

Blood pressure control, hypertension, awareness, and treatment in adults with diabetes in the United States-Mexico border region

Maya Vijayaraghavan,¹ Guozhong He,² Pamela Stoddard,³ and Dean Schillinger^{2,4}

Suggested citation

Vijayaraghavan M, He G, Stoddard P, Schillinger D. Blood pressure control, hypertension, awareness, and treatment in adults with diabetes in the United States-Mexico border region. *Rev Panam Salud Publica*. 2010;28(3):164–73.

ABSTRACT

Objective. To determine prevalence of blood pressure control, hypertension, hypertension awareness, and antihypertensive treatment among adults (≥ 18 years old) with diabetes living in the border region between the United States of America and Mexico, and to explore variation in those variables between all adults on the Mexican side of the border (“Mexicans”) and three groups on the U.S. side of the border (“all U.S. adults,” “U.S.-born Hispanics,” and “Mexican immigrants”).

Methods. Using data from Phase I (February 2001–October 2002) of the U.S.-Mexico Border Diabetes Prevention and Control Project, a prevalence study of type 2 diabetes and its risk factors, age-adjusted prevalence of hypertension-related variables was calculated for the sample ($n = 682$) and differences between the border groups were examined through logistic regression.

Results. Less than one-third of the sample had controlled blood pressure ($< 130/80$ mm Hg), almost half had hypertension ($\geq 140/90$ mm Hg), and hypertension awareness and treatment were inadequate. After adjusting for demographics, body mass index, and access to health care, there were no differences in blood pressure control, hypertension, hypertension awareness, or treatment between Mexicans and both U.S. adults and Mexican immigrants. However, compared to Mexicans and Mexican immigrants, U.S.-born Hispanics, particularly younger individuals, had the lowest rates of blood pressure control (17.3%) and the highest rates of co-existing hypertension (54.8%). Compared to Mexicans, U.S.-born Hispanics had lower odds of controlled blood pressure (odds ratio [OR] 0.30, 95% confidence interval [CI] 0.09–0.95) and greater odds of hypertension (OR 3.75, 95% CI 1.51–9.29) and hypertension awareness (OR 6.19, 95% CI 1.46–26.15).

Conclusions. Co-occurrence of diabetes and hypertension is a major public health problem among U.S.-Mexico border residents. The low rate of blood pressure control among various border groups, especially younger U.S.-born Hispanics, suggests that initiatives should aggressively target blood pressure control.

Key words

Hypertension; diabetes mellitus, type 2; blood pressure; disease management; health services accessibility; border health; United States; Mexico.

¹ Division of General Internal Medicine, University of California–San Francisco, San Francisco, California, United States of America.

² California Diabetes Program, California Department of Public Health and University of California–San Francisco, Sacramento, California, United States of America. Send correspondence to Guozhong He, guozhong.he@ucsf.edu; ghe@dhs.ca.gov

³ Phillip R. Lee Institute for Health Policy Studies, School of Medicine, University of California–San Francisco, San Francisco, California, United States of America.

⁴ Department of Medicine, Center for Vulnerable Populations, San Francisco General Hospital, San Francisco, California, United States of America.

Hypertension is a commonly occurring condition affecting 20% to 60% of people with diabetes (1, 2). Hypertension in adults with diabetes increases the risk of microvascular and macrovascular events, and public health guide-

lines recommend a target blood pressure of < 130/80 mm Hg to prevent morbidity and mortality from renal and cardiovascular disease (1). Control of blood pressure may decrease diabetes-related death and cardiovascular events, and slow progression to end-stage renal disease (ESRD) (2–4). Intensive blood pressure control (systolic blood pressure [SBP] $\leq$ 120 mm Hg) in people with diabetes is controversial because it has not been shown to decrease fatal and non-fatal cardiovascular events when compared to moderate blood pressure control (SBP < 140 mm Hg) (5).

Previous studies have shown that rates of diabetes and hypertension are high in both the United States and Mexico. In the United States, between 1999 and 2004, overall prevalence of diabetes was 9.4% and hypertension 28.7%, and almost three-fourths of adults with diabetes had hypertension (6–8). In Mexico, in 2000, prevalence of diabetes was 7.5% and hypertension 30.7%, and almost half of the adults with diabetes had hypertension (9–11). Although overall rates of hypertension treatment have increased in recent years in both countries, evidence indicates poor blood pressure control among treated individuals (7, 12). Among adults with diabetes in the United States, between 1999 and 2004, only 29.6% were able to meet the target blood pressure level (< 130/80 mm Hg) (7). In Mexico, in 2000, only one-third were able to maintain moderate blood pressure control (< 140/90 mm Hg) and even fewer (11.4%) met the target blood pressure level (12).

Diabetes and hypertension are major risk factors for cardiovascular disease, the leading cause of death in both the United States and Mexico. Nephropathy is another important cause of morbidity in adults with diabetes. In the United States, the incidence of ESRD due to diabetes increased 86% between 1993 and 2005 (13), and Hispanics with diabetes have a higher risk of ESRD when compared to non-Hispanic whites (14–16). In Mexico, the prevalence of chronic kidney disease increased from 0.5% in 1993 to 10.9% in 2000 and was the highest among adults with diabetes and uncontrolled hypertension (9).

While data on hypertension rates among adults with diabetes are available for both the United States and Mexico as a whole, less is known about this prevalence in the U.S.-Mexico border population (17), home to 13 million people, 86%

of whom live in 14 border cities (18). Relative to the U.S. border population overall, U.S. Hispanics living in border counties are less educated, have lower annual incomes (US\$ 26 842 per capita), higher poverty levels, and lower access to health insurance and preventive services (19, 20). All of these factors lead to poorer health and health outcomes.

Preliminary data from the U.S.-Mexico Border Diabetes Prevention and Control Project, a large-scale prevalence study of type 2 diabetes and its risk factors that treats the U.S.-Mexico border region as a single epidemiologic unit, suggest a high prevalence of both diabetes and hypertension among the border population. Prevalence of pre-diabetes, diabetes, and hypertension in the region was estimated at 13.9%, 15.7%, and 21.8% respectively—very high rates, given the relatively young age of border residents (average age 41.1 years) (21). These estimates suggest that rates of co-existing diabetes and hypertension may be elevated in the U.S.-Mexico border region. Understanding the patterns and determinants of the risk factors for these conditions can help target efforts to improve early detection, access to treatment, and blood pressure control for all adult border residents with diabetes. In addition, examining variation in cardiovascular risk factors between various border groups, for which there are limited data, may help target limited resources and guide future interventions.

Using the U.S.-Mexico Border Diabetes Prevention and Control Project data, the current study aimed to 1) identify the prevalence of blood pressure control, hypertension, hypertension awareness, and antihypertensive treatment among all adults with diabetes living in the U.S.-Mexico border region, and 2) compare differences in those variables for all adults on the Mexican side of the border (“Mexicans”) versus three groups on the U.S. side of the border (“all U.S. adults,” “U.S.-born Hispanics,” and “Mexican immigrants”) before and after adjusting for demographics, body mass index (BMI), and access to health care.

