SOCIODEMOGRAPHIC AND HEALTHCARE CHARACTERISTICS OF *COLONIA* RESIDENTS: THE ROLE OF LIFE STAGE IN PREDICTING HEALTH RISKS AND DIABETES STATUS IN A DISADVANTAGED HISPANIC POPULATION

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An assessment of the risk or diagnosis of diabetes in a random sample of 386 adult border residents found 46% obese, 12% at risk for diabetes, and 18% diagnosed with diabetes. While obesity was associated with greater diabetes risk, > 50% of obese adults reported not being told of their diabetes risk. Independent of other characteristics, boomers were at increased risk (OR 3.88) for diabetes. Comorbidities increased the risk for actual diabetes diagnosis (OR 4.79). Skipping medications increased risk of developing diabetes (OR 2.98). Disadvantaged obese boomers are at particular risk, warranting culturally appropriate interventions before onset of chronic illnesses. (*Ethn Dis*. 2009;19:280–287)

Key Words: Border Health, Diabetes, Life Stage

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INTRODUCTION

Approximately 12 million people live at the United States-Mexican border, and the population is expected to double by 2025.[1] The United States-Mexico Border Health Commission created the Healthy Border 2010 initiative to help optimize health and quality of life in this region. In recent years, diabetes has been recognized as a major health problem at the Texas-Mexico border, where there is a greater prevalence of diabetes, as well as higher diabetes-related mortality rates compared to elsewhere in the nation.[2,3] The Agency for Health Research and Quality has documented poor receipt of recommended services among Hispanic and low-income adults with diabetes.[4,5] Obesity, a major risk factor for diabetes, is disproportionately high in Hispanic populations, especially those living under disadvantaged circumstances.[6] The Pan American Health Organization reports that 72% of adults at the border are overweight and, among those, 34.7% are obese.[7]

Although increased age is a strong predictor of diabetes, more type 2 diabetes is seen in younger, obese populations.[8,9] This changing face of diabetes often overshadows an awareness that the obesity epidemic has also exploded in the baby boomer population. National obesity rates among adults aged >50 years doubled between 1980 and 2001, raising the risk for diabetes in the aging population and contributing to an overall increase in medical care expenditures.[10–12] The life and health contexts of middle-aged adults are important predictors of future healthcare costs. The aging of a poor, unhealthy Hispanic population is likely to add more fuel to escalating diabetes prevalence rates and further strain national healthcare budgets. Thus, more attention must be directed toward the growing population of middle-aged and older Hispanic border residents whose disadvantaged living situations often lead to a disproportionate share of health problems relative to other Americans.[13]

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This article brings attention to minority health and aging issues by examining the life contexts of persons in different age cohorts on a variety of sociodemographic and other risk parameters. Often, disparity-research studies examine differences across ethnic/minority groups. However, this article examines predictors within a predominantly poor Hispanic population living in *Colonias* in Hidalgo County, TX in the Lower Rio Grande Valley. An underlying question for investigation is whether factors typically related to diabetes status in general population studies will remain predictors within this more ethnically homogeneous

study. For example, a well-documented relationship exists between socioeconomic status (SES) and poor health,[14] but whether this gradient will persist in a population characterized by extreme impoverishment is unknown. Our analyses also distinguish between young adults, baby boomers and older adults, permitting a more in-depth analysis of baby boomers than generally conducted in diabetes-related studies.

A goal of this article is to further an understanding of the factors that predict who gets diabetes testing, who is labeled "at-risk," and who receives a formal diagnosis from their healthcare provider. The identification of health and social correlates is important for expanding the knowledge base as well as for targeting services and planning appropriate public health intervention strategies. While our dataset did not include all risk factors associated with diabetes,[15,16] it did include many variables associated with diabetes, in particular, or greater morbidity, in general.[17] In addition to age and obesity, two of the strongest predictors of diabetes,[18] the dataset included other factors which have been examined as diabetes risk factors in Texas *Colonias*[19] such as health status (eg, co-morbidities), sociodemographic variables (eg, education, income, and insurance status), behavioral risk factors (eg, smoking and alcohol use), and access to health care (eg, perceived access problems or difficulties in affording recommended medical care).

