Actions to Control High Blood Pressure Among Hypertensive Adults in Texas Counties Along the Mexico Border: Texas BRFSS, 2007

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ABSTRACT

Objectives. We examined the prevalence of actions taken to control blood pressure as measured by taking antihypertensive medication or making lifestyle modifications among hypertensive adults residing along the Texas/Mexico border.

Methods. We used self-reported data from the 2007 Texas Behavioral Risk Factor Surveillance System, with oversampling of border counties. We calculated the age-standardized prevalence of actions taken to control hypertension by selected characteristics.

Results. In analyses that combined ethnicity with predominant language spoken, those least likely to take any action to control their blood pressure—either by taking an antihypertensive medication or by making any of four lifestyle modifications—were Spanish-speaking Hispanic people ($83.2\% \pm 2.7\%$ standard error [SE]), with English-speaking non-Hispanic people ($88.9\% \pm 0.8\%$ SE) having the highest prevalence of taking action to control blood pressure. When analyzed by type of medical category, uninsured Hispanic people ($63.8\% \pm 4.8\%$ SE) had the lowest prevalence of taking action to control their blood pressure compared with uninsured non-Hispanic people ($75.4\% \pm 4.7\%$ SE). Nonborder Texas residents with hypertension were more likely to take antihypertensive medications ($78.4\% \pm 1.0\%$ SE) than border county residents with hypertension ($70.7\% \pm 2.0\%$ SE).

Conclusions. Public health efforts must be undertaken to improve the control of hypertension among residents of Texas counties along the Mexico border, particularly for uninsured Hispanic people.

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Hypertension, or high blood pressure, is a major risk factor for death and disability from heart disease, stroke, and kidney failure, and one in three adults in the United States has hypertension.¹ Currently, hypertension is defined by one or more of the following: (1) systolic pressure ≥ 140 millimeters of mercury (mmHg), (2) diastolic pressure of ≥ 90 mmHg, (3) taking antihypertensive medication, or (4) having been told at least twice by a physician or other health professional that one has high blood pressure.²

A Healthy People (HP) 2010 objective (Objective 12-11) was to increase the proportion of adults with hypertension who are taking action to control their blood pressure,³ and the retained but modified HP 2020 Objective HDS-5 is to increase the proportion of adults with hypertension who meet the recommended guidelines for body mass index (BMI), saturated fat consumption, sodium intake, physical activity, and moderate alcohol consumption.⁴

Additionally, specific guidelines from the Seventh Report of the U.S. Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) have been readily available for health-care providers and their patients since 2003.⁵ These guidelines recommend that patients take action in the form of lifestyle modifications (e.g., reducing sodium intake, changing eating habits, controlling weight, moderating alcohol intake, and increasing physical exercise) to prevent hypertension; if the hypertension remains uncontrolled, they should proceed with medical management. Yet, levels of adherence to lifestyle modifications and adherence to medical management of hypertension are both low, leading to low rates of blood pressure control.⁶⁻⁸ In the case of medical management, this finding is particularly unfortunate because the use of antihypertensive medications to achieve targeted blood pressure levels reduces the risk of stroke by 35%, of congestive heart failure by 42%, and of coronary heart disease by 28%.⁷ In the U.S., the prevalence of hypertension is highest among non-Hispanic black (NHB) people, followed by Mexican Americans, and then non-Hispanic white (NHW) people. Mexican Americans, however, have lower rates of hypertension control than NHB or NHW people.²

Overall, Hispanic people are the fastest-growing ethnic population in the U.S.,⁹ and in 2008 Mexican Americans comprised 67% of all Hispanic people in the U.S. In Texas, however, Mexican Americans comprised 88% of all Hispanic people in 2008.⁹ Compared with NHW and NHB people, Hispanic people have been shown to be one of the most underserved groups in the U.S. in terms of access to health care and preventive health services.¹⁰ Therefore, not surprisingly, a study

on state-specific variation in health care and preventive health services using data from the Behavioral Risk Factor Surveillance System (BRFSS) indicated that, in Texas, Hispanic people had lower rates for health checkups and doctor visits for both 1991–1996 and 1997–2004 than did NHW people.¹¹ In addition, a comparison of the two time periods revealed a significant decrease for Texas Hispanic people in both health checkups and doctor visits. That study included no data specifically on screening for hypertension or its evaluation or control.

