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Diabetes Self-Management Behaviors, Health Care Access, and Health Perception in Mexico-US Border States

Purpose

The purpose of this study was to describe diabetes self-management behaviors, diabetes health care access, and health perception for Mexican adults and Hispanics residing in the Mexico-US border region.

Methods

This study used data from the Behavior Risk Factor Surveillance System (BRFSS) survey diabetes items (n = 26) to assess characteristics of Hispanics in 4 Arizona border counties (n = 216) and cross-sectional data from a modified BRFSS in a convenience sample of adults residing in Monterrey, Mexico (n = 351). Data were analyzed for descriptive statistics with SPSS.

Results

The Mexico cohort was younger than the Arizona cohort (59.36 [11.5] vs 65.54 [11.1], respectively) and the mean length of time with type 2 diabetes was similar. Less than 10% (9.7%) of the Arizona cohort reported never monitoring blood glucose compared to 22.5% of the Mexico cohort. The mean (SD) number of times in the past 12 months the Mexico cohort saw their health care provider was 9.09 (6.8) vs 4.49 (8.3) for the Arizona cohort. Despite provider access, there were differences in self-management behaviors between the cohorts.

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Conclusions

Due to environmental and policy factors in the Mexico-US border region, there continues to be a gap in evidence-based practice and uptake of self-management behaviors for adults with diabetes. Resources such as the BRFSS and shared practice guidelines would bridge this gap.

Type 2 diabetes (T2DM), largely preventable, is a serious threat to global population health.[1] In Mexico, about 7.31 million of adults (14.4% of total population) have this disease, and it is the leading cause of death from non-infectious disease. In 2008, a total of 75 552 Mexicans died of T2DM, representing 14% of all causes of death.[2] The 2015 prevalence of diabetes in the United States was 9.4%.[3] The prevalence of diabetes in Mexico ranged between 9.2% in 2013[4] and 14.4% in 2010.[5] There are many reasons for this prevalence variability, and one of the main reasons is the lack of a national registry for diabetes.[2] In addition, the age-adjusted prevalence of T2DM in the Mexico-US border region (hereafter referred to as border) was estimated at 15.4% during 2001 to 2002 (16.6% on the Mexican side and 14.7% on the US side), exceeding the national averages for both countries.[6] Canela-Soler et al[7] reported higher age-adjusted prevalence of diabetes on the Mexican side of the border (19.5%) vs the US side of the border (16.1%). The rate of diabetes on the US side of the border for persons of Mexican descent is higher compared to persons of Mexican descent and other Hispanic subgroups living elsewhere in the United States.[8]

Diabetes control, defined as a glycosylated hemoglobin (A1C) of <7% (53 mmol/mol) in otherwise healthy adults,[9] is a challenge binationally and specifically to adults with T2DM who reside on the Mexico-US border. Analysis of the 2006 Mexican National Nutrition Survey (ENSANUT) found that only 6.6% of adults with diabetes had an A1C <7% (53 mmol/mol).[2] This is compared to 52.5% of the 2007-2010 US age-adjusted percentage of adults 20 years or older with diabetes who had an A1C <7% (53 mmol/mol), but only 43.5% of Mexican Americans achieved this goal.[10] Specific to the Mexico-US border, findings from a cross-sectional study of 466 adults reported an A1C of <7% (53 mmol/mol) in 42.1% of US Hispanics and 37.6% for Mexicans.[11]

Diabetes has been one of the primary causes of death among men and women in Mexico and the United States since 2000.[2] The economic burden of diabetes related to decreased productivity, disability, and medical costs is staggering. Mexico estimated that the direct and indirect costs of diabetes were US$778 billion in 2010.[12] The United States estimated that total costs of diagnosed diabetes were $245 billion in 2012.[13] The economic burden increases significantly when diabetes-related complications occur.[2,12]

