Quality of diabetes care: a cross-sectional study of adults of Hispanic origin across and along the United States-Mexico border

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ABSTRACT

Objective. *To assess and monitor the quality of care provided to Hispanics diagnosed with diabetes living in the border region between the United States of America and Mexico.*

Methods. *From April 2001 to November 2002, Phase I of the U.S.-Mexico Border Diabetes Prevention and Control Project, a prevalence study of type 2 diabetes and its risk factors, was conducted along the U.S.-Mexico border using two-stage cluster sampling of towns and households within towns. A questionnaire was administered on diabetes (self-reported) and lifestyle and a physical examination and blood sample were obtained. Of the 4 027 study participants, 521 (13.0%) reported receiving a pre-study diagnosis of diabetes. Of those, 466 were of Hispanic origin (226 on the Mexican side of the border and 240 on the U.S. side).*

Results. *Results indicated 42.1% of Hispanics on the U.S. side of the border (95% confidence interval [CI] 35.8%–48.6%) and 37.6% of Hispanics on the Mexican side (95% CI 31.3%–44.3%) had controlled diabetes (defined as glycosylated hemoglobin A1c < 7.0 %), and only one (on the Mexican side of the border) received optimal diabetes care, defined according to international criteria for systolic blood pressure and body mass index as well as health provider provision of yearly examinations of foot and eyes as preventive care measures for early detection of diabetes complications.*

Conclusions. *Adult Hispanics diagnosed with diabetes and living on the U.S.-Mexico border region are not receiving adequate diabetes-related care, and health care professionals are not following international recommendations for providing that care. To improve diabetes control in the region, health care providers must become more aware of the effect of education and culture on diabetes self-care as well as the provision of preventative measures by health care professionals.*

Key words Diabetes mellitus, type 2; prevalence; border health; Mexico; United States.

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Diabetes is a common chronic disease that is rapidly increasing in prevalence and affects around 194 million people worldwide (5.1% of all adults > 20 years of age). By the year 2030, an estimated 84 billion or 7.8% of the world's population will suffer from diabetes—including 284 million in developing countries (an increase of 170% from 1995 to 2025) (1). Diabetes currently affects more than 20 million people in the United States of America (2) and more than 8 million in Mexico (3). Individuals with diabetes are at increased risk of microvascular complications (e.g., renal disease, neuropathy, and retinal vascular damage) as well as macrovascular complications (e.g., coronary heart disease, stroke, and peripheral vascular disease). Heart disease and stroke are responsible for about 65% of deaths in people with diabetes (1).

In Mexico, diabetes is the leading cause of death. In both Mexico and the United States, it is the leading cause of new cases of blindness and kidney failure, and an important cause of severe neuropathy, which can lead to lower-extremity amputations (LEAs) (2, 3).

Risk of developing diabetes-related microvascular and macrovascular complications is strongly associated with hyperglycemia, which is measured by levels of glycosylated hemoglobin A1c (HbA1c) (4), systolic blood pressure (SBP) (5), and lipids (1–4, 5), as well as body mass index (BMI).

The objectives of diabetes treatment are to eliminate symptoms of hyperglycemia, achieve optimum metabolic control, reduce or eliminate vascular complications, treat associated disorders, improve patients' quality of life, and reduce mortality from the disease or its complications. The World Health Organization (WHO) has recommended a target HbA1c of < 7.0% (6), and a similar goal has been set in the United States by the American Diabetes Association (ADA) (7). In Mexico, the Mexican Official Norms (NOM) goal for this health measurement is < 6.5% (8). Other recommended treatment goals for people with diabetes include SBP < 130 mm Hg and diastolic blood pressure (DBP) < 80 mm Hg, low-density lipoprotein (LDL) < 100 mg/dL, high-density lipoprotein (HDL) > 50 mg/dL, and triglycerides < 150 mg/dL. A dilated and comprehensive eye exam conducted after the initial diagnosis of diabetes, repeated annually, and an annual comprehensive foot examination, are also recommended.

Although diabetes is a known problem among Hispanics of Mexican descent, and U.S. Hispanics have a lower level of diabetes control than U.S. non-Hispanic whites, few studies have been conducted to examine the quality of medical care and monitoring provided to people from those ethnic groups who are diagnosed with diabetes, many of whom live in the U.S-Mexico border region (where the proportion of Hispanics on the U.S. side of the border is ~71%) (9).