MATERIALS AND METHODS

Data source and population

Phase I (February 2001–October 2002) of the U.S.-Mexico Border Diabetes Prevention and Control Project was a

population-based cross-sectional survey administered to noninstitutionalized individuals $\geq$ 18 years old ($n = 4\,027$) from counties in four U.S. states (Arizona, California, New Mexico, and Texas) and six Mexican states (Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas) contiguous with the U.S.-Mexico border (21). Using a stratified, multistage sample design, each state was considered a unique stratum, except California and Texas, where two county-based strata were created. Each stratum on the U.S. side of the border included ethnicity-specific Hispanic and non-Hispanic samples. Within each stratum, census tracts and then blocks within census tracts were selected using a probability proportional to their population sizes, followed by a random selection of households within each block and then an individual from each household $\geq$ 18 years old. For the ethnicity-specific samples on the U.S. side of the border, 33 census tracts were selected for the Hispanic sample and 13 for non-Hispanic samples. The Hispanic and non-Hispanic samples were selected according to a probability proportional to each ethnic group in a sampled area. The survey was conducted in 44 communities (28 in the United States and 16 in Mexico). The overall survey response rate was 93.2%.

Study procedures

A trained interviewer conducted face-to-face interviews with selected adults about demographics, socioeconomic status, employment, knowledge and awareness of diabetes and hypertension, general health status, access to health care, and health care behaviors. Participants also underwent a health assessment that included anthropometric and blood pressure measurements as well as a fasting blood drawing by a trained phlebotomist to determine fasting plasma glucose (FPG) and glycosylated hemoglobin A1c (HbA1c) levels.

Definition of variables

The current study analyzed hypertension outcomes among survey respondents with diabetes, defined as those with an FPG $\geq$ 126 mg/dL or a self-report of a health care provider’s diagnosis of diabetes. Women that self-reported having diabetes only during pregnancy were excluded. Blood pressure readings were

based on the average of three independent measurements. Blood pressure control among people with diabetes was defined as SBP < 130 mm Hg and diastolic blood pressure (DBP) < 80 mm Hg (1, 22). Participants with an SBP $\geq$ 130 mm Hg or DBP $\geq$ 80 mm Hg were coded as having uncontrolled blood pressure. Hypertension was defined as SBP $\geq$ 140 mm Hg or DBP $\geq$ 90 mm Hg, or a self-report of being on antihypertensive medications (22). Survey respondents were coded as being aware of their condition if they answered affirmatively to the question “Has a doctor or health care worker ever told you that you had high blood pressure or hypertension?” Use of antihypertensive treatment was only directed to survey respondents who had hypertension and were aware of their condition (affirmative responses to the question “Are you now being treated for high blood pressure?”)

To allow for comparison of hypertension-related variables across various border groups with diabetes, five distinct populations were identified: all adult U.S.-Mexico border residents (“all adults”); all adults from the U.S. side of the border (“all U.S. adults”); two Hispanic groups from the U.S. side of the border (“U.S.-born Hispanics” and “Mexican immigrants”); and all adults from the Mexican side of the border (“Mexicans”). “U.S.-born Hispanics” included survey sample respondents who were born in the United States and self-reported being Hispanic. “Mexican immigrants” included those who reported being born in Mexico but currently lived in the United States. Non-Hispanic whites and non-Hispanic adults from other racial/ethnic groups were included in “all U.S. adults” but were not analyzed separately in order to examine the effects of Hispanic ancestry on hypertension variables across border populations.

Other variables examined in the current study included age (18 to 44 years, 45 to 64 years, and 65 years or more); sex; BMI; and access to health care. BMI was included as a surrogate for obesity because it increases the risk of hypertension among people with diabetes. BMI categories were based on measurements of weight (kg) and height (m²) and defined as follows: underweight < 18.5, normal weight 18.5–24.9, overweight 25–29.9, and obesity $\geq$ 30.0. Access to health care was measured based on the following indicators: 1) having health insurance, 2) lacking a usual place to receive health care, 3) hav-

ing an unmet need for health care, and 4) not receiving health care in the past year. Access to health care was included in the analysis because it was anticipated that variation in blood pressure control, hypertension awareness, and antihypertensive treatment among border populations could be attributable to differences in this variable. Survey respondents were coded as “having health insurance” if they reported primary medical coverage in either the United States (Medicare, Medicaid, private insurance, health maintenance organization [HMO], or military) or Mexico (Mexican Social Security Institute [*Instituto Mexicano de Seguro Social*, IMSS]; ministry of health [*Secretaría de Salud*]; or Mexican social security for state workers [*Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado*, ISSSTE]). Respondents coded as “not having a usual place to receive health care” were those who either 1) answered negatively to the question “Is there a particular clinic, health center, or doctor that you usually go to when you are sick or need routine health care?” or 2) reported using an emergency room or pharmacy as their usual source of care. Respondents were coded as “having an unmet need for health care” if they self-reported trouble seeking needed care in the past year. Respondents were coded as “not receiving health care in the past year” if they answered negatively to the question “Have you visited a doctor or other health care worker in the past 12 months?”

Analysis

Descriptive statistics were reported for demographics, BMI categories, and access to health care for the five border groups (“all adults,” “all U.S. adults,” “U.S.-born Hispanics,” “Mexican immigrants,” and “Mexicans”). The chi-square test was used to measure differences in distributions and proportions of covariates for Mexicans versus 1) all U.S. adults and 2) the two U.S. Hispanic groups (“U.S.-born Hispanics” and “Mexican immigrants”). Mean BMI and mean arterial pressure $((2 \times \text{DBP}) + \text{SBP})/3$ were calculated for the entire sample ($n = 682$). All hypertension-related statistics were population-weighted (using probability weights provided by the U.S.-Mexico Border Diabetes Prevention and Control Project) and included crude, age-adjusted (to the World Health Organization standard population), and age- and sex-specific data for all

adults with diabetes in each border group (23). Estimates were adjusted for age because the overall age distribution of the Mexican border population was younger than that of the U.S. border population. For the analysis of prevalence of blood pressure control and hypertension among adults with diabetes, the weighted sample size was 682. The analysis of prevalence of hypertension awareness was restricted to adults who had both diabetes and hypertension ($n = 395$), whereas the analysis of prevalence of antihypertensive treatment only included adults with diabetes and hypertension who were aware of their hypertension status ($n = 250$) (the survey design limited data collection on antihypertensive treatment to those who reported receiving a diagnosis of hypertension from a health care provider).

