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Neighborhood Perceptions and Health-Related Outcomes among Latinos with Diabetes from a Rural Agricultural Community

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Abstract

Little is known about how neighborhood perceptions are related to diabetes outcomes among Latinos living in rural agricultural communities. Our objective was to examine the association between perceived neighborhood problems and diabetes outcomes. This is a cross-sectional survey study with medical record reviews of a random sample of 250 adult Latinos with type 2 diabetes. The predictor was a rating of patient ratings of neighborhood problems (crime, trash and litter, lighting at night, and access to exercise facilities, transportation, and supermarkets). The primary outcomes were the control of three intermediate outcomes (LDL-c <100 mg/dl, A1C < 9.0%, and blood pressure (BP) < 140/80 mmHg), and body mass index (BMI) < 30 kg/m². Secondary outcomes were participation in self-care activities (physical activity, healthy eating, medication adherence, foot checks, and glucose checks). We used regression analysis and adjusted for age, gender, education, income, years with diabetes, insulin use, depressive symptoms, and comorbidities. Forty-eight percent of patients perceived at least one neighborhood problem and out of the six problem areas, crime was most commonly perceived as a problem. Perception of neighborhood problems was independently associated with not having a BP < 140/80 (Adjusted odds ratio [AOR]= 0.45; 95% CI: 0.22, 0.92), and BMI < 30 (AOR=0.43; 95% CI: 0.24, 0.77), after controlling for covariates. Receipt of recommended processes of care was not associated with perception of neighborhood. Perception of neighborhood problems among low-income rural Latinos with diabetes was independently associated with a higher BMI and BP.

Keywords

Latinos; neighborhood; health behaviors; rural; diabetes

INTRODUCTION

Neighborhood and environment are important determinants of health in addition to individual characteristics and contributions of the health care system. Individuals living in poor neighborhoods are at increased risk of obesity, diabetes, and cardiovascular disease. [1–3] For the 26 million in the United States that have diabetes, [4] neighborhood plays an important role in health and health behavior. Clinical guidelines recommend that patients with diabetes eat certain foods, exercise regularly and participate in other recommended self-care activities. [5] These recommendations can be difficult to follow for individuals that have limited access to stores that sell healthy foods and places to exercise. [6–9]

For Latinos that face disparities in diabetes care, [10–14] residing in low-income areas with crime, litter, and dilapidated housing may produce complicated psycho-social perceptions of their neighborhood that discourage these healthy behaviors. In one study of managed care patients, perceived neighborhood problems were independently associated with poor health behaviors and elevated blood pressure among individuals with diabetes. [15] No other study that we are aware of has investigated the relation between perceived neighborhood problems and worse self-care behaviors and poor health-related outcomes among those with diabetes. [15–19] We know even less about how neighborhood problems might influence these outcomes in Latinos with diabetes. Among Latinos, neighborhood economic disadvantage is an important predictor of self-rated health status, [20] but paradoxically living in areas with higher numbers of Latinos may confer some protection to health. [21] Latinos from rural agricultural communities have been historically among the most disadvantaged in the United States. How the rural residential context may affect their participation in beneficial self-care behaviors has not been studied. [22–24]

In this study, we examined whether perceived neighborhood problems were independently associated with health behaviors and diabetes-related clinical outcomes among rural Latinos. We hypothesized that perceived neighborhood problems would be associated with less participation in recommended self-care behaviors and poor diabetes-related outcomes.

RESEARCH DESIGN AND METHODS

Conceptual Framework

We used Brown et al.'s conceptual framework of socioeconomic position and health among persons with diabetes mellitus [25] to guide our study and explain the interplay of neighborhood with diabetes-related outcomes. The model posits that two types of factors (proximal and distal) influence the relation between socioeconomic position and health for persons with diabetes. Proximal factors include health behaviors, processes of care, and access; and distal factors include characteristics of persons with diabetes, their health care system including providers, and their communities or neighborhood. In this model, critical covariates (age, gender, and race-ethnicity) may have an independent effect on the relation

between neighborhood and health. Poor persons with diabetes are more likely to experience different elements of poor neighborhoods such as higher priced foods, dilapidated housing, and high crime. [26] Figure 1 is a simplified schematic of the conceptual framework adapted for this study.