Background

The state of Nuevo Leon is contiguous with the state of Texas. Monterrey is the third largest metropolitan area in Mexico and the capital of Nuevo Leon. Monterrey is the second wealthiest city in Mexico and has been termed the most Americanized city in Mexico.[14] The prevalence of diabetes in Nuevo Leon in 2012 was 15.5%, the highest in all of the regions of Mexico and higher than the national prevalence rates.[15] The prevalence of diabetes in Arizona in 2011 was 8.1% for the total population and 11.8% for Hispanics.[16] The prevalence of diabetes (8.1%) and the percentage of Hispanics in the 4 Arizona border counties exceed the state rates (29.6%).[17] Yuma County had the highest rate of diabetes (13%; 59.7% Hispanics), followed by Santa Cruz County (12%; 82.8% Hispanics).[16] Pima and Cochise counties had the same rate of diabetes (9%)[16] but a smaller Hispanic population (34.6% and 32.4%, respectively) when compared to the other 2 Arizona border counties.[17] Mexicans and US Hispanics living on the Mexico-US border have an increased diabetes burden when compared to their national and state (Nuevo Leon and Arizona) rates.[15-17]

Diabetes practice guidelines, which are not consistent between Mexico and the United States, provide clinicians with the elements of diabetes care (screening, diagnostic, and therapeutic actions), general treatment goals, and tools to evaluate quality of care. In the United States, clinical practice guidelines are based on a literature review conducted by highly trained clinicians and researchers. Evidence from multiple sources (rigorous clinical trials to expert opinion) is used to formulate recommendations that are drafted, reviewed, and submitted to the American Diabetes Association (ADA) Executive Committee for approval.[9] In contrast, Mexico has different sets of guidelines and norms for diabetes treatment. General treatment for diabetes in medical practice was

described in the 1994 Mexican Official Norm (NOM).[18] However, in 2010, a new NOM was released with more updated criteria.[19] Two major health systems in Mexico—Instituto Mexicano del Seguro Social (IMSS) for the private workers sector and Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (ISSSTE) for government workers—and other public health services have their own guidelines.[20] Mexico and US diabetes practice guidelines include routine health care visits, diabetes education, and patient engagement in diabetes self-management behaviors.[9,18-20] The authors found only 1 study conducted with adults diagnosed with T2DM that examined differences in diabetes care between Mexicans and US Hispanics who resided on the Mexico-US border between 2001 and 2002.[11] Despite differences in national diabetes practice guidelines, both countries use the A1C as the gold standard for assessing glucose homeostasis.

There is consistent evidence of increasing rates of diabetes among Mexicans and Hispanics who reside on the Mexico-US border, and there are compelling economic implications for addressing diabetes outcomes.[6,7] However, there is a paucity of data that describe factors influencing diabetes outcomes in this region. Therefore, the purpose of this study was to describe personal characteristics, diabetes self-management behaviors, health care access for diabetes care, and health perception for Mexican adults residing in Monterrey, a municipality of Nuevo Leon, Mexico, and Hispanics residing in 4 Arizona border counties. Research questions guiding this study for each cohort (Mexico and United States) included the following: What diabetes self-management behaviors do participants engage in? Is insurance status a barrier to accessing diabetes care? Does care provided meet national diabetes practice guidelines? What is their perception of health?

Methods

Design

A cross-sectional study design was used to describe the diabetes self-management behaviors, care access and provision of health care, and health perception of the sample.

Sample

The sample for the Arizona cohort was selected from 2014 and 2015 Behavior Risk Factor Surveillance System (BRFSS) surveys. BRFSS is an ongoing, cross-sectional, multistage design developed and currently coordinated and funded by the Centers for Disease Control and Prevention (CDC).[21] The BRFSS is a telephone survey administered to the US adult population to collect uniform state-specific data on health-related risk behaviors, chronic health conditions, and use of preventive services.[21] Data were selected from 4 counties contiguous with the international border: Cochise, Pima, Santa Cruz, and Yuma. The survey was administered in either English or Spanish based on the participant's language preference.