METHODS

Setting

This article examines residents in Texas *Colonias*, areas characterized by their persistent poverty status. Population statistics reveal major disadvantages on most sociodemographic indicators.[20] Hidalgo County, which is 89% Hispanic, is designated a "Health Professional Shortage Area and a Medically Underserved Area."[20] Unemployment in Hidalgo County is 13.2%, compared to 6.3% for the state of Texas.[20] Many poor immigrants lack documentation concerning legal residence and employment in the United States severely restricts eligibility for public health insurance.[21]

Data Source and Survey Design

The data for this article come from an evaluation of the Integrated Health Outreach System Project jointly sponsored by the Robert Wood Johnson Foundation and the Health Resources and Services Administration initiated in April 2002. We analyzed data drawn from household interviews in selected *Colonias*, conducted from December 2002 to March 2003 as part of a Health and Healthiness Study. Survey respondents were selected randomly by the selection of census block groups, then households, then residents within households. Trained *Promotoras* (community health workers) conducted the interviews at respondents' residences; 68.8% of the interviews were conducted in Spanish. Participants signed an informed consent approved by the institutional review board at Texas A&M University.

Study Sample

This study sample is composed of a cross section of the *Colonia* population at baseline which included 646 individuals (446 adults and 200 children) living in three *Colonia* areas in Hidalgo County (Faysville, San Carlos and Alton). Our final sample included 386 adults aged ≥18 years (data were missing for 60 respondents).

Measures

Baseline surveys included self-reported items on sociodemographics, health status and risk factors, and availability and use of medical and social services. The major dependent variable was a measure of self-reported diabetes status. A three-response variable was calculated from questions that assessed if respondents had ever been told by a doctor that they had diabetes or were at a high risk for developing diabetes, excluding gestational diabetes. Adults were characterized in one of three mutually exclusive categories: having no risk (no risk), being told they were at-risk (at-risk), or being diagnosed with diabetes by a healthcare provider (diagnosed). While there was not a measure of diabetic control, respondents reported whether or not they had a blood sugar test/diabetes screening in the past (coded as never, more than two years ago, between one and two years ago, and in the past year).

Independent Variables

Three classes of variables associated with diabetes status were identified. Since age is one of the strongest predictors,[22] this variable was conceived in terms of three life stages at the time of the interview: young adults (aged 18–36 years); baby boomers (aged 37–57 years), and older adults (aged ≥58 years). Sex and educational attainment status were also assessed.

Household income was not included since it highly correlates with educational level. We had no measure of immigration status (documented or undocumented), but a proxy measure of residential stability for descriptive purposes, assessed by number of years at current residence, was considered, and categorized into three groups: low residential stability (<3 years at current address); moderate residential stability (4–10 years at the same address); and high residential stability (≥10 years at the current address).

One health-related variable associated with diabetes was obesity.[23] Adults were described as normal weight (body mass index (BMI)=18.5–25), overweight (BMI=25–29.9), obese category 1 (BMI=30–34.9), and obese category 2 (BMI ≥35).[24] There were no underweight study participants (BMI <18.5).

A rough indicator of smoking status (smoking >2 cigarettes a day in the past 30 days) was included. Drinking status was assessed through a measure of how many alcoholic drinks (one bottle/can of beer, glass of wine, mixed drink, or shot of liquor) respondents drank in a week.

A measure of co-morbid status was calculated by summing the number of reported chronic care conditions dichotomized for cross-tabulations into those who experienced ≥3 conditions vs those who reported <3 conditions.

The study included several global assessments for quality health care. Respondents were asked to rate how they assessed access to medical care when they needed it (on a 5 point Likert scale from poor to excellent). A measure of time needed to obtain medical services was assessed by estimating how many minutes it took to get to care, dichotomizing the variable into ≤30 minutes vs a longer period. To describe respondents general medical care access, respondents reported on whether or not they had a regular place to go when they felt sick or needed advice about their health. Other access-type assessments included whether respondents put off seeing healthcare providers (yes/no), skipped medication or treatment because of expense (yes/no), or reported having health insurance (yes/no).

Data Analyses

Statistical analyses were performed using Stata, Version 9.[25] Descriptive statistics were calculated to describe the population in terms of sociodemographic status, health and healthcare status. Chi-square coefficients were employed to determine the existence of significant relationships among categorical variables. We examined relationships with life-stage, the relationship of age and BMI to diabetes screening and diabetes status, and tested the influence of two highly predictive risk factors in this population.