Setting

We used principles of community-based participatory research (CBPR) that included both academic and community partners working collaboratively in all aspects of the research from study design to dissemination. [27, 28] The study was conducted in partnership with a large migrant health center that provides safety-net care in two rural counties in California's San Joaquin Valley, an agricultural region with long-standing poverty. [29] One of these counties ranks worst in the state for obesity prevalence and in the bottom five for overweight, participation in physical activity, and consumption of fruits or vegetables. [30, 31] The region has one of the highest diabetes prevalence rates in this state [32] and patients with diabetes from this region have a high risk for poor diabetes outcomes. [33, 34]

Sample and data sources

We conducted a cross-sectional survey between July 2009 and January 2010 among 250 Latino adults with diabetes. Study inclusion criteria were: (1) self-identified as Latino; (2) spoke Spanish; (3) had a current diagnosis of diabetes type 2; (4) 18 years of age or older; and (5) at least two primary care visit for diabetes care in the last 12 months.

A list of potential participants was generated from an electronic diabetes registry (n=5,128). The registry captures health information for over 90% of diabetics in the system. Clinic staff randomly called eligible patients and asked them to participate in the survey study. The survey was administered by telephone in Spanish after verbal consent was obtained. Patients were called up to 15 times during different days and times of the week and the survey response rate was 68%. Inaccurate contact information was the primary reason for survey non-response. The medical chart of all survey participants was reviewed for the most recent blood pressure, height, and weight. The survey was pre-tested with volunteer patients and bilingual health workers to assess the skip pattern. The study was approved by the RAND (Santa Monica, CA) protection of human subjects review committee (IRB).

Main independent variables

The primary predictor variable was perceived neighborhood problems as measured with validated items that were adapted from the Translating Research into Action for Diabetes (TRIAD) study. [15, 35] Participants were asked "thinking about where you live, how much of a problem are each of the following issues: (1) Crime in area; (2) Access to exercise facilities; (3) Trash and litter; (4) Lighting at night; (5) Access to public transportation; and (6) Access to supermarkets. Response options for each item were: *very serious, somewhat serious, minor, or not a problem.*" Responses to this set of items (Cronbach's alpha = 0.86) were summed to calculate a summary score (range: 1–24, mean 21, best = 24). Because the distribution of the summary score was skewed, patients were classified into two groups (no problems *versus* one or more problems). Those that responded *not a problem* to all six items were put into the no problem category.

Dependent variables

Dependent variables examined were hemoglobin A1C (A1C), LDL-cholesterol (LDL-c), blood pressure (BP), and body mass index (BMI). The patient medical records were reviewed 1 to 4 weeks after the interview using a published chart abstraction tool. [35] BMI was calculated using patient's weight and height obtained from medical record and classified as normal weight (BMI<25 kg/m²), overweight (BMI 25–30 kg/m²) and obese (BMI>30 kg/m²). A1C, LDL-c, BMI, and BP values were all collected through electronic registry and medical record reviews and dichotomized as A1C <9%, LDL-c < 100 mg/dL, BMI < 30 kg/m², and BP < 140/80 mmHg based on recommended clinical targets. Receipt of 6 recommended diabetes processes of care [36] was ascertained by asking patients if in the last 12 months they had received: a dilated eye exam, flu vaccine, foot exam, LDL-c blood test, A1C blood test, and were taking or recommended aspirin (all dichotomous: *yes* or *no*). We used the Summary of Diabetes Self Care Activities (SDCA) questionnaire to measure patient participation over the last seven days in foot care, eating a healthy diet, exercise, medication adherence, and glucose self-monitoring. [37]

Other variables

Based on Brown et al.'s conceptual model, we measured other important variables. Patients were queried about their satisfaction with their neighborhood with one global item (All things considered, which of the following best describes your neighborhood as a place to live - would you say you are *very satisfied*, *satisfied*, *dissatisfied* or *very dissatisfied*?). [35] The presence of depressive symptoms was measured with the Patient Health Questionnaire 2 (PHQ-2). [38, 39] Self-reported health status was measured by asking participants, "In general, would you say your health status is: excellent, very good, good, fair or poor?" and classifying responses into excellent/very good/good, fair or poor. Severity of diabetes was ascertained by determining the years with diabetes and use of insulin. Co-morbidities were captured from the medical chart (hypertension, elevated cholesterol, coronary heart disease, congestive heart failure, cirrhosis, chronic kidney disease, asthma, cerebrovascular disease, and emphysema [dichotomous: *yes* or *no*]). We also examined household size, housing type and the number of years a patient lived in their current location.