Currently, even though the Texas/Mexico border region has drawn the attention of some scholars in the area of health services,⁹⁻¹¹ there is a paucity of literature on the prevalence of hypertension among adults living there or on their rates of taking antihypertensive medications or making lifestyle modifications to combat hypertension. Our study was designed to (1) estimate the prevalence of hypertension among U.S. adults residing in Texas border and nonborder regions; (2) assess the proportion of people with hypertension who are taking action to control their hypertension with antihypertensive medications or by modifying their lifestyle behaviors; and (3) determine whether these estimates varied by ethnicity, language, medical insurance coverage (for Texas overall), or geography (along the Texas-Mexico border).

METHODS

Data source and population

In Texas, the BRFSS is sponsored by the Texas Department of State Health Services in partnership with the Centers for Disease Control and Prevention (CDC). As in other states, it is an ongoing, monthly telephone survey to collect information from adults relating to their health status, personal health habits, and health practices associated with morbidity and medical expenditures. The 2007 Texas BRFSS collected data during a 12-month period from 17,208 Texas residents, of whom 4,381 (25.5%) resided within one of the five Texas regions bordering Mexico: El Paso County, Big Bend area (Brewster, Culberson, Hudspeth, Jeff Davis, Pecos, Presidio, and Terrell counties), Val Verde and Maverick counties, Webb and Zapata counties, and the Lower Rio Grande Valley (Hidalgo, Starr, and Cameron counties). The sample size needed for each of the five areas in this survey was determined using estimates of the adult population, telephone coverage rates, and response rates in previous editions of the BRFSS. The cooperation rates for the 2007 Texas BRFSS were 64.8% (range: 58.7%–68.6%) for the border area and 67.7% (65.7%–69.8%) for the nonborder area.

Data collection and definitions

The 2007 Texas BRFSS asked questions relating to health and quality of life, with specific questions related to hypertension. Respondents were identified as having hypertension if they responded “yes” when asked if they had ever been told by a physician that they had high blood pressure. Reported hypertension during pregnancy was excluded. Those who reported hypertension were asked whether they were taking antihypertensive medication to control their blood pressure and had modified any lifestyle behaviors, such as (1) changing eating habits, (2) reducing or cutting down on salt, (3) not drinking or reducing alcohol use, and (4) exercising. Reduced weight action was not included in this analysis.

Sociodemographic characteristics assessed included age group (18–44, 45–64, and ≥ 65 years of age), gender, race/ethnicity (NHB, NHW, and Hispanic), level of education (<high school graduate, high school graduate, some college, and $\geq$ college graduate), predominant language spoken (Spanish or English), annual household income (<\$15,000, \$15,000–\$34,999, and $\geq$ \$35,000), health insurance (no, yes), and medical insurance coverage of health-care cost (full insurance coverage, underinsured [i.e., partial insurance coverage], or uninsured [i.e., no insurance but uses Medicare, Medicaid, or free services or self-pay only]).

Data analysis

Prior to analysis, the data were weighted to adjust for unequal probabilities of selection and to make the final data reflective of the state’s age and gender distributions. All statistical analyses were run on the weighted data using SUDAAN® to account for the complex survey design.¹² The estimates are reported with either the standard error (SE) or a 95% confidence interval (CI), with $p < 0.05$ considered statistically significant. Prevalence rates are shown and, where appropriate, rates are adjusted by age and gender to the 2000 standard U.S. population.

To present the sociodemographic profile for the prevalence of hypertension in Texas and the Texas border regions, we estimated this prevalence by gender, age, race/ethnicity, education, language spoken (English or Spanish), income, health insurance, medical coverage, and region within the Texas border area. To assess differences between the prevalence of taking action to combat hypertension (either taking antihypertensive medications or modifying any of four lifestyle behaviors), we stratified these data by race/ethnicity or only ethnicity, language, and medical coverage. Additionally, we performed Chi-square tests for overall differences by coverage category in taking action and

for differences within selected categories of coverage. These tests were two-tailed with significance defined as $p < 0.05$. Any estimate with a sample of <50 people or a relative SE $> 30\%$ was considered unreliable and was not reported.