Logistic regression was used to determine the odds of having blood pressure control, hypertension, hypertension awareness, and antihypertensive treatment for Mexicans versus 1) all U.S. adults, 2) U.S.-born Hispanics, and 3) Mexican immigrants. For all analyses, Mexicans served as the reference group. Model 1 examined the unadjusted odds of hypertension variables for all U.S. adults and U.S. Hispanics versus Mexicans. Subsequent models controlled for the effects of age and sex and then adjusted for BMI and access-to-care variables individually to determine the independent contributions of each variable to the association between each of the five border groups and hypertension variables. The final model adjusted for all independent variables. Survey respondents with missing data were excluded from the regression analysis, resulting in a sample of 584 for the analysis on blood pressure control and hypertension, 337 for hypertension awareness, and 238 for hypertension treatment. All analyses were conducted using SAS version 9.13 (SAS Institute Inc., Cary, NC, USA). SUDAAN version 9.0.1 (SUDAAN Statistical Software Center, Research Triangle Park, NC, USA) was used to adjust for the complex survey design.

RESULTS

Sample characteristics

Table 1 provides descriptive statistics weighted for each border group (“all adults,” “all U.S. adults,” “U.S.-born Hispanics,” “Mexican immigrants,” and “Mexicans”). The majority (71.8%) of

TABLE 1. Characteristics of adults with diabetes living in the U.S.-Mexico border region,^a by border group, U.S.-Mexico Border Diabetes Prevention and Control Project, Phase I, February 2001–October 2002

Characteristic	U.S.-Mexico border region (n = 682)		U.S. border groups				Mexican border group			
	No.	%	All U.S. adults ^b (n = 339)		U.S.-born Hispanics (n = 106)		Mexican immigrants (n = 168)		All Mexican adults (n = 343)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Age (years) ^{c,d}										
18–44	164	30.9	55	21.1	22	35.5	25	15.4	109	45.8
45–64	336	40.9	159	41.1	40	11.0	95	62.9	177	40.6
≥ 65	182	28.2	125	37.8	44	25.6	48	21.8	57	13.5
Sex										
Female	225	51.1	122	52.5	38	53.6	53	35.5	103	49.2
Body mass index										
18.5–24.9 (normal weight)	102	14.9	40	12.1	7	4.5	24	12.9	62	19.1
25.0–29.9 (overweight)	227	31.4	114	28.8	39	26.1	53	26.4	113	35.4
≥ 30.0 (obese)	347	53.7	179	59.1	57	69.5	90	60.7	168	45.6
Access to health care										
Have health insurance ^d	521	80.0	246	83.1	88	86.8	100	46.4	275	75.4
Have usual place to receive health care	597	89.8	292	89.3	91	90.8	142	80.4	305	90.5
Have unmet need for health care ^d	70	9.8	46	11.6	9	26.8	33	23.6	24	6.9
Received health care in past year ^{c,d}	554	83.2	290	89.7	92	93.2	138	75.7	264	73.4
	Mean	SE ^e	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Body mass index ^{c,d}	31.3	0.6	32.2	1.0	35.4	2.0	33.0	0.9	29.9	0.5
Mean arterial pressure	97.6	1.1	98.2	1.6	99.0	2.1	98.4	1.2	96.7	1.2

^a Counties in four U.S. states (California, Arizona, New Mexico, and Texas) and six Mexican states (Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas) contiguous with the U.S.-Mexico border.

^b Including non-Hispanic whites and non-Hispanic adults from other racial/ethnic groups (n = 65; not analyzed separately).

^c P < 0.01 for all U.S. adults versus all Mexican adults.

^d P < 0.01 for U.S.-born Hispanics and Mexican immigrants versus all Mexican adults.

^e SE: standard error.

adults with diabetes in the U.S.-Mexico border region were less than 65 years old and the mean age was 41.1 (Table 1). There were differences in age distributions for Mexicans versus “all U.S. adults” ($P < 0.01$) and the two U.S. Hispanic groups (“U.S.-born Hispanics” and “Mexican immigrants”) ($P < 0.01$). Adult Mexicans with diabetes living in the border region were younger, with the highest proportion between the ages of 18 to 44 years (45.8%). There were few differences in the proportion of men versus women in any of the border groups, with the exception of Mexican immigrants, among whom only 35.5% were female. U.S.-born Hispanics (69.7%) had higher rates of obesity when compared to Mexican immigrants (60.7%) and Mexicans (45.6%). Mean BMI varied for Mexicans versus “all U.S. adults” ($P < 0.02$) and the two U.S. Hispanic groups collectively ($P < 0.01$). There were also differences in mean arterial pressure between Mexicans and the two U.S. Hispanic groups, with the highest levels reported among U.S.-born Hispanics ($P < 0.01$).

Compared to the other border groups, Mexican immigrants were less likely to report having health insurance or receiving

health care in the past year, and more likely to report having an unmet need for health care. U.S.-born Hispanics (86.8%) reported the highest rates of health insurance when compared to Mexican immigrants (46.4%) and Mexicans (75.4%) ($P < 0.01$). Reported rates of having a usual place to receive health care were high and varied little between border groups. Mexican immigrants (23.6%) and U.S.-born Hispanics (26.8%) were most likely to report having an unmet need for care relative to Mexicans (6.9%; $P < 0.01$). U.S. adults (89.7%) were more likely to report receiving health care in the past year relative to Mexicans (73.4%; $P < 0.01$). U.S.-born Hispanics (93.2%) were more likely to report receiving health care in the past year when compared to Mexican immigrants (75.7%) and Mexicans (73.4%; $P < 0.01$).

Blood pressure control, hypertension, hypertension awareness, and antihypertensive treatment

Population-weighted, crude, age-adjusted, and age- and sex-specific prevalence of blood pressure control, hypertension, hypertension awareness, and

antihypertensive treatment among adults with diabetes in the five U.S.-Mexico border groups (“all adults,” “all U.S. adults,” “U.S.-born Hispanics,” “Mexican immigrants,” and “Mexicans”) are presented in Table 2.

Overall, rates of blood pressure control were poor, with less than one-third of adults with diabetes having an average blood pressure measurement < 130/80 mm Hg across all sample groups (Table 2). U.S. adults (16.9%) had lower age-adjusted rates of controlled blood pressure compared to Mexicans (30.5%). The age-adjusted prevalence of blood pressure control was 17.3% for U.S.-born Hispanics, 21.6% for Mexican immigrants, and 30.5% for Mexicans. For Mexicans and Mexican immigrants, blood pressure control was best for the youngest age groups and worsened with age, whereas for U.S. adults and U.S.-born Hispanics it was worst for the youngest age group and improved with age.