To help fill this gap, the U.S.-Mexico Border Diabetes Prevention and Control Project, a prevalence study of type 2 diabetes and its risk factors, was conducted on both sides of the entire U.S.-Mexico border region, in a single systematic way, using the same definitions and procedures on both sides of the border, to determine the proportion of persons with diabetes that receive the level of treatment and control recommended by the ADA and NOM. The current study drew from data generated by the project's population-based household survey to assess and monitor the quality of care provided to Hispanics diagnosed with diabetes living in the U.S.-Mexico border region.

MATERIALS AND METHODS

The current study was based on data from the results of Phase I of the U.S.-Mexico Border Diabetes Prevention and Control Project, which consisted of a population-based, cross-sectional survey conducted on both sides of the U.S.-Mexico border between April 2001 and November 2002 using two-stage cluster sampling. Based on 1990 Mexican and U.S. census population estimates, communities with a population of at least 2 500 persons were eligible to participate. A stratified, multistage probability sampling design with substitution was used, and selections were made from sampling units based on geographic area. On the U.S. side of the border, census tracts within communities were divided into two strata based on 1990 population estimates of ethnicity. The individual aged 18 or older in each enumerated household with the most recent birthday was selected to participate in the survey.

Potential interviewers were selected by the state and local agencies on both sides of the border who participated in the project. On the U.S. side, interviewers had to be bilingual and included nurses, community health workers, and university students. In Mexico, interviewers included physicians and nurses.

A questionnaire was administered to each participant face-to-face, in his/her home, by a trained interviewer. As mentioned above, on the U.S. side, interviewers were fluent in both English and Spanish, so participants could choose to complete the survey in whichever language he/she felt more comfortable. Signed consent forms were obtained from all participants before administration of the questionnaire. Data was obtained for six sections with a total of 65 questions covering general knowledge of diabetes, health and medical services, lifestyle (physical activity, diet, and tobacco and alcohol use), reproductive health, and socio-cultural characteristics.

Ethical clearance was obtained from the U.S. Centers for Disease Control and Prevention (CDC) and from the Mexican ministry of health.

Following the completion of the interview, various health indicators were measured, including body weight (in kg, with participants wearing light clothing and no shoes), and height (in cm). BMI was calculated as weight divided by the square of height in meters. Blood pressure was measured after a 15-minute rest period, with study participants in the seated position. Three readings were recorded for both SBP and DBP over a 5-minute interval and their averages were used in the analyses.

Blood samples were taken the morning after a minimum of eight hours of fasting. Samples were centrifuged and stored locally at –20° and then packed in ice and transported by air to the central laboratory in each country (the University of Missouri Diabetes Diagnostic Laboratory, in the United States, and the Nuevo León State Laboratory in Mexico). Plasma glucose was measured using the Cobas Mira Chemistry System (Roche Diagnostic Systems, Inc., Montclair, N.J., USA), a Sorvall GLC-2B centrifuge (DuPont Instruments, Wilmington, Del., USA), and a Jouan GR4-22 refrigerated centrifuge (Valley Biomedical, Winchester, Va., USA). HbA1c was analyzed with the Primus Automated CLC385 HPLC system (Primus IV, Kansas City, Mo., USA). Laboratory personnel from both countries were trained by personnel from the central laboratory from each country and by Primus personnel. To ensure the integrity of the laboratory results, both laboratories used the same equipment and the same specifications. For simultaneous quality control, both laboratories exchanged 20 samples every three months. Samples were tested in both countries and the results were compared between laboratories. The laboratories agreed to accept a 3% variance in the results. If the discrepancy was higher than 3%, Primus technicians were sent to both laboratories to evaluate and resolve the problem.

Drawing from the study sample above, the current study analyzed data for the study participants with "diagnosed diabetes." Study participants were classified as having "diagnosed dia-

betes" if they reported being diagnosed by a physician or other health care professional prior to the survey. "Age of diagnosis" was the [self-reported] age of participants when they were first diagnosed with diabetes. The current study's analyses were restricted to Hispanics on both sides of the border in order to identify differences in diabetes control by country of residence. Ethnic origin was classified as "Hispanic" for study participants that reported being born in Mexico or identified themselves as Hispanic.