We conducted logistic regression analyses to assess the odds ratios (ORs) of action taken while adjusting for sociodemographic characteristics and other risk factors. We conducted forward stepwise modeling to assess which covariates should remain in the final saturated model (i.e., gender, age, insurance, diabetes, smoking, binge drinking, education, income, BMI [defined as weight in kilograms divided by height in meters squared], and region). The final saturated model shown is for hypertensive adults residing in Texas counties along the Mexico border and nonborder regions.

RESULTS

For Texas as a whole, the prevalence of hypertension from self-reports was $27.8\% \pm 0.5\%$ SE (Table 1). NHB people had a significantly higher prevalence of hypertension ($41.2\% \pm 2.0\%$ SE) than either Hispanic ($26.4\% \pm 0.9\%$ SE) or NHW ($26.0\% \pm 0.5\%$ SE) people ($p < 0.05$ for both comparisons with NHB people). The prevalence of hypertension increased with age group while it decreased with each successively higher level of education and income ($p < 0.05$ for both comparisons). Hypertension was more common among predominantly English-speaking Texas residents ($29.3\% \pm 0.6\%$ SE) than among their exclusively Spanish-speaking counterparts ($19.6\% \pm 1.3\%$ SE) ($p < 0.05$). Those who self-paid for their medical coverage had the lowest prevalence of hypertension ($16.1\% \pm 1.2\%$ SE), far below the uninsured ($26.9\% \pm 1.8\%$ SE), those with full coverage ($29.9\% \pm 0.6\%$ SE), and the underinsured ($31.9\% \pm 1.8\%$ SE) ($p < 0.05$).

Among Texas adult residents with hypertension, 77.9% were taking antihypertensive medications (Table 1). The prevalence of taking antihypertensive medications was lower among men, Hispanic people, those aged 18–44 years, those with <high school education, those with income <\$15,000, and those with no health insurance than among their respective counterparts. With respect to insurance, hypertensive people who were uninsured had the lowest prevalence of taking antihypertensive medications ($50.0\% \pm 4.0\%$ SE), followed by self-payers ($68.6\% \pm 3.8\%$ SE), the underinsured ($74.8\% \pm 2.8\%$ SE), and those with full health coverage ($83.9\% \pm 0.9\%$ SE) ($p < 0.05$).

Among hypertensive adults residing in Texas, the prevalence of taking any action to control hypertension (i.e., taking an antihypertensive medication or

Table 1. Age-standardized (weighted) prevalence of hypertension and of taking antihypertensive medication, by selected characteristics: Texas BRFSS, 2007