Rates of hypertension (SBP ≥ 140/90 mm Hg) among adults with diabetes were high for the U.S.-Mexico border population overall (47.6%) and all other border groups (Table 2). Age-adjusted prevalence of hypertension was 55.7%

TABLE 2. Population weighted, crude, age-adjusted, and sex-specific prevalence of hypertension-related variables (blood pressure control, hypertension, hypertension awareness, and antihypertensive treatment) among adults with diabetes living in the U.S.-Mexico border region,^a by border group, U.S.-Mexico Border Diabetes Prevention and Control Project, Phase I, February 2001–October 2002

Variable	U.S.-Mexico border region (n = 682)		U.S. border group						Mexican border group	
			All U.S. adults ^b (n = 339)		U.S.-born Hispanics (n = 106)		Mexican immigrants (n = 168)		All Mexican adults (n = 343)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Blood pressure control ^c										
Crude	156	23.7	67	21.5	16	9.4	39	24.5	89	27.0
Adjusted by age (years)	156	26.3	67	16.9	16	17.3	39	21.6	89	30.5
18–44	59	27.0	14	9.6	4	5.2	8	29.5	45	39.2
45–64	69	18.8	31	18.8	6	10.3	22	26.9	38	18.6
≥ 65	28	27.4	22	31.2	6	13.9	9	14.2	6	11.3
Sex										
Men	118	24.8	47	15.9	10	10.4	30	23.0	71	37.5
Women	38	22.7	20	26.7	6	8.5	9	27.3	18	16.3
Hypertension ^d										
Crude	397	60.3	229	69.0	112	63.2	76	63.2	168	47.2
Adjusted by age (years)	397	47.6	229	55.7	112	54.8	76	49.5	168	40.5
18–44	54	39.3	23	45.6	11	56.0	8	19.4	31	34.8
45–64	205	67.1	108	77.3	62	55.1	30	89.8	97	51.5
≥ 65	138	73.7	98	73.1	39	91.7	38	83.6	40	75.8
Sex										
Men	256	57.1	139	66.0	73	59.6	48	85.0	117	44.4
Women	141	63.5	90	71.8	39	69.9	28	44.4	51	50.0
Hypertension awareness										
Crude	281	68.1	175	69.4	57	86.7	84	73.3	106	65.1
Adjusted by age (years)	281	51.1	175	53.6	57	64.4	84	50.8	106	47.9
18–44	31	46.3	14	51.6	7	97.9	4	38.7	17	41.3
45–64	144	71.2	84	69.8	20	82.3	51	93.7	60	75.0
≥ 65	106	76.7	77	75.3	30	90.4	29	53.2	29	82.1
Sex										
Men	193	76.3	113	77.3	38	92.4	60	84.9	80	74.0
Women	88	61.5	62	63.4	19	77.3	24	55.6	26	56.9
Antihypertensive treatment										
Crude	238	91.7	149	93.6	52	94.7	64	76.1	89	87.1
Adjusted by age (years)	238	73.5	149	74.9	52	66.3	64	50.1	89	59.8
18–44	23	76.8	11	81.8	6	65.3	3	82.4	12	71.1
45–64	119	91.2	68	91.8	18	98.3	37	71.3	51	90.0
≥ 65	96	97.8	70	98.7	28	99.7	24	88.6	26	94.3
Sex										
Men	167	91.8	96	90.9	37	100.0	45	71.2	71	93.9
Women	71	91.7	53	96.2	15	84.3	19	87.6	18	78.9

^a Counties in four U.S. states (California, Arizona, New Mexico, and Texas) and six Mexican states (Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas) contiguous with the U.S.-Mexico border.

^b Including non-Hispanic whites and non-Hispanic adults from other racial/ethnic groups (n = 65; not analyzed separately).

^c Systolic blood pressure (SBP) < 130 mm Hg and diastolic blood pressure (DBP) < 80 mm Hg.

^d SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg, or self-report of being on antihypertensive medications.

for all U.S. adults and 40.5% for Mexicans. U.S.-born Hispanics had higher rates of hypertension (54.8%) relative to Mexican immigrants (49.5%) and Mexicans (40.5%). Age-adjusted estimates of hypertension were lower than crude estimates for all border groups, suggesting that variations in age distributions resulted in differences between these two estimates. Women had a higher prevalence of hypertension than men for all border groups, with the exception of Mexican immigrants.

About half (51.1%) of the adults with diabetes in the U.S.-Mexico border population were aware of their hypertension

status (Table 2). U.S.-born Hispanics had the highest age-adjusted prevalence of hypertension awareness among all border groups (64.4%) whereas Mexicans had the lowest (47.9%). Despite having the lowest levels of access to health care, Mexican immigrants (50.8%) had similar rates of hypertension awareness in comparison to Mexicans (47.9%).

The age-adjusted prevalence of antihypertensive treatment among adults with diabetes who were aware of their hypertension status was 73.5% for all U.S.-Mexico border residents (Table 2). Rates of antihypertensive treatment were higher for U.S. adults (74.9%) com-

pared to Mexicans (59.8%). Of the two U.S. Hispanic groups, U.S.-born Hispanics (66.3%) had higher rates of treatment relative to both Mexican immigrants (50.1%) and Mexicans (59.8%).

Multivariate analysis

Unadjusted and adjusted odds of blood pressure control, hypertension, hypertension awareness, and antihypertensive treatment for U.S. adults, U.S.-born Hispanics, and Mexican immigrants versus Mexicans are shown in Table 3. As shown in Panel 1, there were no differences in the unadjusted odds of

TABLE 3. Unadjusted and adjusted odds ratio (OR) and 95% confidence intervals (CI) for blood pressure control, hypertension, hypertension awareness, and antihypertensive treatment among adults with diabetes living in the U.S.-Mexico border region,^a by border group, U.S.-Mexico Border Diabetes Prevention and Control Project, Phase I, February 2001–October 2002