Quality of diabetes monitoring was based on HbA1c, SBP, and BMI measurements, and the results were grouped as follows: HbA1c (< 6.0%, 6.0–6.9%, 7.0–7.9%, and ≥ 8.0%), SBP (< 120 mm Hg, 120–129 mm Hg, 130–139 mm Hg, 140–159 mm Hg, and ≥ 160 mm Hg), and BMI (< 24.9, 25.0–29.9, and ≥ 30). In the logistic regression analysis, age, age of diagnosis, levels of HbA1c and SBP, and BMI were used as continuous variables.

Preventive care measures chosen for analysis were eye examination and foot examination. For both indicators, responses of "Don't know," Refuse," or "Not sure" were coded as "missing data." A "dummy" variable was created for the eye examination to comprise study participants who reported having "at least one eye exam" or "no eye exam" since their initial diabetes diagnosis. Study participants that reported having had "at least one" foot examination were included in the "yes" category for that variable.

Based on study participants' responses, diabetes treatment was classified as one of four groups ("use of oral hypoglycemic drugs," "use of insulin," "use of oral hypoglycemic drugs and insulin," and "no use of oral hypoglycemic drugs or insulin").

A dummy variable was created for "self-monitoring of blood glucose" and classified as "yes" if study participants reported checking their blood glucose "at least once per month" and "not only when referred by a doctor or other health care professional to a laboratory." Number of diabetes-related visits to a physician in last 12 months was grouped as "> 12," "7–12," "1–6," or "none."

Insurance status was categorized as "having medical coverage" or "not having medical coverage" based on study participants' response to two questions: "What type of medical facility do you usually use?" and "What is your primary medical coverage plan?" Study participants on the U.S. side of the border who reported having Medicare, Medicaid, private or HMO (health maintenance organization) insurance, or access to medical services for military personnel were categorized as having medical coverage, along with those on the Mexican side of the border who reported having private insurance or access to services covered by Mexican social security (*Instituto Mexicano del Seguro Social*, IMSS), state workers' social security (*Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado*, ISSSTE) or other public health entities. Responses of "Don't know," "Refuse," or "Not sure" were coded as "missing data" for the respective variables.

Study participants' socioeconomic status was categorized separately for each country based on employment status and education indicators.

Statistical analysis

The initial statistical analysis described various study participant characteristics, including age distribution, age of diagnosis, monitoring of diabetes (based on HbA1c and SBP levels), and BMI. Tabulations were made by country to examine differences in preventive care measures (foot and eye examinations), use of diabetes drug treatments, self-monitoring of blood glucose, number of diabetes-related visits to a physician in last year, and medical coverage. Differences were tested for statistical significance using Pearson's chi-square test and the Student's *t*-test for grouped and continuous data respectively.

Logistic regression was performed to estimate odds ratios (ORs) with 95% confidence intervals (CIs) for the independent effect of each variable. In the country analyses, Mexico was the reference category. The outcome was "uncontrolled diabetes," defined as HbA1c ≥ 7.0%.

The analyses focused on the effects of 1) place of residence (U.S. side of the border versus Mexican side of the border) and 2) diabetes control (defining uncontrolled disease as HbA1c ≥ 7.0%). In the current study, Hispanics on the U.S. side of the border were considered to be from the same ethnic group and to have a similar culture and language background as Hispanics on the Mexican side of the border. All statistical analyses were performed using STATA 10 for Windows (StataCorp LP, College Station, Texas, USA).

RESULTS

Of the 4 027 adults that participated in the original study, 521 (13.0%) reported a previous diagnosis of diabetes by a physician or other health care professional. Of those 521 individuals, 466 were of Hispanic origin (226 or 48.5% on the Mexican side of the border and 240 or 51.5% on the U.S. side). Of those 466 individuals, 424 (91.0%) had biochemical data available for analysis.

Socioeconomic, demographic, health, lifestyle, and family history characteristics of study participants with previously diagnosed diabetes, by country of residence, are presented in Table 1. As shown in the table, Hispanics with a prestudy diagnosis of diabetes on the U.S. side of the border were older (with a mean age of 58 years) and received their diabetes diagnosis later in life (at a mean age 49). Hispanics on the Mexican side of the border had a mean age of 54 years and a mean age of diagnosis of 47 years. Hispanics on the U.S. side of the border had significantly higher BMI but reported more physical activity and higher education and socioeconomic status than those living on the Mexican side of the border. Hispanics on the Mexican side of the border reported higher levels of smoking versus their U.S. counterparts. No difference was observed between the two groups with regard to family history of diabetes.