Adjusted multinomial logistic regression models were utilized to examine whether life stage would have an association with diabetes status, independent of other known risk factors such as co-morbidities, socioeconomic characteristics, behavioral risk factors, and health access variables. We included two key sociodemographic factors, sex and education, but chose to exclude residential stability since this factor was seen as an artifact of age (eg, the older one was, the more likely one was to have the opportunity to live in a place longer, and was not found to be related to diabetes risk factors in preliminary bivariate analyses). Additionally, we excluded income because of its relationship to education and to potentially modifiable access variables we wanted to highlight in the model (eg, insurance status, difficulty with access, time to obtain medical care). We included skipping medications as a specific healthcare barrier because of the recent studies revealing the high prevalence of skipping doses to save money.[26] We also wanted to explore the association with two behavioral risk factors associated with diabetes: 1) smoking which has been seen as increasing risk of type 2 diabetes; and 2) alcohol intake. which has a suggested relationship in another *Colonia* population in South Texas.[19]

RESULTS

Sample Characteristics

The sample was primarily Hispanic (97.2%) with >two thirds describing themselves as Mexican or Mexican American. Most had lived at the same address for some time (9.5 years median). The sample was predominately female (61.7%), and married persons (67.6%). The median age was 39.

The disadvantaged status of this population is reflected in several socioeconomic and health access measures. Education levels were low (44.8% had <8th grade education) paralleled by equally low family incomes (56.8% <$11,600 annual income) and lack of any healthcare insurance (58.8%). Putting off health care or skipping medications due to expenses were common phenomena in this population (50.8% and 49.2%, respectively).

Half of the respondents (50.5%) characterized their health as fair to poor, with high rates of reported overweight/obesity and co-morbidities. For example, the median BMI was almost 30. A third of the sample were overweight (33.1%); 27.2% were obese category 1, and 18.5% were obese category 2. Smoking was infrequent (17.1%). The majority (77.7%) didn't drink alcohol on a weekly basis, and <10% drank more than 10 drinks per week. Nearly 20% reported having at least three chronic conditions (eg, high blood pressure, heart disease, cancer, lung disease, arthritis, stroke, osteoporosis, or diabetes).

In respect to diabetes-specific variables, 18.3% reported being told by a doctor that they had diabetes; 12.2% were told by a doctor that they were at high-risk for developing diabetes. Whereas 58.5% reported having a diabetes screening in the past year, 22.5% had never had a diabetes test/screening.

People at the three different life stages can be characterized on selected sociodemographic, health risk, and health care access factors (Table 1). There was a relationship between key study variables and life stage, answering the questions of whether various factors are differentially prevalent at different life stages, and if breaks may occur anywhere in the general distributions. Reporting only on significant relationships determined by a series of Chi-square tests, low education can be seen as more typical among baby boomers and older adults. Similarly, older adults are more likely to have lower incomes.

Severe obesity rates jump dramatically in the baby boomer years relative

Table 1. Characteristics of *Colonia* residents: 2002–2003 baseline survey

	Life Stage			
	Young Adults(%)	Baby Boomers(%)	Older Adults(%)	Total (%)
Sociodemographic				
Female	59.7	66.4	57.8	61.7
Low education*	28.3	55.0	73.4	44.8
Low income*	50.5	55.0	79.7	56.8
Residential stability*	38.2	55.7	73.4	50.0
Health risks				
Severe obesity*	11.9	23.3	28.1	18.5
Smoking	19.4	14.5	15.6	17.1
Co-morbidity*	5.2	22.9	54.7	19.4
Access				
No Regular place for care	31.9	28.2	20.3	28.8
Perceived access problems*	37.2	53.4	48.4	44.6
At least 30 minutes to medical care	37.8	42.5	31.7	38.4
Put off medical care*	53.9	56.5	29.7	50.8
Skip medications	49.2	51.9	43.8	49.2
No health insurance*	67.5	61.1	28.1	58.8

Note: Sample size: $N=386$, except for slight variations due to missing data.
* $P \leq .05$ by chi-square Test for relationships between two variables.

to the younger population (23.3% vs 11.9%). Co-morbidity rates start to climb in the middle years, and accelerate among the older population (5.2% vs 22.9% vs 54.7%). Baby boomers reported the greatest problems with accessing medical care especially relative to younger adults (53.4% vs 37.2%). Older adults are relatively advantaged in comparison to baby boomers and younger adults when it comes to having access to health insurance (28.1% vs 61.1% vs 67.5% don't have insurance, respectively). Older adults are also less likely than the other age groups to put off going to their healthcare provider because visits are too expensive (29.7% vs 56.5% vs 53.9% put off care, respectively).