Panel/model	All U.S. adults ^b versus all Mexican adults ^c		U.S.-born Hispanics versus all Mexican adults ^c		Mexican immigrants versus all Mexican adults ^c	
	OR	95% CI	OR	95% CI	OR	95% CI
Panel 1						
Blood pressure control						
Model 1: unadjusted odds	0.93	0.36–2.41	0.22	0.07–0.67	0.61	0.27–1.39
Model 1 + age + sex	0.98	0.43–2.19	0.25	0.09–0.76	0.74	0.32–1.69
Model 1 + age + sex + BMI ^d	1.29	0.57–2.92	0.36	0.11–1.16	0.84	0.32–2.21
Model 1 + age + sex + access to insurance	0.96	0.43–2.17	0.25	0.08–0.74	0.83	0.35–1.95
Model 1 + age + sex + usual place to receive health care	0.97	0.43–2.21	0.25	0.08–0.77	0.73	0.31–1.72
Model 1 + age + sex + unmet need for health care	0.98	0.43–2.19	0.26	0.09–0.76	0.68	0.31–1.52
Model 1 + age + sex + receipt of health care in past year	0.93	0.41–2.09	0.23	0.08–0.69	0.79	0.35–1.81
Model 1 + all variables	1.16	0.51–2.67	0.30	0.09–0.95	0.86	0.31–2.36
Panel 2						
Hypertension						
Model 1: unadjusted odds	2.51	1.19–5.27	4.08	1.74–9.57	2.81	1.17–6.74
Model 1 + age + sex	1.75	0.87–3.49	3.57	1.49–8.56	2.05	0.83–5.05
Model 1 + age + sex + BMI	1.65	0.83–3.28	3.42	1.42–8.27	1.99	0.83–4.83
Model 1 + age + sex + access to insurance	1.75	0.87–3.50	3.56	1.48–8.54	2.12	0.88–5.08
Model 1 + age + sex + usual place to receive health care	1.78	0.88–3.59	3.61	1.49–8.73	2.13	0.89–5.11
Model 1 + age + sex + unmet need for health care	1.75	0.87–3.50	3.56	1.49–8.51	2.11	0.83–5.35
Model 1 + age + sex + receipt of health care in past year	1.78	0.89–3.57	3.76	1.54–9.17	1.97	0.80–4.86
Model 1 + all variables	1.75	0.86–3.54	3.75	1.51–9.29	2.07	0.85–5.04
Panel 3						
Hypertension awareness						
Model 1: unadjusted odds	1.12	0.31–4.06	3.98	1.28–12.35	1.49	0.56–3.93
Model 1 + age + sex	0.87	0.27–2.81	2.82	0.89–8.94	1.01	0.41–2.50
Model 1 + age + sex + BMI	0.94	0.31–2.89	2.89	0.89–9.29	1.02	0.41–2.54
Model 1 + age + sex + access to insurance	0.87	0.27–2.84	2.72	0.86–8.56	1.12	0.39–3.14
Model 1 + age + sex + usual place to receive health care	1.01	0.29–3.55	5.27	1.33–20.85	1.41	0.53–3.75
Model 1 + age + sex + unmet need for health care	0.86	0.26–2.82	2.90	0.91–9.26	0.89	0.36–2.19
Model 1 + age + sex + receipt of health care in past year	0.83	0.24–2.79	2.67	0.94–7.58	1.45	0.44–4.71
Model 1 + all variables	1.07	0.34–3.37	6.19	1.46–26.15	1.45	0.37–5.77
Panel 4						
Antihypertensive treatment						
Model 1: unadjusted odds	2.48	0.75–8.21	2.35	0.25–21.64	0.75	0.21–2.66
Model 1 + age + sex	1.33	0.34–5.10	1.89	0.24–15.18	0.36	0.08–1.79
Model 1 + age + sex + BMI	1.39	0.34–5.67	2.04	0.25–16.50	0.39	0.79–1.98
Model 1 + age + sex + access to insurance	1.34	0.34–5.31	1.91	0.34–15.19	0.35	0.08–1.54
Model 1 + age + sex + usual place to receive health care	1.38	0.36–5.29	1.98	0.21–18.97	0.37	0.08–1.79
Model 1 + age + sex + unmet need for health care	1.49	0.39–5.74	1.67	0.21–13.62	0.51	0.12–2.27
Model 1 + age + sex + receipt of health care in past year	1.49	0.41–5.45	1.84	0.22–15.57	0.49	0.10–2.34
Model 1 + all variables	1.55	0.39–6.22	1.90	0.19–19.27	0.51	0.12–2.23

^a Counties in four U.S. states (California, Arizona, New Mexico, and Texas) and six Mexican states (Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas) contiguous with the U.S.-Mexico border.

^b Including non-Hispanic whites and non-Hispanic adults from other racial/ethnic groups (not analyzed separately).

^c Reference population.

^d BMI = body mass index.

blood pressure control between U.S. adults and Mexicans (odds ratio [OR] 0.93, 95% confidence interval [CI] 0.36–2.41) or between Mexican immigrants and Mexicans (OR 0.61, 95% CI 0.27–1.39). However, U.S.-born Hispanics had significantly lower odds of blood pressure control relative to Mexicans (OR 0.22, 95% CI 0.07–0.67). Adjusting for various covariates did not change the likelihood of having controlled blood pressure for U.S. adults or Mexican immigrants versus Mexicans. The differ-

ence in blood pressure control between U.S.-born Hispanics and Mexicans was somewhat mitigated after adjusting for age, sex, BMI, and access to health care, but remained significant (adjusted OR 0.30, 95% CI 0.09–0.95).

Panel 2 of Table 3 shows the unadjusted and adjusted odds of having hypertension ($\geq 140/90$ mm Hg) across the five border groups. Relative to Mexicans, the unadjusted odds of having hypertension among adults with diabetes was greater for U.S. adults (OR 2.51, 95% CI

1.19–5.27), U.S.-born Hispanics (OR 4.08, 95% CI 1.74–9.57), and Mexican immigrants (OR 2.81, 95% CI 1.17–6.74). Age and sex explained the differences in the odds of having hypertension between U.S. adults and Mexicans (OR 1.75, 95% CI 0.87–3.49) and between Mexican immigrants and Mexicans (OR 2.05, 95% CI 0.83–5.05). However, for U.S.-born Hispanics, age and sex only partially explained the higher odds of hypertension relative to Mexicans (OR 3.57, 95% CI 1.49–8.56). An additional control for BMI

did not substantially change the likelihood of hypertension for U.S. adults (OR 1.65, 95% CI 0.83–3.28), U.S.-born Hispanics (OR 3.42, 95% CI 1.42–8.27), or Mexican immigrants (OR 1.99, 95% CI 0.83–4.83) relative to Mexicans. Access to health care did not further explain the differences in hypertension rates for U.S.-born Hispanics versus Mexicans. After adjusting for all covariates, U.S.-born Hispanics had higher adjusted odds of having hypertension compared to Mexicans (OR 3.75, 95% CI 1.51–9.29).

Panel 3 of Table 3 shows the unadjusted and adjusted odds ratios for hypertension awareness across the five border groups. There were no differences in the unadjusted odds of being aware of hypertension between U.S. adults (OR 1.12, 95% CI 0.31–4.06) and Mexican immigrants (OR 1.49, 95% CI 0.56–3.93) relative to Mexicans. U.S.-born Hispanics, in contrast, were more likely to be aware of their hypertension status relative to Mexicans (OR 3.98, 95% CI 1.28–12.35). Controlling for the presence of a usual place to receive health care increased the odds of hypertension awareness for U.S.-born Hispanics compared to Mexicans (OR 5.27, 95% CI 1.33–20.85). After adjusting for all covariates, U.S.-born Hispanics remained more likely to be aware of their hypertension status relative to Mexicans (OR 6.19, 95% CI 1.46–26.15).