The BRFSS is currently not conducted in Mexico; therefore, the sample for the Mexico cohort was selected using convenience sampling. Potential respondents were recruited from local supermarkets in the metropolitan area of Monterrey, Nuevo Leon. Following informed consent, face-to-face interviews were conducted by trained data collectors using items from the BRFSS in 6 supermarkets in the main cities of the metropolitan area (Monterrey, San Nicolas, San Pedro, Guadalupe, Apodaca, and Escobedo). The study protocol for the Mexican sample was approved by institutional ethics and research committees. Additional information about design, sample, and data collection procedures can be found in McEwen et al.[22]

Potential respondents from both sites were included who met the following criteria: (1) 18 years of age or older; (2) Hispanic or Mexican; (3) living in one of the 4 Arizona border counties or living in one of the main cities of the metropolitan area (Monterrey, San Nicolas, San Pedro, Guadalupe, Apodaca, and Escobedo), Monterrey, Nuevo Leon, Mexico; (5) told by a doctor they have diabetes; and (6) responded to the BRFSS diabetes module questions. Women diagnosed with gestational diabetes were excluded from the study. There was no monetary incentive for participation in the survey.

BRFSS Survey

The BRFSS survey is composed of a set of core questions and optional modules (eg, diabetes). Details about the BRFSS sampling design, purpose, validity, and reliability are available through the CDC website.[23] Demographic variables included age, sex, marital status, education level, employment status, annual household income, body mass index (BMI) >25 kg/m^2, exercise, and smoking status. Health care access included health care insurance and personal health care provider. Diabetes-related services and health management behavior questions included age at diabetes diagnosis, number of years with diabetes, currently taking insulin, frequency of blood glucose checks, checked feet for sores, seen a health care provider for diabetes care, health care

provider checked A1C and feet, eye examination with pupil dilation, told diabetes affected eyes or had retinopathy, and taken a course or class on managing diabetes. Number of years with diabetes was calculated from BRFSS data. Finally, data were collected from 4 health perception questions, including general health, days that physical health and mental health were not good in the past 30 days, and days that poor physical or mental health kept person from usual activities in the past 30 days.

Statistical Analysis

Descriptive statistics were used to describe sample characteristics, aspects of diabetes care, and health perceptions. Because the data sets are not comparable, no statistical comparisons were done. Data were analyzed using the SPSS Statistics version 24 (SPSS, Inc, an IBM Company, Chicago, Illinois).

Results

In total, 567 participants who met inclusion criteria responded to the survey: 351 residing in the metropolitan area of Monterrey, Nuevo Leon, Mexico, and 216 residing in the Arizona border counties. A description of the demographic characteristics of the 2 cohorts is presented in Table 1. The mean age of the participants was slightly higher in the Arizona cohort, with a higher percentage completing high school or greater and having an annual income greater than $20 000 per year. The percent employed and having health insurance were similar across cohorts. In the Arizona cohort, a higher percentage had a personal health care provider and exercised regularly, and a lower percentage were currently smokers.

Diabetes care variables (self-management behaviors, access to and health care provider examinations, medication and diabetes self-management education) are reported in Table 2. Mean age at diabetes diagnosis was slightly higher in Arizona, but mean years with diabetes was similar across cohorts. Respondents in the Arizona cohort reported engaging in more self-management behaviors (blood glucose monitoring and checking feet for sores) while the Mexico cohort reported more visits to their health care provider. The frequency with which the health care provider checked feet for sores and checked A1C in the past 12 months was similar across cohorts. Access to health care providers for diabetes management was not a barrier; over 90% reported having health insurance (Arizona, 92.1%; Mexico, 94.9%), and the majority reported having a personal health care provider (Arizona, 85.2%; Mexico, 75.5%). Despite access to care and diabetes education classes, differences were found for most of the diabetes care requirements.

Table 3 reports findings from health perception questions. Perception of general health and the number of days physical health was not good were similar across cohorts. The mean number of days mental health was not good was higher in the Mexico cohort, while the mean number of days physical and mental health were not good was higher in the Arizona cohort.