Characteristic	All	Hypertension	Hypertensive people ^a taking antihypertensive medication
	N	N (percent $\pm$ SE)	N (Percent $\pm$ SE)
Texas total	17,208	6,113 (27.8 $\pm$ 0.5)	5,173 (77.9 $\pm$ 0.9)
Gender			
Male	5,881	2,140 (27.7 $\pm$ 0.8)	1,728 (77.9 $\pm$ 0.9)
Female	11,327	3,973 (28.0 $\pm$ 0.6)	3,415 (81.3 $\pm$ 1.0) ^c
Race/ethnicity ^b			
Non-Hispanic white ^d	10,065	3,797 (26.0 $\pm$ 0.5) ^c	3,290 (80.9 $\pm$ 1.0)
Non-Hispanic black ^d	1,121	545 (41.2 $\pm$ 2.0)	466 (80.1 $\pm$ 2.7)
Hispanic, any race	5,344	1,544 (26.4 $\pm$ 0.9)	1,227 (69.7 $\pm$ 2.2)
Age (in years) ^b			
18–44	5,605	707 (13.6 $\pm$ 0.7) ^c	361 (52.3 $\pm$ 2.6) ^c
45–64	6,632	2,577 (38.9 $\pm$ 0.8)	2,153 (82.8 $\pm$ 1.1)
≥ 65	4,777	2,757 (58.0 $\pm$ 0.9)	2,598 (93.7 $\pm$ 0.8)
Education ^b			
<High school	2,825	1,195 (31.1 $\pm$ 1.3) ^c	1,009 (74.4 $\pm$ 2.5) ^c
High school graduate	4,624	1,773 (29.7 $\pm$ 1.0)	1,522 (78.9 $\pm$ 1.6)
Some college	4,544	1,589 (28.5 $\pm$ 1.0)	1,318 (75.5 $\pm$ 1.9)
$\geq$ College graduate	5,157	1,540 (24.1 $\pm$ 1.0)	1,309 (81.7 $\pm$ 1.6)
Language spoken ^b			
Spanish only	2,309	697 (19.6 $\pm$ 1.3) ^c	557 (71.4 $\pm$ 3.6) ^c
English predominant or only	12,683	4,652 (29.3 $\pm$ 0.6)	3,977 (78.9 $\pm$ 1.0)
Income ^b			
<\$15,000	2,181	971 (37.6 $\pm$ 1.8) ^c	809 (74.2 $\pm$ 2.8) ^c
\$15,000–\$34,999	4,507	1,747 (29.4 $\pm$ 1.0)	1,453 (74.7 $\pm$ 1.9)
$\geq$ \$35,000	7,805	2,330 (24.5 $\pm$ 0.7)	1,970 (79.2 $\pm$ 1.3)
Medical coverage ^b			
Full	12,081	4,626 (29.9 $\pm$ 0.6) ^c	4,112 (83.9 $\pm$ 0.9) ^c
Self-pay	1,866	391 (16.1 $\pm$ 1.2)	293 (68.6 $\pm$ 3.8)
Underinsured	1,415	565 (31.9 $\pm$ 1.8)	451 (74.8 $\pm$ 2.8)
Uninsured	1,723	482 (26.9 $\pm$ 1.8)	274 (50.0 $\pm$ 4.0)

^aThe question about taking antihypertensive medication was asked only of respondents who reported being hypertensive.

^bValues were missing for the following categories: race/ethnicity ($n=678$), age ($n=194$), education ($n=58$), language spoken ($n=2,216$), income ($n=2,715$), health insurance ($n=5,180$), and medical coverage ($n=123$).

^cStatistically significant at $p<0.05$

^dNon-Hispanic people include those who answered “no” or “don’t know” to the question, “Are you Hispanic or Latino?”

BRFSS = Behavioral Risk Factor Surveillance System

SE = standard error

modifying any of four lifestyle behaviors) was significantly lower among Spanish-speaking Hispanic people (83.2% $\pm$ 2.7% SE) than among English-speaking non-Hispanic people (88.9% $\pm$ 0.8% SE) (Figure 1). Within three of the four medical coverage groups (all but full coverage), non-Hispanic people were significantly more likely than Hispanic people to take action to control their hypertension (Figure 2). The lowest prevalence of taking action to control hypertension was found for the uninsured, including Hispanic people (63.8% $\pm$ 4.8% SE) and non-Hispanic people (75.4% $\pm$ 4.7% SE).

For the entire state of Texas, Hispanic adults were

40 times less likely to take action to control their hypertension (OR=0.6, 95% CI 0.5, 0.8) than non-Hispanic people (data not shown), but the degree and statistical significance was removed when adjusting for modifying effect factors. Our final model indicates that although there were no significant findings, we found that among hypertensive adults, women, non-Hispanic people of any race, and those who were predominantly English speakers were somewhat more likely to either take an antihypertensive medication or to modify a lifestyle behavior than were their respective reference groups (Table 2). Compared with their reference group (i.e.,

Figure 1. Weighted prevalence of taking action^a to control hypertension among Hispanic and non-Hispanic adults with hypertension in Texas, by predominant language spoken: Texas BRFSS, 2007

^aTaking action includes taking an antihypertensive medication or making at least one of four lifestyle modifications: changing eating habits, reducing or cutting down on salt, not drinking or reducing alcohol use, and exercising.

^bData not shown because sample size was too small ($n=25$) for reliability of results and statistical testing.