In the current study, diabetes control was defined as having an HbA1c level < 7.0%. Based on that criterion, 42.1% (CI 35.8–48.6%) of Hispanics on the U.S. side of the border and 37.6% (CI 31.3–44.3%) of those on the Mexican side of the border had controlled diabetes. However, this difference was not statistically significant ($P = 0.10$) (Table 2).

With regard to preventive care practices, Hispanics on the U.S. side of the border reported having significantly more foot and eye examinations than those on the Mexican side ($P < 0.001$). Use of insulin (alone, and in combination with oral medication) was significantly lower among Hispanics on the Mexican side of the border versus their counterparts on the U.S. side of the border

TABLE 1. Socioeconomic, demographic, health, lifestyle, and family history characteristics of diabetic Hispanics[a] with self-reported pre-study diagnosis of diabetes, by country of residence, U.S.-Mexico border region,[b] April 2001–November 2002

Characteristic	Mexico (*n* = 226)	United States (*n* = 240)	*P*
Age (years)[c]	54 ± 13	58 ±14	0.005[d]
Age of diagnosis (years)[c]	47 ± 12	49 ± 14	0.03[d]
Glycosylated hemoglobin A1c (%)	7.9 ± 2.6	7.6 ± 2.0	0.10[d]
Height (cm)[c]	158 ± 9.2	161 ± 10	0.01[d]
Weight (kg)[c]	76.4 ± 17	82.1 ± 20	< 0.001[d]
Body mass index[c]	30.4 ± 6.3	31.8 ± 7.0	0.03[d]
Waist circumference (cm)[c]	101.2 ± 13.3	103.6 ± 14	0.06[d]
Waist-to-hip ratio[c]	0.92 ± 0.08	0.92 ± 0.08	0.85[d]
Blood pressure[c]			
Systolic (mm Hg)	132 ± 18	136 ± 20	0.02[d]
Diastolic (mm Hg)	80 ± 12	80 ± 11	0.72[d]
Smoking status (%)			0.002[e]
Never smoked	66.5	70.1	
Former smoker	13.7	20.9	
Current smoker	19.8	9.0	
Alcohol consumption (%)			0.13[e]
Current drinker	20.7	26.7	
Physical activity (%)			< 0.001[e]
Yes	21.3	38.2	
No	78.4	61.8	
Education (%)			< 0.001[e]
> 12 years	3.5	11.3	
7–12 years	25.2	41.0	
≤ 6 years	55.8	39.8	
Illiterate	15.5	8.0	
Socioeconomic status (%)			< 0.001[e]
High	3.5	13.0	
Medium	61.5	59.4	
Low	35.0	27.6	
Family history of diabetes (%)			0.36[e]
Yes	35.7	31.7	
No	64.3	68.3	

[a] Individuals who reported being born in Mexico or identified themselves as Hispanics.
[b] Arizona, California, New Mexico, and Texas, in the United States, and Baja California, Chihuahua, Coahuila, Nuevo León, Sonora, and Tamaulipas, in Mexico.
[c] Mean ± standard deviation.
[d] Based on the Student's t-test.
[e] Based on Pearson's chi-square test.

($P \leq 0.001$). No statistically significant difference was found between study participants by country of residence for either oral hypoglycemic treatment or diet (Table 2). For each Hispanic on the Mexican side of the border who reported self-monitoring his/her blood glucose, there were three Hispanics on the U.S. side of the border who reported the same behavior. More Hispanics with previously diagnosed diabetes on the Mexican side of the border reported not having visited a doctor in the last 12 months preceding the study, but this difference was not statistically significant. Less Hispanics on the U.S. side of the border reported having some type of medical coverage versus Hispanics on the Mexican side of the border.