Bi-variate Correlates with Diabetes and Other Health Risks

Table 2 explores the bi-variate relationship between diabetes status, age and obesity. Examining the percentages of persons reporting that their healthcare providers told them they had diabetes, the percentages for older adults are more than twice as high as those for baby boomers, and more than five times as high as for younger adults (46.9% vs 19.1% vs 7.9%). A greater proportion of baby boomers are likely to be told that they are at-risk for diabetes (but not yet diagnosed) than younger adults (18.3% vs 9.9%). Conversely, the youngest adults are most likely not to see themselves at risk. In terms of screening, the proportion of adults receiving testing accelerates among the baby boomers and is highest in the older adults (66.3% vs 85.5% vs 93.5%).

Those in the normal BMI category are less likely to see themselves at-risk for developing diabetes than those in other weight categories. However, it should be noted that more than half of the persons in the two obesity categories do not see themselves at risk. The percentages of those having been told they are at risk does increase with weight categories, with a more marked increase in proportions starting with the obesity categories. Percentages of diabetes diagnoses also increase among people with higher BMIs, with another marked increase between the overweight and the obesity category levels. Diabetes testing/screening was highly prevalent in this population and was not statistically associated with the four-category BMI.

Multinomial Logit Estimation

In order to evaluate the role of one's life stage on the risk of 1) developing, or 2) having diabetes, relative to 3) no risk of diabetes, a multinomial logit model

Table 2. Bi-variate predictors of diabetes-related variables

	Life Stage			*BMI*			
	Young Adults(%)	Baby Boomers(%)	Older Adults(%)	Normal BMI(%)	Over-weight(%)	Obesity 1 (%)	Obesity 2 (%)
Diabetes Testing/Screening*							
% Yes	66.3	85.5	93.5	72.2	74.0	80.6	82.9
Diabetes Status†							
No perceived risk	82.2	62.6	48.4	81.3	78.4	58.3	57.1
Diabetes risk	9.9	18.3	4.7	7.5	8.0	18.4	15.7
Diabetes diagnosis	7.9	19.1	46.9	11.3	13.6	23.3	27.1

Note: Sample size: $N=386$, except for slight variations due to missing data.
* $P \leq .05$ by chi-square test for relationships between two variables, only significant for life stage.
† $P \leq .05$ by chi-square test for both life stage and BMI.

Table 3. Multinomial logistic model predicting *Colonia* residents' risk of developing or having diabetes. Survey Data from the Integrated Health Outreach (IHOS) Program, 2003–2006

	Outcome 1: At Risk of Diabetes			Outcome 2: Has Diabetes		
	RRR‡	*P* Value	95% CI	RRR	*P* Value	95% CI
Baby boomers	2.32	0.034*	(1.07, 5.05)	0.98	0.97	(0.32, 2.95)
Older Adults	0.88	0.86	(0.20, 3.84)	1.22	0.75	(0.36, 4.14)
Alcohol (drinks) per week	1.02	0.49	(0.97, 1.08)	0.95	0.38	(0.86, 1.06)
BMI = 25–29	1.02	0.98	(0.33, 3.08)	1.63	0.5	(0.40, 6.65)
BMI = 30–34	3.88	0.014*	(1.32, 11.4)	2.32	0.23	(0.60, 9.07)
BMI = > 35	2.76	0.086†	(0.23, 0.86)†	3.42	0.096†	(1.02, 11.52)†
Co-morbidities > 3	1.2	0.34	(0.83, 1.72)	4.79	0.0*	(3.20, 7.18)
Education <8th grade	0.37	0.016*	(0.17, 0.83)	1.27	0.59	(0.52, 3.10)
Difficulty to access medical care	0.92	0.83	(0.45, 1.91)	0.55	0.17	(0.23, 1.30)
Time to medical care > 35 min	0.45	0.044*	(0.20, 0.98)	1.54	0.36	(0.61, 3.86)
Smoker	0.54	0.27	(0.18, 1.61)	2.98	0.06†	(1.12, 7.94)†
Female	1.66	0.2	(0.76, 3.64)	0.36	0.03*	(0.14, 0.91)
Uninsured	1.56	0.27	(0.71, 3.44)	1.19	0.73	(0.45, 3.15)
Skips Medication	2.98	0.004*	(1.40, 6.33)	1.12	0.8	(0.48, 2.62)