BRFSS = Behavioral Risk Factor Surveillance System

hypertensive adults aged 18–44 years), hypertensive adults aged ≥ 65 years were eight times as likely to take an antihypertensive medication or to make a lifestyle modification ($OR=8.4$, 95% CI 4.7, 15.0), while those aged 45–64 years were three times as likely to do so ($OR=3.1$, 95% CI 2.2, 4.4). Uninsured hypertensive adults were about half as likely ($OR=0.5$, 95% CI 0.3, 0.8) to take any form of action compared with those who had full medical coverage. Albeit not statistically significant, hypertensive adults residing in border counties were somewhat less likely to take any form of action compared with those residing in nonborder counties. Even with the oversampling of residents in the Texas border regions, the samples were too small to assess differences in the actions taken to control hypertension by a combination of regional and sociodemographic characteristics.

The prevalence of hypertension was lower in the five Texas border regions combined ($24.7\% \pm 2.8\%$ SE) than it was in the remainder of Texas ($28.2\% \pm 0.5\%$ SE) (Figure 3), regardless of race/ethnicity, gender, or

age. The Big Bend region had the lowest prevalence of hypertension ($21.7\% \pm 3.2\%$ SE), with the prevalence for the other border regions estimated at $25.0\% \pm 1.3\%$ SE in El Paso, $26.6\% \pm 2.3\%$ SE in Val Verde and Maverick, $27.4\% \pm 2.7\%$ SE in Webb and Zapata, and $27.6 \pm 1.3\%$ SE in the Lower Rio Grande Valley.

Among adults with hypertension, those residing in the Big Bend region had the lowest prevalence of taking antihypertensive medications ($68.0\% \pm 11.5\%$ SE), followed by those residing in the Lower Rio Grande Valley ($69.8\% \pm 3.0\%$ SE), Val Verde and Maverick ($76.2\% \pm 5.5\%$ SE), El Paso ($77.5\% \pm 3.2\%$ SE), and Webb and Zapata ($80.3\% \pm 5.2\%$ SE) (Figure 4).

Among hypertensive adults in the border regions (Figure 5), those who were taking antihypertensive medications were significantly more likely than those not taking such drugs to change their eating habits (74.6% vs. 56.8%), reduce salt intake (82.2% vs. 64.5%), and exercise more (80.2% vs. 67.4%). In addition, a somewhat greater proportion of those who took antihypertensive medications reduced their

Figure 2. Weighted prevalence of taking action to control hypertension^a among Hispanic and non-Hispanic adults with hypertension in Texas, by medical coverage: Texas BRFSS, 2007

^aTaking action includes taking an antihypertensive medication or making at least one of four lifestyle modifications: changing eating habits, reducing or cutting down on salt, not drinking or reducing alcohol use, and exercising.

^b $p < 0.0001$ for significant Chi-square differences in percentage taking action to control hypertension for both medical coverage overall and within ethnic groups

BRFSS = Behavioral Risk Factor Surveillance System

alcohol intake (76.7% vs. 72.2%), but this difference was not significant. The overall prevalence among Texas residents of taking any type of action to control their hypertension was 86.9% $\pm$ 0.7% SE (data not shown).

In the border regions, the lowest prevalence of taking any type of action to control hypertension was seen in the Lower Rio Grande Valley (79.8% $\pm$ 2.7% SE), followed by El Paso (84.2% $\pm$ 3.0% SE), Webb and Zapata (84.2% $\pm$ 4.9% SE), Val Verde and Maverick (85.1% $\pm$ 4.7% SE), and Big Bend (92.4% $\pm$ 3.7% SE) (Figure 6). It is important to note that Big Bend has a greater proportion of NHW people than the other border regions.

DISCUSSION

In an analysis based on the 2007 Texas BRFSS, we found that the overall age-standardized prevalence of self-

reported hypertension in Texas (27.8%) was well above the HP 2010 Objective 12.9 target of 14% hypertension prevalence among adults.^{3,6} And in the newly launched HP 2020, the relevant target has been raised to 26.9% for Objective HDS-5.⁴ Our study prevalence was slightly lower than the U.S. age-standardized prevalence of 29.9% using National Health and Nutrition Examination Survey 2005–2008 data, but the survey's definition of hypertension included self-reported hypertension as well as newly diagnosed hypertension based on physical examination blood pressure measurements.¹² Additionally, hypertensive adults residing in Texas, young adults (aged 18–44 years), uninsured Hispanic people, and those residing in the Lower Rio Grande Valley region were less likely than their respective comparison groups to take some sort of action against their hypertension (i.e., by using antihypertensive medications or modifying their behavior). This finding is well below the HP