Panel 4 of Table 3 shows the unadjusted and adjusted odds of receiving antihypertensive treatment among adults with co-existing diabetes and hypertension (who, by definition, were aware of their hypertension status). There were no significant differences in the unadjusted odds of being on antihypertensive treatment for U.S. adults (OR 2.48, 95% CI 0.75–8.21), U.S.-born Hispanics (OR 2.35, 95% CI 0.25–21.64), and Mexican immigrants (OR 0.75, 95% CI 0.21–2.66) versus Mexicans. After adjusting for age and sex, the odds of being on antihypertensive treatment remained statistically insignificant. After controlling for all covariates, there were no significant differences in the adjusted odds of being on antihypertensive treatment for any of the five border groups.

DISCUSSION

The current findings indicate that in 2001–2002 more than two-thirds of adults with diabetes in the U.S.-Mexico border region had uncontrolled blood pressure. These results are consistent

with prior research from independently conducted surveys in the United States and Mexico (7, 12). While rates of blood pressure control were higher among younger age groups for both Mexicans and Mexican immigrants, they were *lower* for younger U.S.-born Hispanics. Hypertension prevalence was high for all adults with diabetes in the U.S.-Mexico border region, with almost half of the adults with diabetes having hypertension (SBP $\geq$ 140/90). As with blood pressure control, U.S.-born Hispanics had greater odds of hypertension and hypertension awareness than Mexicans, even after adjusting for demographics, BMI, and access-to-care variables. Overall rates of antihypertensive treatment for adults with diabetes were low for all U.S.-Mexico border residents, and increased awareness did not translate to increased rates of treatment among U.S.-born Hispanics.

The American Diabetes Association (ADA) recommends a target blood pressure of < 130/80 mm Hg to prevent microvascular and macrovascular complications among adults with co-occurring diabetes and hypertension. In this high-risk population, controlling blood pressure to this level is likely to reduce cardiovascular morbidity and mortality even more than improving glycemic control (24, 25). Control of blood pressure among adults with diabetes has been estimated to result in health care cost savings of as much as US\$ 2 400 per quality adjusted life year (QALY) gained and is a remarkable public health investment compared to intensive glycemic control, which is estimated to cost US\$ 35 000 per QALY gained (26).

Among adults with diabetes enrolled in the United Kingdom Prospective Diabetes Study, a 10-mm Hg decrease in SBP was associated with a decrease of 12% in diabetes-related complications, 15% in diabetes-related deaths, 11% in myocardial infarctions, and 13% in microvascular complications (25). Blood pressure control may be especially important among Hispanic adults with diabetes because of their increased risk of ESRD (15, 16, 27). In one study, Mexican Americans with diabetes were found to have a four to six times higher incidence of diabetes-related ESRD and a two to three times higher incidence of hypertension-related ESRD when compared to non-Hispanic whites (14). Therefore, adequate control of blood pressure for all

Hispanic adults living on the border should be made a public health priority.

Findings from the current study show that disparities exist in blood pressure control by age among the various border groups, with rates of control rising with age in two of the border groups (all U.S. adults and U.S.-born Hispanics) and dropping with age in the others. Therefore, blood pressure control interventions should be targeted by age group, with special focus on younger U.S.-born Hispanic adults with diabetes, given that this group will have a longer cumulative exposure to hypertension and is at high risk for end-organ damage. In addition, differences in blood pressure control between the border groups were not explained by differences in access to health care, suggesting a role for other factors.

U.S.-born Hispanics were more obese than Mexicans, yet adjusting for BMI did not substantially account for the notable differences in blood pressure control between these two border populations, which are similar with respect to ethnicity but different in terms of environmental exposures. Factors other than BMI that may account for differences in blood pressure control between U.S.-born Hispanics and Mexicans include dietary salt intake, diets rich in saturated fats and red meat, and sedentary lifestyle. The better health profiles of recently immigrated Hispanics versus long-term Hispanic immigrants and U.S.-born Hispanics have been attributed to the phenomenon known as the “Hispanic Paradox” (28–30). This advantage among newly immigrated Hispanics wanes with acculturation and increased length of stay in the United States. While the processes of acculturation are complex and have both positive and negative consequences in terms of health, various studies suggest negative effects on dietary and exercise-related habits for U.S.-born Hispanics and long-term Hispanic immigrants residing in the United States (28). While findings in the current study suggest interventions to improve blood pressure control for U.S.-born Hispanics, future work should examine the effects of differences in contextual/environmental factors that may account for varied rates of control between U.S.-born Hispanics and Mexicans.

Overall, the current results demonstrate that uncontrolled blood pressure represents a significant public health problem in the U.S.-Mexico border re-

gion, especially for younger U.S.-born Hispanics, whose low rates of control may result in increased rates of hospitalization, decreased productivity (given the young age of this population), increased cardiovascular morbidity and mortality, and early progression to ESRD. Therefore, clinical interventions targeting this group as well as other border populations should focus not only on increasing access to antihypertensive treatment but also on educating health care providers to escalate treatment when blood pressure is not at goal. Public health initiatives should focus on structural interventions that enable healthier lifestyle choices.

As with blood pressure control, U.S.-born Hispanics were more likely than Mexicans to have hypertension, even after adjusting for demographics, BMI, and access-to-care variables. U.S.-born Hispanics also had a higher prevalence of hypertension awareness (i.e., in regression analysis, the odds of being aware of hypertension were higher for U.S.-born Hispanics when compared to Mexicans). Women had a higher prevalence of hypertension in all border groups except Mexican immigrants, and yet had lower rates of hypertension awareness, suggesting that prevention and control efforts should be targeted toward women.

Mexican immigrants had the lowest prevalence of antihypertensive treatment relative to other border groups. Although not statistically significant, the current findings also suggest that Mexican immigrants with diabetes who are aware of their hypertension may be less likely to be on antihypertensive treatment compared to Mexicans. In addition, Mexican immigrants had the worst measures of access to health care relative to other border groups, even after being made aware of their hypertension status. As it seems likely that limited access to care would reduce the odds of receiving antihypertensive treatment, interventions to increase access to antihypertensive treatment should have a special focus on Mexican immigrants to avoid delayed diagnosis and suboptimal control of hypertension.

The four access to care indicators measured in the current study (having health insurance, having a usual place to receive health care, having an unmet need for health care, and not receiving health care in the past year) were not independently associated with hypertension-related

variables among the U.S.-Mexico border population as a whole or in any of the four border groups. Despite reporting high rates of having a usual place to receive health care, U.S.-born Hispanics and Mexican immigrants reported a substantial unmet need for care. For Mexican immigrants, increased unmet need may be due to lack of health insurance. Although not examined in this study, both U.S.-born Hispanics and Mexican immigrants may also face other barriers to health care, including inadequate transportation, inability to get medical appointments due to difficult working hours, inability to afford health care, and language discordance, among many others. Future work should explore these and other factors that may contribute to differences in access to health care across various U.S.-Mexico border groups, and their effects on hypertension control in the border population as a whole.