Based on the multiple logistic regression models, crude ORs for diabetes control were higher for Hispanics on the U.S. side of the border (1.21, 95% CI 0.83–1.75) versus Hispanics on the Mexican side. Adjusting for only sex and age did not change this OR, but adjusting for sex, age, SBP and DBP, BMI, and preventive care measures for early detection of diabetes complications (examination of feet and eyes) increased it to 1.48 (95% CI 0.97–2.26). This was attributed to the fact that U.S. Hispanics reported more examinations of feet and eyes than Hispanics in Mexico. In the fully adjusted model, no statistically significant difference was observed for diabetes control between Hispanics on the U.S. side of the border versus those on the Mexican side, as shown in Table 3. A statistically significant difference was found between quality of care provided to non-Hispanic whites versus Hispanics on the U.S. side of the border, an outcome that is reviewed in a forthcoming report.

DISCUSSION

The U.S.-Mexico Border Diabetes Prevention and Control Project is one of the few studies documenting diabetes care among noninstitutionalized individuals in Mexico or the United States. In addition, along with the National Health and Nutrition Examination Survey, a population-based survey carried out every two years in the United States, it is one of the largest studies to date to assess type 2 diabetes prevalence in the noninstitutionalized population of counties and municipalities along the U.S.-Mexico border.

The purpose of the current study was to assess and monitor quality of care provided to Hispanics with a previous diagnosis of diabetes on the U.S. side of the U.S.-Mexico border and those on the Mexican side of the border to identify differences in diabetes care between two groups with a very similar genetic background and culture but living in two very different countries: one middle-income and the other highly developed.

In the United States, Hispanics, mainly from Mexican descent, are the fastest growing minority and are disproportionably affected by type 2 diabetes (2). Hispanics have the worst glycemic control and are more likely to be pharmacologically treated and have higher rates of diabetes complications, including end-stage renal disease, retinopathy, blindness, neuropathy, and LEA, when compared with non-Hispanic whites (10–12). In Mexico, which has one of the highest diabetes prevalence in the world, type 2 diabetes is the leading cause of death, blindness, LEA, and end-stage renal disease (3).

The current study found that along the U.S.-Mexico border the underuse of recommended preventive practices is common among individuals with diabetes, as is the under-provision of these measures by some health professionals. This lack of adherence to recommended control measures may be responsible for the less-than-optimal health outcomes documented in this study, as well as other research providing evidence of suboptimal quality of care provided by health care professionals (10–14); poor self-management by patients, in spite of receiving appropriate medical advice (15–17); and other factors associated with poor control of diabetic patients.

TABLE 2. Preventive care practices, use of medication, medical coverage, and socioeconomic status of diabetic Hispanics[a] with self-reported pre-study diagnosis of diabetes, by country of residence, U.S.-Mexico border region,[b] April 2001–November 2002

Variable	Mexico (%) (*n* = 226)	United States (%) (*n* = 240)	*P*
Preventive care practices			
Examination of feet			< 0.001[c]
Yes	24.8	55.0	
No	75.2	45.0	
Examination of eyes			< 0.001[c]
Within last year	27.0	56.6	
Within last 2 years	6.2	9.6	
2 years or more	10.2	12.1	
Never	56.0	21.7	
Self-monitoring of blood glucose			< 0.001[c]
Yes	17.8	56.3	
Number of visits to doctor in last 12 months			0.32[d]
>12	5.8	7.6	
7–12	34.2	22.7	
1–6	49.8	63.0	
None	10.2	6.7	
Use of medication			
Use of oral hypoglycemic	76.3	70.8	0.18[c]
Use of insulin	6.7	18.8	< 0.001[c]
Use of oral hypoglycemic and insulin	2.2	12.5	< 0.001[c]
No use of oral hypoglycemic or insulin	18.5	22.9	0.24[c]
Has medical coverage	85.8	70.2	< 0.001[c]
Socioeconomic status			0.001[c]
High	3.5	13.0	
Medium	61.5	59.4	
Low	35.0	27.6	

[a] Individuals who reported being born in Mexico or identified themselves as Hispanics.
[b] Arizona, California, New Mexico, and Texas, in the United States, and Baja California, Chihuahua, Coahuila, Nuevo Leon, Sonora, and Tamaulipas, in Mexico.
[c] Based on Pearson's chi-square test.
[d] Based on Student's t-test.

