		ref**	
35–49 years	518 (72)	1.40*	1.05, 1.86	1.48*	1.09, 2.02	560 (78)	1.47*	1.08, 1.99	1.87**	1.35, 2.61
50–64 years	179 (72)	1.38	0.96, 1.99	1.35	0.90, 2.03	186 (75)	1.22	0.84, 1.78	1.88**	1.22, 2.91
65+ years	16 (62)	0.85	0.37, 1.94	0.82	0.34, 1.99	20 (77)	1.36	0.53, 3.49	2.62	0.96, 7.14
Birthplace										
U.S.	186 (74)	0.80	0.59, 1.09	1.15	0.80, 1.67	199 (79)	0.79	0.57, 1.11	0.79	0.53, 1.19
Mexico	728 (70)	ref		ref		786 (75)	ref		ref	
Diagnosed with Diabetes										
No	786 (68)	0.25**	0.15, 0.43	0.29**	0.17, 0.51	869 (75)	0.71	0.46, 1.10	0.88	0.55, 1.39
Yes	128 (90)	ref		ref		116 (81)	ref		ref	
Family History										
No	364 (66)	0.71**	0.56, 0.90	0.79	0.61, 1.01	393 (72)	0.66**	0.51, 0.86	0.72*	0.55, 0.95
Yes	550 (74)	ref		ref		592 (79)	ref		ref	

Odds ratios are the probability of providing a correct response compared to the reference group. An asterisk next to the reference for factors with multiple levels indicates the overall variable is statistically significant.

Indicators of level of statistical significance:

* $P \leq .05$,

** $P < .01$.