Note:
Referent group: At no risk of diabetes
Pseudo R-Square = .36
* Significant at P ≤ .05
† Significant at P ≤ .10 or 90% confidence interval.
‡ Relative risk ratio (similar to odds ratio)

[mlogit] using Stata 9 was employed.[25,27–28] In Table 3, the dependent variables are reported as two categories: Outcome 1= at-risk of diabetes; Outcome 2=has been diagnosed with diabetes (with neither diagnosed or at-risk serving as the referent category). These outcomes were reported as odds ratios since they are very similar. The odds ratios or relative risk ratios for multivariate analyses confirm the importance of life stage as well as health status on the odds that *Colonia* residents are at-risk of developing diabetes or have been diagnosed with diabetes, controlling for other sociodemographic, behavioral and health access variables.

For Outcome 1 (at-risk of diabetes), Table 3 shows that the odds of developing diabetes was 2.3 times higher for baby boomers than it was for young adults (95% CI: 1.07–5.05, $P < .03$); with significantly elevated odds if one's BMI was 30–34 (OR = 3.9, 95% CI: 1.32–11.36, $P < .01$), the odds for BMI > 35% were significant only at the $P < .10$ level but did indicate elevated odds at 2.8 times greater than the odds for those with normal BMI (90% CI: 0.23–.86, $P = 0.08$). The importance of taking medication is confirmed in the reported odds for those who skip medication. The odds of being at risk for diabetes are nearly three times higher if one skips medication (OR = 2.98, 95% CI: 1.41–6.33, $P < .001$). Somewhat surprisingly, the odds ratio for low education (below 8th grade) is 63% lower (OR = .37, 95% CI: 0.17–.0.83, $P < .016$) than the odds for adults with higher than 8th grade education. Likewise, the odds of being at-risk for developing diabetes for those who must drive more than 30 minutes to see a healthcare provider are 55% lower (OR = .44) than they are for persons who drive less than 30 minutes (95% CI: 0.20–0.98, $P < .04$).

The Outcome 2 category (diagnosed with diabetes) was also analyzed at the same time using the same mlogit model. In Outcome 2 the odds of having diabetes were strongly associated with having other chronic conditions (co-morbidities). The odds of having diabetes were nearly five times as high as (OR = 4.8) for those with multiple co-morbidities (95% CI: 3.20–7.18, $P < .000$). Severe obesity, (elevated BMI > 35%) presented a risk or odds that someone was 3.4 times more likely to develop diabetes than those who were not obese, however this outcome was significant only at $P = .10$ (90% CI: 1.02–11.52). Smokers are nearly three times more likely than nonsmokers to develop diabetes (OR = 2.98) but this outcome was significant only at $P = .06$ (90% CI: 1.12–7.94). Conversely, females are 64% less likely than males to have diabetes ($P < .03$, 95% CI: 0.14–0.91).

DISCUSSION

This study emphasizes the triple jeopardy of poor Hispanics of Mexican origin living at the Texas border. As illustrated in this study, diabetes prevalence rates in the *Colonia* cohort increased with age, with almost half of the older adults having been diagnosed

As illustrated in this study, diabetes prevalence rates in the Colonia *cohort increased with age, with almost half of the older adults having been diagnosed with diabetes.*

with diabetes. This finding is consistent with other studies indicating high rates of diabetes among Texas Hispanics[29] and especially high rates for Hispanics living in *Colonias* in Texas.[18,30]

The rates reported in this Texas border study are dramatically higher than those reported statewide and confirm the pattern of ethnic/minority populations experiencing onset of disease at earlier ages than their non-ethnic counterparts.[18] Comparisons with statewide prevalence data at approximately the same time period[18] document these regional health disparities among both baby boomers and older adults, with particularly large disparities among the oldest age groups (eg, 46.9% of Hispanic adults, aged ≥ 58 years, living at the border report being diagnosed with diabetes vs. 19.1% for those ≥65 statewide). [18] These analyses illuminate age-based profiles for health risk and diabetes-related outcomes in an exceptionally disadvantaged population, where little prior attention has been paid to the interaction of demographic, health, and healthcare access factors across different life stages.