TABLE 3. Crude and adjusted odds ratio (OR) for diabetes control and its association with selected variables among U.S. Hispanics,[a,b] versus Hispanics in Mexico, U.S.-Mexico border region,[c] April 2001–November 2002

Diabetes control	OR	95% CI[d]
Crude	1.21	0.83–1.75
Adjusted for:		
Sex, age, and systolic blood pressure	1.21	0.83–1.75
Sex, age, SBP,[e] DBP,[f] BMI,[g] and foot and eye examination	1.48	0.97–2.26
Sex, age, SBP, DBP, BMI, foot and eye examinations, use of oral hypoglycemic, and use of insulin	1.25	0.81–1.95
Sex, age, SBP, DBP, BMI, foot and eye examination, use of oral hypoglycemic, use of insulin, self-monitoring of blood glucose, number of visits to doctor, medical coverage, and socioeconomic status	1.18	0.72–1.94

[a] Individuals who reported being born in Mexico or identified themselves as Hispanics.
[b] Reference group.
[c] Arizona, California, New Mexico, and Texas, in the United States, and Baja California, Chihuahua, Coahuila, Nuevo Leon, Sonora, and Tamaulipas, in Mexico.
[d] CI: confidence interval.
[e] SBP: systolic blood pressure.
[f] DBP: diastolic blood pressure.
[g] BMI: body mass index.

The current study found that survey respondents from the Mexican side of the U.S.-Mexico border had lower mean fasting glucose and SBP than populations studied in other research conducted in Mexico and elsewhere in Latin America (15–17). It also found a higher proportion of Hispanics on the U.S. side of the border with recommended levels of HbA1c and SBP than found by other studies for U.S. border states (18, 19).

Although both the ADA and NOM recommendations advocate educating diabetes patients to maintain a BMI < 25, the current study found that around 50% of Hispanics with diabetes on the Mexican side of the border and 31.8% on the U.S. side of the border had a BMI ≥ 30, and less than 18% and 13% respectively had a BMI within the recommended optimum level (< 25).

Even though research has shown that Hispanics with diabetes in the United States have a higher prevalence of lesions of retinopathy and the highest rate of retinopathy prevalence at ≥ five years' duration of diabetes compared with non-Hispanic whites, the percentage of U.S. Hispanic with diabetes that have had an eye examination is low (19, 20). This group receives a similarly low level of preventive care for lower-limb diabetes-related complications, which can lead to foot ulcers and nontraumatic amputations. As reported by Lee et al. (21), the risk for LEAs in Texas is higher in Texas-Mexico border counties, where ~80% of the inhabitants are of Mexican origin. However, the results of the current study indicated a higher percentage of Hispanics on the U.S side receiving a foot examination compared with previous U.S. studies (11, 22).

According to the current study results, for every three U.S. Hispanics that self-monitored their blood glucose monthly, there was only one Hispanic in Mexico with the same behavior (< 18% of all Hispanic with diabetes on the Mexican side of the border, most of whom use insulin). This result may be partially attributable to differences in the recommendations of the ADA versus the NOM. However, even the higher percentage of blood-glucose self-monitoring found for Hispanics on the U.S. side of the border (56.3%) is below the goal set by Healthy People 2010 (a U.S. national initiative for health promotion and disease prevention).

The current study also found that Hispanics with diabetes on the U.S. side of the border reported using no medication and controlling their diabetes only through diet and exercise more often, and had a higher percentage of individuals with HbA1c < 7.0%, versus those on the Mexican side. In addition, contrary to findings by Saydah et al. (23), this study found that Hispanics with diabetes using insulin on the U.S. side of the border had better control than those using oral medication alone or in combination with insulin. Current results also indicated that study participants that used a combina-

tion of oral medication and insulin had the lowest diabetes control.

Although this study compared quality of diabetes care in a developed versus a developing country (United States versus Mexico), no statistical difference was found (Table 3). However, evidence has shown that care provided to people of Hispanic origin who have diabetes is poor in the United States (10–12, 18), and worse in Mexico, mostly with regard to preventive care measures, as found in the current study. These results also support the theory that cultural behavior among Hispanics in the Southern United States and in Northern Mexico, and its repercussions on health, are similar.