Discussion

This study was the first to use BRFSS items to describe demographic characteristics, diabetes self-management behaviors, diabetes health care access, and participants' perception of health between Hispanics in 4 Arizona border counties and Mexicans in Nuevo Leon, Mexico, diagnosed with T2DM. Many of the border studies, while examining diabetes-related variables, focus only on one side of the border. While these findings do not represent the full frontier population, they will be compared with previously reported border studies. The current study examined 60 variables within a unique binational region. The discussion is organized to address the comparisons between the 2 cohorts on demographic characteristics, diabetes self-management behaviors, diabetes care delivered by a health care provider, and participants' perception of health.

In terms of demographic characteristics, in comparison to the 2002 US-Mexico Border Diabetes Study,[11] the most important findings from the current study include older respondent age, a much higher level of education in the Nuevo Leon cohort than the previous Mexican cohort, and the majority on both sides of the border having health insurance, despite higher poverty and unemployment rates in previous border studies.

The education level of respondents in the current study, especially the proportion with a high school education or greater, was higher than a previous border study.[11] A possible explanation for this is that the Arizona BRFSS data represent the entire county, not exclusively communities along the border. In addition, Monterrey is an urban community with several government and private universities and a higher socioeconomic level than other border communities. Therefore, the Arizona and Nuevo Leon data are not likely to be representative of the larger border population. However, in both border cohorts, the average

Table 1

Demographic Characteristics[a]

Characteristic	Arizona Border Counties (n = 216)	Nuevo Leon, Mexico (n = 351)
Sex		
Male	81 (37.5)	131 (37.3)
Female	135 (62.5)	220 (62.7)
Age, mean (SD) [range], y	65.54 (11.1) [34-88]	59.36 (11.5) [31-94]
Marital status		
Married	108 (50.0)	258 (73.5)
Not married	108 (50.0)	92 (26.2)
Education		
Some high school or less	86 (39.8)	235 (67.0)
High school or greater	129 (59.7)	116 (33.0)
Currently employed		
Yes	85 (39.4)	146 (41.6)
No	129 (59.7)	205 (58.4)
Income (US dollars)		
$20 000 or less/year	95 (44.0)	270 (76.9)
Greater than $20 000/year	84 (38.9)	45 (12.8)
Health care insurance		
Yes	199 (92.1)	333 (94.9)
No	17 (7.9)	16 (4.6)
Personal health care provider		
Yes	184 (85.2)	265 (75.5)
No	29 (13.4)	86 (24.5)
Body mass index		
25 kg/m^2 or less	42 (19.4)	58 (16.5)
Greater than 25 kg/m^2	156 (72.2)	260 (74.1)
Exercise		
Yes	146 (67.6)	161 (45.6)
No	63 (29.2)	188 (53.6)
Current smoker		
Yes	21 (9.7)	48 (13.7)
No	65 (30.1)	299 (85.2)

Abbreviation: SD, standard deviation.
[a]Values are presented as number (%) unless otherwise indicated. Numbers vary because of refused or not sure or missing values.

household income is <$20 000. The increase in the unemployment rate (34%-39%) on the Mexican side since the 2002 survey may be due to the limited item response options of employed or unemployed. The 2002 survey was stratified for employed, student, retired, or work in the home. Education and income operate in an inverse relationship with diabetes; the higher the education and income levels, the lower the rate of diabetes. Data from

Table 2

Diabetes Care[a]