There were several limitations to the study. First, the data are from 2001–2002, and current border region rates of blood pressure control, hypertension, hypertension awareness, and treatment as well as comorbid diabetes and hypertension may have changed in the intervening years. However, to the best of the authors' knowledge, no additional studies that examine the overall health of the U.S.-Mexico border population as a single epidemiologic unit have been conducted since 2002. Therefore, the current findings provide a unique perspective for understanding hypertension patterns among adults with diabetes in the border region. Second, the definition of uncontrolled blood pressure was based on prior epidemiologic analyses and current ADA guidelines that recommend a target blood pressure of < 130/80 mm Hg to prevent long-term cardiovascular and renal morbidity and mortality. Data presented in the recent ACCORD (Action to Control Cardiovascular Risk in Diabetes) trial show that there were no differences in fatal and nonfatal cardiovascular events for those who achieved SBP < 120 mm Hg (intensive blood pressure control) versus those with SBP < 140 mm Hg (moderate blood pressure control) (5). However, the current report focuses on the long-term effects, at the population level, of exposure to poor blood pressure control in adults with diabetes, rather than blood pressure targets for treatment decisions. Third, questions about antihypertensive treatment

were restricted to those adults with diagnosed hypertension self-reporting awareness of their condition—and therefore rates of actual antihypertensive treatment may have been underestimated. Finally, the results of the study may not be generalizable to the larger Hispanic population in the United States (which is diverse with regard to country of origin), as the majority of U.S.-Hispanics surveyed were of Mexican origin. In addition, these findings may not be applicable to the overall Mexican population because rates of diabetes and hypertension at the Mexican border may be higher than in other regions of Mexico.

The strengths of the study included the following: the information was collected systematically, through random sampling of households in the U.S.-Mexico border region, using a method that treated the border region as a single epidemiologic unit; measurements were made using uniform methodology; and the response rate for the survey was very high. The resulting data reflect differences in hypertension-related variables by border population and can thus be used to target specific groups for improved access to treatment and better blood pressure control.

In conclusion, co-occurring diabetes and hypertension is a significant public health concern at the U.S.-Mexico border. Blood pressure control was suboptimal for all border groups, especially younger U.S.-born Hispanics. Efforts to improve blood pressure control should focus not only on increasing access to treatment and preventing hypertension but also on educating patient and health care providers to intensify treatment regimens for high blood pressure among adults with diabetes. Because obesity is a significant concern among all border populations, especially U.S.-born Hispanics, comprehensive hypertension prevention and control efforts should also address obesity prevention and treatment. Additional efforts should involve reducing dietary salt consumption (31), a major risk factor for uncontrolled blood pressure. While changing individuals' behavior is difficult, data suggest that efforts to do so with regard to blood pressure control may translate to population-wide benefits due to decreased health care costs as well as reduced morbidity and mortality from cardiovascular and renal disease. Toward that end, the current study highlights the urgency of the problem and

may provide additional impetus for improving comprehensive hypertension prevention and control efforts at both the individual and population level among adults with diabetes residing in the U.S.-Mexico border region.

Acknowledgments. MV was supported by a Primary Care Research Fellowship

through the Division of General Internal Medicine at the University of California, San Francisco. GH was funded by U.S. Centers for Disease Control and Prevention grant #1U58DP002007-01. PS' contributions to this research were supported by a postdoctoral fellowship funded by the Phillip R. Lee Institute for Health Policy Studies at the University of California,

San Francisco. DS was funded by U.S. National Institutes of Health grant #ULRR02413. The authors would like to acknowledge use of data for this study provided by the Pan American Health Organization/World Health Organization (PAHO/WHO) U.S.-Mexico Border Office.