Possible limitations of the current study include the fact that it was conducted several years ago (2001–2002), so the level of diabetes control among Hispanics on both sides of the border could be different at present. In addition, like most survey samples based on voluntary participation, the source study experienced both household and individual nonresponse. Nonresponse was most common among non-Hispanics, young and male, resulting in an overrepresentation of Hispanics, older people, and females. Given that study participants were selected at home (according to the "most recent birthday" criterion), and considering the fact that people with health problems are more likely to stay at home than healthier individuals, overrepresentation of people with health problems and under-estimation of the number of healthy people in the current study data are also possible. In addition, age of diagnosis could have been misreported due to recall problems among those self-reporting a diagnosis of diabetes versus no diagnosis of diabetes, and this could have resulted in an over- or under-estimation of the effect of access to care for control and diagnosis of the disease. In addition, because the prevalence of diagnosed diabetes was based on self-reporting of a pre-study diagnosis of diabetes, it is possible that differential misclassification could have occurred if individuals not diagnosed with diabetes reported having diabetes anyway, for various reasons (e.g., due to the expectation of free health care), when answering the questionnaire. Also, no information on lipids levels was available in this study, so that measurement was not included in the section on monitoring and therefore can not be compared with other studies that include this information. Finally, prevalence of study participants with diabetes may have been skewed due to the use of the question "Has a doctor or a other health care professional ever told you that you have diabetes," as some of those surveyed may have answered "yes" as a result of being told that they were at *risk* of diabetes. This potential bias may also have resulted in skewed measures of association with regard to the treatment received to control levels of HbA1c.

Based on the current findings that persons of Hispanic origin are not receiving optimal control for their diabetes, it is important that health professionals become more aware of the important role that education and culture play among people with diagnosed diabetes living in the U.S.-Mexico border region. Because of the similarities between Hispanics on both sides of the border, the development and establishment of binational educational programs is crucial. It is also important to empower persons with diabetes to play a more active role in ensuring that they receive preventive care measures, such as eye and foot examinations.

The development of multidisciplinary, multicultural, and binational health care "teams" would help Hispanic diabetes patients, as well as their families and doctors, with support and provision of better diabetes control and the prevention of diabetes-related complications.

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RESUMEN

Calidad de la atención de la diabetes: un estudio transversal de adultos hispanos residentes en ambos lados de la zona fronteriza entre México y los Estados Unidos

Objetivo. Evaluar y vigilar la calidad de la atención prestada a los hispanos diagnosticados de diabetes residentes en la zona fronteriza entre los Estados Unidos y México.

Métodos. De abril del 2001 a noviembre del 2002, se llevó a cabo la primera fase del Proyecto de Prevención y Control de la Diabetes en la Frontera México-Estados Unidos, un estudio sobre la prevalencia de la diabetes tipo 2 y sus factores de riesgo; el proyecto se realizó a lo largo de la zona fronteriza entre los Estados Unidos y México, mediante muestreo por conglomerados, en dos etapas, de poblaciones y hogares de esas poblaciones. Mediante un cuestionario (se recogió la información facilitada por los entrevistados sobre la diabetes y su modo de vida; también se realizó una exploración física y se obtuvo una muestra de sangre. De los 4 027 participantes, 521 (13,0%) informaron que previamente al estudio ya se les había diagnosticado diabetes. De estos, 466 eran de origen hispano (226 del lado mexicano de la frontera y 240 del estadounidense).

Resultados. Los resultados indicaron que en 42,1% de los hispanos residentes en el lado estadounidense de la frontera (intervalo de confianza [IC] de 95%: 35,8–48,6%) y en 37,6% de los hispanos del lado mexicano (IC de 95%: 31,3–44,3%) la diabetes estaba controlada (hemoglobina glicosilada A1c < 7,0%) y solo una persona (residente en el lado mexicano de la frontera) recibía una atención óptima de su diabetes, definida según los criterios internacionales en cuanto a la presión arterial sistólica, el índice de masa corporal, la realización de revisiones anuales oftalmológicas y de los pies, llevadas a cabo por un proveedor de servicios de salud como medidas de atención preventiva para la detección temprana de las complicaciones de la diabetes.

Conclusiones. Los adultos hispanos con diagnósticos de diabetes residentes en la zona fronteriza entre los Estados Unidos y México no reciben una atención adecuada en relación con su enfermedad, y los profesionales de la salud no siguen las recomendaciones internacionales para la prestación de esa atención. Para mejorar el control de la diabetes en la zona, los proveedores de atención sanitaria deben ser más conscientes de la repercusión de la educación y la cultura en el autocuidado de la diabetes, así como de la importancia de la provisión de medidas preventivas por parte del personal de salud.

Palabras clave Diabetes mellitus tipo 2; prevalencia; salud fronteriza; México; Estados Unidos.