Table 2. Odds ratio for taking action against hypertension^a among hypertensive adults residing in Texas, by selected characteristics: Texas BRFSS, 2007

Characteristic	OR (95% CI)
Ethnicity	
Non-Hispanic ^b	Ref.
Hispanic	0.9 (0.7, 1.6)
Gender	
Male	Ref.
Female	1.4 (1.0, 2.0)
Age (in years)	
18–44	Ref.
45–64	3.1 (2.2, 4.4)
≥65	8.4 (4.7, 15.0)
Education	
<High school graduate	Ref.
High school graduate	0.9 (0.6, 1.7)
Some college	0.7 (0.4, 1.2)
≥College graduate	1.2 (0.6, 2.3)
Language spoken	
Spanish-speaking only	Ref.
English predominant or only	1.1 (0.6, 2.1)
Medical coverage	
Full	Ref.
Self-pay	0.7 (0.4, 1.2)
Underinsured	0.6 (0.3, 1.0)
Uninsured	0.5 (0.3, 0.8)
Border region	
Nonborder counties	Ref.
Border counties	0.8 (0.5, 1.3)

^aTaking action includes taking an antihypertensive medication or making at least one of four lifestyle modifications: changing eating habits, reducing or cutting down on salt, not drinking or reducing alcohol use, and exercising.

^bNon-Hispanic people are those who answered “no” or “don’t know” to the question, “Are you Hispanic or Latino?”

BRFSS = Behavioral Risk Factor Surveillance System

OR = odds ratio

CI = confidence interval

Ref. = reference group

2010 Objective 12.11 target of 98% of hypertensive adults taking action to lower their blood pressure.^{3,6} Likewise, we should continue to be mindful of our nation’s progress in taking action to control blood pressure, as the newly launched HP 2020 Objectives HDS-10–10.5 contain redefined development objectives to increase the proportion of hypertensive adults who meet the recommended guidelines for BMI, saturated fat intake, sodium intake, physical activity, and moderate alcohol consumption.⁴

The finding about uninsured Hispanic people is by no means surprising, as people who lack medical

insurance tend to receive less preventive care and also receive less therapeutic care once they are diagnosed.¹⁴ Interestingly, 26% of Texas residents lack medical insurance—the highest percentage of uninsured people of any state in the U.S. and almost twice the national percentage of uninsured people (14%). The situation in the Texas-Mexico border region is significantly more severe, with 40% of adults lacking any medical insurance. Of the border regions, the Lower Rio Grande Valley reported the highest proportion of adults without medical insurance (47%).¹⁵ Given these facts, one would expect that many hypertensive adults living in the border region would not be taking action to control their blood pressure.

The lower prevalence of hypertension and overall rate of taking antihypertensive medication in the border area compared with the nonborder region of Texas could reflect some of the characteristics of health service delivery along the border. In Texas generally, and also in its border area, the delivery of health services depends in large part on private health-care providers and health plans offering care through a complex variety of financial arrangements, including government assistance programs for the poor, the elderly, and the disenfranchised. Low-income and Hispanic people who are not enrolled in these government assistance programs, and often even those who are, frequently do not obtain the health services they need.^{10,11} Clearly, people who are poorly served are less likely to be aware of their hypertension status, no doubt in part explaining the low reported prevalence of hypertension we saw for some groups in this study (e.g., a prevalence of only 16.1% for Texas adults without health insurance who self-pay for medical care and 26.9% of uninsured people).

In the U.S.-Mexico border region, several factors may be especially important for understanding why residents often have apparently low rates of access to medical care. First, many Mexican Americans who live in the region are more familiar with Mexico’s medical care than they are with U.S. medical care, and indeed many Mexican Americans will cross the border into Mexico to seek services.^{15–17} In addition, medical care in the U.S. and Mexico is very different in terms of infrastructure and operation, and the two health systems operate in the context of different economies and cultures. Although U.S. medical care has greater coverage of services than that found in Mexico, many Mexican Americans living in Texas are not aware that these services exist.¹⁶ Furthermore, in Texas as a whole, a lower proportion of state residents is believed to access health-care services than is the case nationally,¹¹ although services received in Mexico by Texas

residents would often go uncoun­ted, result­ing in an underestimation of services used.^{10,11}