REFERENCES

1. Arauz-Pacheco C, Parrott MA, Raskin P. Treatment of hypertension in adults with diabetes. *Diabetes Care*. 2003;26(1 Suppl):S80-2.
2. Arauz-Pacheco C, Parrott MA, Raskin P. The treatment of hypertension in adult patients with diabetes. *Diabetes Care*. 2002;25(1):134-47.
3. United Kingdom Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular microvascular complications in type 2 diabetes: UKPDS 38. *Br Med J*. 1998;317(7160):703-13.
4. Heart Outcomes Prevention Evaluation Study Investigators. Effects of ramipril on cardiovascular and microvascular outcomes in people with diabetes mellitus: results of the HOPE study and MICRO-HOPE substudy. *Lancet*. 2000;355(9200):253-9.
5. ACCORD Study Group, Cushman WC, Evans GW, Byington RP, Goff DC, Grimm RH Jr, et al. Effects of intensive blood-pressure control in type 2 diabetes mellitus. *N Engl J Med*. 2010;362(17):1575-85.
6. Hajar I, Kotchen TA. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988-2000. *J Am Med Assoc*. 2003;290(2):199-206.
7. Suh DC, Kim CM, Choi IS, Plauschinat CA, Barone JA. Trends in blood pressure control and treatment among type 2 diabetes with comorbid hypertension in the United States: 1988-2004. *J Hypertens*. 2009;27(9):1908-16.
8. Cowie CC, Rust KF, Byrd-Holt DD, Eberhardt MS, Flegal KM, Engelgau MM, et al. Prevalence of diabetes and impaired fasting glucose in adults in the U.S. population: National Health And Nutrition Examination Survey 1999-2002. *Diabetes Care*. 2006;29(6):1263-8.
9. Garcia-Garcia G, Aviles-Gomez R, Luquin-Arellano VH, Padilla-Ocho R, Lepe-Murillo L, Ibarra-Hernandez M, et al. Cardiovascular risk factors in the Mexican population. *Ren Fail*. 2006;28(8):677-87.
10. Velásquez MO, Rosas Peralta M, Lara Esqueda A, Pastelín Hernández G, Attie F, Tapia Conyer R, et al. Arterial hypertension in Mexico: results of the National Health Survey 2000. *Arch Cardiol Mex*. 2002;72(1):71-84.
11. Olaiz-Fernández G, Rojas R, Aguilar-Salinas CA, Rauda J, Villalpando S. Diabetes mellitus in Mexican adults: results from the 2000 National Health Survey. *Salud Publica Mex*. 2007;49(Suppl 3):S331-7.
12. Aguilar-Salinas CA, Velazquez MO, Gomez-Perez FJ, Gonzalez Chávez A, Esqueda AL, Molina Cuevas V, et al. Characteristics of patients with type 2 diabetes in Mexico: results from a large population-based nationwide survey. *Diabetes Care*. 2003;26(7):2021-6.
13. Williams ME, Lacson E Jr, Teng M, Ofsthun N, Lazarus JM. Hemodialyzed type I and type II diabetic patients in the US: characteristics, glycemic control, and survival. *Kidney Int*. 2006;70(8):1503-9.
14. Pugh JA, Stern MP, Haffner SM, Eifler CW, Zapata M. Excess incidence of treatment of end-stage renal disease in Mexican Americans. *Am J Epidemiol*. 1988;127(1):135-44.
15. Peralta CA, Shlipak MG, Fan D, Ordoñez J, Lash JP, Chertow GM, et al. Risks for end-stage renal disease, cardiovascular events, and death in Hispanic versus non-Hispanic white adults with chronic kidney disease. *J Am Soc Nephrol*. 2006;17(10):2892-9.
16. Hall YN, Choi AI, Chertow GM, Bindman AB. Chronic kidney disease in the urban poor. *Clin J Am Soc Nephrol*. 2010;5(5):828-35.
17. Pan American Health Organization. United States-Mexico border area. In: *Health in the Americas, 2007. Vol. II. Countries*. Washington, D.C.: PAHO; 2007. (Scientific Publication 622).
18. Rao SP. The health and well-being of individuals, families, and communities that make up the US-Mexico border region. Foreword. *Fam Community Health*. 2009;32(1):2-3.
19. United States-Mexico Border Health Commission. Topic brief: health care reform: border challenges and opportunities. El Paso, TX: USMBHC; 2009. Available from: http://www.borderhealth.org/files/res_1356.pdf. Accessed 12 March 2010.
20. DeNavas-Walt C, Proctor BD, Smith JC, U.S. Census Bureau. Income, poverty and health insurance coverage in the United States: 2007. Current population reports, P-60-235. Washington, D.C.: U.S. Government Printing Office; 2008.
21. Pan American Health Organization; U.S. Centers for Disease Control and Prevention. The U.S.-Mexico Border Diabetes Prevention and Control Project: first report of results. Washington, D.C.: PAHO; 2005.
22. Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Bethesda, MD: National Institute of Health, High Blood Pressure Education Program, National Heart, Lung, and Blood Institute; 2004. (NIH Publication 04-5230).
23. Ahmad O, Boschi-Pinto C, Lopez AD, Murray CJL, Lozano R, Inoue M. Age standardization of rates: a new WHO standard. GPE. Geneva: World Health Organization; 2001. (Discussion Paper no. 31. EIP/GPE/EBD).
24. Vijan S, Hayward RA. Treatment of hypertension in type 2 diabetes mellitus: blood pressure goals, choice of agents, and setting priorities in diabetes care. *Ann Intern Med*. 2003;138(7):593-602.
25. Adler AI, Stratton IM, Neil HA, Yudkin JS, Matthews DR, Cull CA, et al. Association of systolic blood pressure with macrovascular and microvascular complications of type 2 diabetes (UKPDS 36): prospective observational study. *Br Med J*. 2000;321(7258):412-9.
26. Zhang P, Engelgau MM, Norris SL, Gregg EW, Narayan KM. Application of economic analysis to diabetes and diabetes care. *Ann Intern Med*. 2004;140(11):972-7.
27. Benabe JE, Rios EV. Kidney disease in the Hispanic population: facing the growing challenge. *J Natl Med Assoc*. 2004;96(6):789-98.
28. Morales LS, Lara M, Kington RS, Valdez RO, Escarce JJ. Socioeconomic, cultural, and behavioral factors affecting Hispanic health outcomes. *J Health Care Poor Underserved*. 2002;13(4):477-503.
29. Lara M, Gamboa C, Kahramanian MI, Morales LS, Bautista DE. Acculturation and Latino health in the United States: a review of the literature and its sociopolitical context. *Annu Rev Public Health*. 2005;26:367-97.
30. Dey AN, Lucas JW. Physical and mental health characteristics of U.S.- and foreign-born adults: United States, 1998-2003. *Adv Data*. 2006(369):1-19.
31. Bibbins-Domingo K, Chertow GM, Coxson PG, Moran A, Lightwood JM, Pletcher MJ, et al. Projected effect of dietary salt reductions on future cardiovascular disease. *N Engl J Med*. 2010;362(7):590-9.

Manuscript received on 23 March 2010. Revised version accepted for publication on 15 July 2010.

RESUMEN

Control de la presión arterial, hipertensión, concientización y tratamiento en adultos con diabetes de la zona fronteriza entre México y los Estados Unidos

Objetivo. Determinar la prevalencia del control de la presión arterial, la hipertensión, la concientización en materia de hipertensión y el tratamiento antihipertensivo entre los adultos (≥ 18 años) con diabetes residentes en la zona fronteriza entre México y los Estados Unidos, y analizar las diferencias de esas variables en todos los adultos del lado mexicano de la frontera (“mexicanos”) y tres grupos del lado estadounidense (“todos los adultos estadounidenses”, “los hispanos nacidos en los Estados Unidos” y “los inmigrantes mexicanos”).

Métodos. A partir de los datos de la primera fase (febrero del 2001 a octubre del 2002) 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, se calculó en la muestra ($n = 682$) la prevalencia ajustada por edad de las variables relacionadas con la hipertensión, y se analizaron las diferencias entre los grupos fronterizos mediante regresión logística.

Resultados. Menos de un tercio de la muestra tenía una presión arterial controlada ($< 130/80$ mm de Hg), casi la mitad presentaba hipertensión ($\geq 140/90$ mm de Hg), y la concientización y el tratamiento de la hipertensión eran inadecuados. Tras el ajuste en cuanto a los factores demográficos, el índice de masa corporal y el acceso a la atención de salud, no se observaron diferencias en cuanto al control de la tensión arterial (normotensión), la hipertensión, la concientización en materia de hipertensión o el tratamiento entre los mexicanos y los adultos estadounidenses o los inmigrantes mexicanos. Sin embargo, en comparación con los mexicanos y los inmigrantes mexicanos, los hispanos nacidos en los Estados Unidos, en particular los más jóvenes, presentaban las menores tasas de presión arterial normal (17,3%) y las mayores tasas de hipertensión coexistente (54,8%). En comparación con los mexicanos, la probabilidad de tener una tensión arterial normal era menor entre los hispanos nacidos en los Estados Unidos (razón de posibilidades [OR] 0,30, intervalo de confianza [IC] 95% 0,09–0,95), y eran mayores las probabilidades de hipertensión (OR 3,75, IC 95% 1,51–9,29) y concientización en materia de hipertensión (OR 6,19, IC 95% 1,46–26,15).

Conclusiones. La coexistencia de diabetes e hipertensión constituye un importante problema de salud pública en los residentes de la zona fronteriza entre México y los Estados Unidos. La baja tasa de normotensión entre los diversos grupos fronterizos, especialmente en los jóvenes hispanos nacidos en los Estados Unidos, indica que se deben llevar a cabo iniciativas dirigidas enérgicamente hacia el control de la presión arterial.

Palabras clave

Hipertensión; diabetes mellitus tipo 2; presión sanguínea; manejo de la enfermedad; accesibilidad a los servicios de salud; salud fronteriza; Estados Unidos, México.