Variable	Arizona Border Counties (n = 216)	Nuevo Leon, Mexico (n = 351)
Age at diabetes diagnosis, mean (SD) [range], y	52.54 (13.3) [6-80]	47.31 (12.3) [8-81]
Years with diabetes, mean (SD) [range]	12.53 (11.2) [1-60]	12.26 (9.8) [1-59]
Currently taking insulin		
Yes	67 (31.0)	120 (34.2)
No	148 (68.5)	228 (65.0)
Check blood glucose		
Never	21 (9.7)	79 (22.5)
Daily	131 (60.6)	31 (8.8)
Weekly	45 (20.8)	60 (17.1)
Monthly	11 (5.1)	86 (24.5)
Yearly	2 (0.9)	73 (20.8)
Check feet for sores		
Never/no feet	21 (9.7)	53 (15.1)
Daily	150 (69.4)	199 (56.7)
Weekly	26 (12.0)	66 (18.8)
Monthly	11 (5.1)	13 (3.7)
Yearly	3 (1.4)	7 (2.0)
Times in past 12 months seen HCP for diabetes care, mean (SD) [range]	4.49 (8.3) [0-76]	9.09 (6.8) [0-102]
Times in past 12 months HCP checked A1C, mean (SD) [range]	2.67 (2.3) [0-20]	2.61 (2.7) [0-12]
Times in past 12 months HCP checked feet for sores, mean (SD) [range]	2.12 (2.7) [0-22]	3.54 (4.7) [0-20]
Had eye examination with pupil dilation		
Never	19 (8.8)	142 (40.5)
Within past month	44 (20.4)	29 (8.3)
Within past year	96 (44.4)	90 (25.6)
Within past 2 years	31 (14.4)	23 (6.6)
2 or more years ago	22 (10.2)	56 (16.0)
Told diabetes affected eyes or have retinopathy		
Yes	47 (21.8)	145 (41.3)
No	166 (76.9)	198 (56.4)
Taken a diabetes management course or class		
Yes	109 (50.5)	147 (41.9)
No	105 (48.6)	199 (56.7)

Abbreviations: HCP, health care provider; SD, standard deviation.
[a]Values are presented as number (%) unless otherwise indicated. Numbers vary because of refused or not sure or missing values.

Table 3

Health Perceptions[a]

Health Perception	Arizona Border Counties (n = 216)	Nuevo Leon, Mexico (n = 351)
General health		
Excellent	4 (1.9%)	20 (5.7%)
Very good	18 (8.3%)	30 (8.5%)
Good	66 (30.6%)	109 (31.1%)
Fair	95 (44.0%)	168 (47.9%)
Poor	32 (14.8%)	22 (6.3%)
Days in past 30 days physical health not good, mean (SD) [range]	8.44 (11.6) [0-30]	7.97 (10.1) [0-30]
Days in past 30 days mental health not good, mean (SD) [range]	4.11 (8.4) [0-30]	8.14 (10.4) [0-30]
Days in past 30 days poor physical or mental health kept from activities, mean (SD) [range]	6.69 (10.4) [0-30]	4.15 (8.5) [0-30]

Abbreviation: SD, standard deviation.
[a]Values are presented as number (%) unless otherwise indicated. Numbers vary because of refused or not sure or missing values.

the BRFSS in Arizona indicate that adults who made $15 000 or less had more than twice the rate of diabetes (19.5%) of those who made $50 000 or more (8.3%).[16] Socioeconomic factors, including income, are adversely related to disease incidence, prevalence, and health status. These outcomes are similar to those reported by Pan American Health Organization (PAHO) on the border states.[24]

There are similarities and differences among the 2 cohorts related to health insurance and access to care. Almost all (94.9%) of the Nuevo Leon cohort reported having health care insurance, but 24.5% reported no personal health care provider. In contrast, the ENSANUT 2012 national survey health reported that 21.4% of cases did not have access to care.[25] The high rates of having health insurance may be attributed to the Seguro Popular, which was created to protect the uninsured and has increased the national health coverage for Mexican citizens.[25,26] However, Seguro Popular does not offer a personal health care provider, potentially accounting for why only 75.5% reported having a personal health care provider.[26] The majority (92.1%) of the Arizona cohort reported having health insurance, which is slightly greater than the state rate (85.0%) reported in the 2010 US Census.[27,28] This finding is unexpected, because many of the communities in the 4 Arizona counties with greatest proximity to the border have been designated as medically underserved or rural.[28]