Economic conditions also make a difference in terms of access, and the U.S. side of the border is an economically depressed area.^{17,18} Moreover, hospitals and other medical facilities in the U.S.-Mexico border area have reported financial difficulties.¹⁹ Furthermore, consistent with the point made previously about those seeking health-care services in Mexico, U.S. monolingual Spanish speakers are more apt to seek services from Mexican providers, which they may see as fitting their culture better.^{16,17} The practice of seeking care in Mexico may be reflected in the lower prevalence

of Spanish-speaking hypertensive adults who either took antihypertensive medication or modified their lifestyle to control their blood pressure (although this prevalence was not statistically significant).

The cost of health care is a major concern, particularly for low-income Texas residents living in Texas-Mexico border regions. The 2003 estimated lost productivity was highest for hypertension (\$280 billion) compared with cancers (\$271 billion), mental disorders (\$171 billion), and diabetes (\$105 billion), and treatment expenditures for hypertension in 2003 were estimated at \$32.5 billion, which is comparable with those for cancers (\$48.1 billion) and diabetes (\$27.1

Figure 3. Age-standardized (weighted) prevalence (with SE) of hypertension among Texas adults residing in Texas counties along the Mexico border region and nonborder Texas region: Texas BRFSS, 2007

SE = standard error

BRFSS = Behavioral Risk Factor Surveillance System

Figure 4. Age-standardized (weighted) prevalence (with SE) of treatment with antihypertensive medication^a among hypertensive adults residing in Texas counties along the Mexico border area, by region: Texas BRFSS, 2007

^aThe question about taking antihypertensive medication was asked only of respondents who indicated that they were hypertensive.

SE = standard error

BRFSS = Behavioral Risk Factor Surveillance System

billion). DeVol and Bedroussian indicate that because hypertension is preventable, changes in obesity and exercise levels could reduce the progression of hypertension prevalence and reduce treatment expenditure and loss of productivity.²⁰ Our results suggest that there is great potential for reducing the economic burden of hypertension in the border areas by expanding the use of programs to modify behavioral lifestyles, as well as by improving the use of antihypertensive medications. Interventions that have been shown to be cost-effective in hypertension control include programs to improve adherence to the use of antihypertensive medications,²¹

a behavioral stress-reduction approach,²² and a community-based long-term medication therapy management program for hypertension and dyslipidemia.²³

In Texas specifically, programs have been put in place to address the issue of disparities in access to health care and preventive services. In 1998, for example, *Frontera de Salud* (Border Health) was initiated to help provide health care to this underserved working group of residents,²⁴ and many efforts are currently underway to establish *promotoras de salud* (health promoters drawn from the community) for diabetes.²⁵ However, only recently have there been

Figure 5. Weighted prevalence of taking specific lifestyle behavioral actions^a to combat hypertension among hypertensive adults residing in Texas counties along the Mexico border area, by antihypertensive treatment status: Texas BRFSS, 2007

^aThe four lifestyle modifications include changing eating habits, reducing or cutting down on salt, not drinking or reducing alcohol use, and exercising.

^bStatistically significant at $p < 0.01$

BRFSS = Behavioral Risk Factor Surveillance System

community-based interventions that use *promotoras de salud* to address the problem of lack of hypertension control. Although these community-based programs have preliminary results suggesting a positive influence on improved hypertension control in El Paso, Texas, and some Big Bend areas, there has not been sufficient expansion of these programs to other Texas regions bordering Mexico.²⁶ To prevent serious sequelae from uncontrolled hypertension, public health officials should increase focused preventive and complementary health-care services (e.g., community health workers, or *promotoras de salud*) for this underserved population along the Texas-Mexico border.