Some findings were less intuitive and bear further discussion. Reported access to health care was high, with the majority of respondents (71.2%) reporting having a regular place to go for health care. This may reflect the impact of increases in the presence of Federally Qualified Health Centers in these Colonias with active *promotoras* outreach. It is unclear why those with the lowest education levels reported being less likely to be told they are at-risk for diabetes, but perhaps persons with low education levels are not absorbing information about risks received from their doctors, and they are also in the ranks of those with undiagnosed diabetes.[31] Another possible explanation is that individuals with low education levels also have a limited English proficiency levels, affecting their access to health information or communication with doctors. Just as surprising, the educational level was not related to reports of a diabetes diagnosis. In this case, low education is probably related to other stronger factors, eg, co-morbidities and severe obesity; we also found less variance in this generally impoverished population. Similarly, one can only speculate why those living further away from medical care are less likely to be told they are at-risk of diabetes. Those living further away from their medical provider may not be coming in as often and hence not having similar opportunities for feedback from their doctors, or they may be coming in only for specific treatments unrelated to diabetes.

Age differentiations were not always consistent with the youngest cohort being disadvantaged in terms of health insurance coverage, the baby boomers reporting the most difficulty in access to care when they needed it and having to put off medical appointments and skip medications due to expense, and the oldest adults having the highest obesity rates and co-morbidities.

These analyses suggest intervention points for those at-risk for diabetes vs being diagnosed with diabetes by a doctor. Baby boomers' increased risk for developing diabetes might be an opportunity to intervene before this population develops diabetes. Similarly, those at early stages of obesity can be identified for medical and lifestyle interventions, which might help deter the course of the disease.[32] Skipping medications due to cost is a common strategy for making ends meet, but one which it is hoped will be attenuated with the introduction of Medicare Part D coverage, at least for eligible recipients.[33] Until then, continued medication assistance programs for the near elderly is recommended.

Although obesity is a major risk factor, a large number of obese adults do not see themselves at-risk, or report that they had never been screened or tested for diabetes. This suggests improvements in the implementation of diabetes prevention are needed and that management education and clinical guidelines are warranted for this population. Understanding the influence of cultural beliefs on the prevention of diabetes should be considered when implementing culturally sensitive interventions for this population.

Fewer predictors of having been diagnosed with diabetes were found in multivariate analyses that controlled for many of the known risk factors. Co-morbidity emerged as a very strong predictor, which might attenuate the independent influence of increased age, as co-morbidities increase with age, but seemingly at an earlier age in disadvantaged Hispanic adults living at the border.[34] While many other conditions co-exist with diabetes and may be thought of as a potential consequence of diabetes, it is also possible that having other chronic conditions brings one to the attention of the healthcare system, where detection and diagnosis are more likely. It might also be that factors which increase the likelihood of co-morbidities (eg, age, obesity, poverty, lack of access) are exactly the same factors which are predictive of a diabetes diagnosis.

Culturally sensitive interventions to prevent obesity and diabetes among Hispanics living at the US- Mexican border are urgently needed. Interventions should target this population with appropriate age-based interventions and should address diabetes-related cultural beliefs and promote physical activity and nutrition as ways to develop a

healthy lifestyle. It is hoped that the Healthy Border 2010 initiative,[1] reinforced by the World Health Organization's recent awareness of diabetes as a major threat to global health[35] will contribute to age-sensitive policies and programs that can make a difference and help improve the health and quality of life for border Hispanics of all ages.

The urgency for action is underscored by new statewide projections for obesity in Texas that take into account expected demographic trends such as an aging population and increasing ethnic populations.[36] Without concerted prevention efforts, Texas can expect to have 15 million obese adults by 2040. These staggering numbers will be associated with escalated rates of diabetes, loss of functioning and independence, and increased healthcare costs.[37] High obesity and diabetes rates in border counties are a harbinger for higher rates that are likely to be seen throughout Texas as our population shifts, with the rest of the state potentially having the same high diabetes rates that the border now experiences.

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