The current study found that a BMI greater than 25 kg/m^2 was similar in the Mexico cohort (74.1%) and Arizona cohort (72.2%), indicating they were overweight. BMI is an indicator of caloric intake and physical activity. The ADA and NOM[9,19] recommend educating patients to have regular physical activity, have moderate caloric intake, and maintain a BMI <25 kg/m.^{2} While respondents in the current study reported higher levels of physical activity as compared to other border studies,[6,29,30] the BMI findings indicate an imbalance between calories consumed and calories expended. Slightly more than half (53.6%) of the Mexico cohort did not exercise compared to 29.2% of the Arizona cohort. The US-Mexico border has been considered an obesogenic region.[6] Factors that contribute to an obesogenic environment include lack of time, physical pain, depression, being overweight, unsafe neighborhoods, lack of facilities for exercise,[6,29-32] a lower socioeconomic class that experiences poor availability and barriers to accessing high quality reasonably priced foods,[6] and the increased availability of affordable and well-marketed processed high-caloric and high-fat foods.[33]

Monitoring blood glucose and checking feet for sores are the 2 diabetes self-management behaviors assessed in the BRFSS diabetes module. Individuals in both cohorts had relatively high rates related to self-foot care, with 69.4% of the Arizona cohort and 56.7% of the Mexico

cohort checking their feet daily, consistent with ADA guidelines for daily foot checks.[9] In addition, the ADA recommends that persons with diabetes monitor their blood glucose daily when engaging in a self-management program.[9] There were differences between the 2 cohorts on the frequency of checking blood glucose. Over half (60.6%) of the Arizona cohort reported checking their blood glucose daily as compared to 8.8% of the Mexico cohort. While the binational diabetes project[6] reported self-monitoring of blood glucose, they did not break down the frequency of the activity. They reported that 56.3% of the US sample and 17.8% of the Mexico sample engaged in self-monitoring of blood glucose. When compared to the current study, the US (Arizona) cohort has increased this self-management behavior while the Mexico cohort's self-monitoring behavior has diminished over time. In the current study, 22.5% of the Mexico cohort reported never monitoring their blood glucose as compared to 9.7% of the Arizona cohort. The BRFSS does not ask whether the participants have a glucometer and the supplies required for monitoring their blood glucose. However, income would be an expected barrier to not engaging in this critical diabetes self-management behavior.

There are consistencies and differences in diabetes care access with both cohorts, specifically medical care provided by health care providers. The majority in both cohorts reported having a personal care provider, but the Mexico cohort saw their health care provider a mean (SD) of 9.09 (6.8) and the Arizona cohort 4.49 (8.3) times in the past 12 months. The health care provider checked A1C a mean (SD) of 2.67 (2.3) times for the Arizona cohort and 2.61 (2.7) times for the Mexico cohort in the past 12 months. The recommended standard for determining if glycemic targets are achieved is performing an A1C at least twice a year for patients who are meeting treatment goals and quarterly for patients who are not meeting glycemic goals or if treatment has changed.[9] An A1C of 7% (53 mmol/mol) or less has been shown to decrease diabetes microvascular vascular complications such as retinopathy and, if maintained following diagnosis, has been associated with a reduction in long-term macrovascular complications.[9,12] According to the ENSANUT 2012 data, only 11.2% of the Mexican population has their A1C level checked annually.[34] Most Mexicans with T2DM and low levels of diabetes education are not familiar with the A1C test, and they frequently confuse the blood glucose test with an A1C.[22,35]

There were differences between the numbers of times in the past 12 months the respondents had their feet examined by the provider (mean [SD]: Arizona, 2.12 [2.17]; Mexico, 3.54 [4.7]). An annual comprehensive foot examination should be conducted for all patients.[18] US foot-related complications among persons diagnosed with diabetes continue to increase despite evidence-based research documenting the effectiveness of comprehensive diabetes foot examinations, conducted by a health care provider, in reducing foot-related complications.[4]

There were differences in eye examinations with pupil dilation. Within the past year, almost twice as many eye examinations were reported by the Arizona cohort (44.4%) as compared to the Mexico cohort (25.6%). Initial and subsequent eye examinations as recommended are critical to prevent blindness caused by diabetic retinopathy.[9] Almost half (41.3%) of the Mexico cohort reported being told diabetes affected eyes or that they had retinopathy, but only 21.8% of the Arizona cohort reported receiving this information. The prevalence of diabetic retinopathy in this study is consistent with findings in another border study.[36] Despite a high prevalence of retinopathy among diabetes patients in Mexico, rates of preventive examination are low.[37] Commonly, patients are not examined until they have severe ocular damage, a scenario that contributes to high retinopathy rates.[2,4,38]