In 2001, Texas initiated a project in the Laredo, Mexico, area funded by the Health Resources and Services Administration called *Salud Para Su Corazon* (Health for Your Heart), which provided training to various communities in the prevention of behavioral risk factors.²⁷ From 2005 to 2008, the University of

Texas Health Science Center at Houston, School of Public Health, El Paso Regional Campus, in collaboration with the University of Texas at El Paso, initiated a similar project that was funded by the National Institutes of Health to reach high-risk Hispanic populations along the border.²⁸ In addition, CDC funded *Promotoras de Salud Contra la Hipertensión* (Promotoras Against Hypertension), a pilot project in El Paso and Laredo that specifically used *promotoras de salud* to test a randomized intervention for hypertension control.²⁵ Culturally relevant interventions such as *Salud Para Su Corazon* and *Promotoras de Salud Contra la Hipertensión* are strategies being used along the entire border to address the economic burden of hypertension and possibly reduce the sequelae produced by uncontrolled hypertension. However, direct evaluation of the impact of these programs among residents of Texas living in regions along the Mexico border is needed to assess the extent to which the prevention and management

of hypertension has improved. Our results indicate that the prevalence of taking action to control blood pressure among hypertensive adults was higher in the border regions that had programs than for the Lower Rio Grande Valley, which did not have these programs.

Strengths and limitations

The strengths of a BRFSS-based study include the survey's large sample sizes and the ability of researchers to examine data for groups defined by many demographic variables, including race/ethnicity, using standard

protocols. For 2007, the Texas BRFSS increased the sample size in the border area to provide data that could provide information for policy makers and public health professionals. Our results provide useful information on hypertension and whether action was taken to combat it that was categorized by many demographic variables, including medical coverage. Thus, the results can be used by health officials and policy makers to identify key populations and regions that need additional attention to address their needs.

However, using the BRFSS data also had some

Figure 6. Geographic patterns in the age-standardized (weighted) prevalence (with SE) of taking action to combat hypertension^a among adults residing in Texas counties along the Mexico border area, by region: Texas BRFSS, 2007

^aTaking action includes taking an antihypertensive medication or making at least one of four lifestyle modifications: changing eating habits, reducing or cutting down on salt, not drinking or reducing alcohol use, and exercising.

SE = standard error

BRFSS = Behavioral Risk Factor Surveillance System

limitations. The research design is cross-sectional, so one can demonstrate only associations among the variables, not causality. Also, the generalizability of the results is a concern due to the small population size, as our cooperation rates were 64.8% for adults residing in Texas border counties and 67.7% for those residing in nonborder Texas counties. Additionally, recall and desirability biases (i.e., some people do not recall personal information well, and some respondents give socially desirable answers) that are inherent in self-reported data and the exclusion of segments of the population without landline telephones may have distorted the results of our study with an overestimation of desirable actions, such as increased physical activity. Previous studies, however, have generally noted that self-reports of chronic conditions are quite accurate, although they should be verified when possible.²⁹ Still, one weakness of the present study was that respondents without access to health care would be expected to be unaware of their hypertension status, leading to an underestimation of the prevalence of that problem.

CONCLUSIONS

The JNC7 guidelines recommend that hypertension be treated initially through lifestyle modifications to achieve a goal blood pressure of $\leq 120/80$ mmHg for people with prehypertension and $\leq 140/90$ mmHg for individuals with hypertension.⁵ Furthermore, the guidelines recommend that lifestyle modifications are to continue alongside antihypertensive medication, if and when it is prescribed. Clinical evidence has shown that adopting a Dietary Approaches to Stop Hypertension eating plan reduces systolic pressure by 8–14 mmHg, and reducing dietary intake of sodium to no more than 2,400 milligrams/day reduces systolic pressure by 2–8 mmHg.³⁰ In addition, increasing physical activity to 30 minutes or more of brisk walking on most days of the week reduces systolic pressure by 2–4 mmHg. JNC7 guidelines also recommend self-monitoring of blood pressure at home to assist patients and their doctors in the management of hypertension, so that an optimal goal blood pressure can be obtained and consistently maintained.

In response to a request from CDC's Division for Heart Disease and Stroke Prevention, the Institute of Medicine (IOM) brought together an expert committee to review available public health strategies for reducing and controlling hypertension in the U.S. population; the IOM's review³¹ outlines the need for a population-based approach and policy interventions to address hypertension in the U.S. The report also recognizes that community health workers play an

important role in the provision of health care and preventive health services and recommends that CDC, as well as state and local health jurisdictions, focus on population-based strategies that can reach large numbers of people and improve the well-being of entire communities through lifestyle interventions, such as reducing sodium intake, consuming more fruit and vegetables, and increasing physical activity.

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