Conclusion

Important insights into diabetes self-management, access to care, and health perception of Mexicans and Mexican American adults with T2DM who reside on the Mexico-US border were gleaned from this study. Despite robust evidence for self-management education and treatment protocols for diabetes control and prevention of complications, a gap continues to exist in translating the evidence into clinical practice and engaging Mexicans and Hispanics who reside on the Mexico-US border in the required diabetes self-management behaviors. Older age, overweight (BMI >25 kg/m^2), sedentary behaviors, and limited engagement in self-management behaviors increase the potential for future diabetes-related complications among this sample. Binational policies addressing factors that perpetuate an obesogenic environment are critical to making progress toward decreasing diabetes health disparities on the border.

There are important limitations of this study, including those of a self-reported sample survey and the method of data collection and potential selection bias related to the convenience sample used with the Mexican cohort. These

data are cross-sectional; therefore, differences in outcomes may reflect a selection bias. Two methods were used to administer the surveys. Arizona cohort data were collected using the BRFSS randomized telephone calls. In the absence of a BRFSS infrastructure, Mexico cohort data were collected using the same BRFSS items as the Arizona cohort but using face-to-face interviews and a different, less structured convenience sample. It is important to note that conducting surveys via telephone in Mexico is not acceptable as most people refuse to speak with persons who are unknown to them. The convenience sample, although collected from 6 cities in the metropolitan area, may not have been representative of the larger population of Monterrey, Nuevo Leon, Mexico. Standardized protocols for data collection, including training of study personnel, were used to minimize interviewer bias between data collectors in the face-to-face interviews.

Other potential limitations include systematic error, nonresponse or refusal to participate, social desirability, recall bias, and health literacy. Specific to the BRFSS survey administered to the Arizona cohort, systematic error may have occurred due to noncoverage and/or limited telephone coverage among populations of low socioeconomic status. Nonresponse or refusal to participate in the survey or to answer specific questions may have contributed to bias. Measurement error may have occurred related to social desirability or recall bias. Last, a potential biasing effect may have occurred related to the different modes of administering the surveys.[39] Recall bias, or the accuracy or completeness of responses, is a major threat to internal validity. Recall bias was minimized by using a standardized data collection protocol and a standardized, well-structured questionnaire.[21,22] Last, there is always the concern that participants may not have understood the questions that were being asked of them due to the educational levels in both cohorts. For example, there was a discrepancy in the Arizona cohort, with the majority reporting they had an eye examination with pupil dilation, but 76.9% reported they had not been told that diabetes affected eyes or that they have retinopathy. This item asked 2 questions; to increase clarity, it should be divided into 2 items.

Implications/Recommendations

Diabetes educators and health care providers who practice in this bicultural/binational environment face many logistic challenges. Important disparities among the 2 cohorts in diabetes self-management and access to care were identified. These disparities will likely persist unless organizational-level policies across the diverse border health care systems enact evidence-based diabetes medical care standards and diabetes self-management education. Diabetes educators and health care providers who approach the Mexico-US border as an integral epidemiological unit in which standards of diabetes care are consistently implemented, health care providers who are knowledgeable of the state of the science for diabetes care, and data collection tools such as the BRFSS and data analyses that are shared have the potential to strengthen diabetes surveillance and binational health policies for decreasing diabetes health disparities. de Cosío et al[38] provide direction for designing and implementing a binational survey and should be followed. Data collected from the binational tool could be used to inform the development, effective targeting, and evaluation of future binational diabetes health interventions. Finally, increasing the research capacity of human capital on both sides of the border must be a priority for meaningful research in which outcomes contribute to decreasing diabetes health disparities in the US-Mexico border region.

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