We examined several patient sociodemographic characteristics: age (categorized as 21–39 years, 40–49 years, 50–59 years, 60–69 years, or 70 years), gender, marital status, birthplace (United States, Mexico, or other country), years in the U.S., and education (categorized as 0–6 years, 7–11 years, or 12 years of regular school completed). Patients were asked about utilization (number of doctor visits, and emergency visits) in the last 12 months, health insurance coverage of any kind (dichotomous: *yes* or *no*), and yearly household income (0–12,499 dollars, 12,500–17,499 dollars, 17,500–24,999 dollars or 25,000 or more dollars).

Statistical analyses

We computed distributions for our dependent and independent variables and then performed bivariate analyses of perceived neighborhood problems by patient demographic characteristics and health-related measures. Bivariate associations were assessed using ² tests of association for categorical variables and one-way analysis of variance for continuous

variables. For all analyses reported in this study, a p -value of < 0.05 was used to determine statistical significance. Stata version 11.1 (College Station, TX) was used for these analyses.

In the regression models we controlled for age, gender, education, household income, the number of co-morbidities, use of insulin, and years with diabetes. Covariates were included if they were potential confounders based on Brown et al.'s conceptual model, [25] our review of the literature or if they were statistically significant in bivariate analysis. Logistic regression models were computed for each outcome variable (A1C $< 9\%$, LDL-c < 100 mg/dL, BMI < 30 kg/m², and BP $< 140/80$ mmHg). We performed the analysis using the summary neighborhood problems score as a continuous variable but found little difference from that reported (data not shown). We also conducted *post-hoc* analyses to assess whether including the number of clinic visits, number of ER visits, years in the U.S., and birthplace affected the magnitude or direction of coefficients but the results were similar to those reported (data no shown).

We conducted a series of staged linear regression models for BMI to isolate the effect of neighborhood form proximal variables (health behaviors) found to be significantly associated with BMI. In model 1, we included age, gender, education, years with diabetes, and exercising (proximal variable). In model 2, we controlled for model 1 covariates and neighborhood perception. In model 3, we controlled for model 2 covariates plus depressive symptoms.

RESULTS

Forty-eight percent of patients perceived at least one neighborhood problem. The percentage of patients that perceived each of the six different neighborhood areas as a problem ranged from 21% to 32%. Out of the six problem areas, crime was the most commonly perceived problem compared to the other areas. Table 1 describes differences in sociodemographic and health-related characteristics among participants by perceived neighborhood problems.

Among patients that perceived one or more neighborhood problems, mean BMI was higher (35.8 vs. 32.4 kg/m², $p < 0.01$) and mean PHQ-2 scores were higher (2.0 vs. 1.6, $p < 0.001$) than those without perceived problems. Patients that perceived one or more neighborhood problems were more likely to be *dissatisfied/very dissatisfied* with overall neighborhood satisfaction ($p = 0.001$) compared to those that did not perceive a neighborhood problem.

Mean systolic BP was 4.5 mm Hg higher ($p = 0.06$) for patients that perceived neighborhood problems compared to those without neighborhood problems. Mean A1c and LDL-c levels did not differ by neighborhood problems. Table 2 shows the unadjusted proportion of patients with control of intermediate clinical outcomes (LDL-c, A1C, BP, BMI), participation in self-care activities, and rates of receipt of recommended processes of care for participants stratified by whether they perceived one or more neighborhood problems. Those with neighborhood problems were less likely to have a BMI < 30 kg/m² and/or a BP $< 140/80$ mmHg and less participation in self care (physical activity/exercise, healthful eating, and self-foot exams) compared to counterparts without perceived problems (all $p < 0.05$). There were no statistically significant differences in receipt of processes of care by

groups. Patients with perceived problems were more likely to participate less in health behaviors (physical activity and exercise, healthful eating, self-foot exams).

Table 3 shows results from the logistic regression analysis for the 4 primary outcomes (A1C < 9%, BP < 140/80mmHg, LDL-c < 100 mg/dL, BMI < 30 kg/m²) as a function of perceived neighborhood problems controlling for demographic characteristics, years with diabetes, insulin use, exercise/physical activity, and PHQ-2 scores. Table 4 shows the linear regression results for BMI as a function of exercise/physical activity behavior. In model 2 of Table 4, the addition of perceived neighborhood problems slightly attenuated the independent effect of exercise/physical activity on BMI. The addition of depressive symptoms in model 3 did not attenuate the effect of participation in exercise/physical activity. In the final model (3), for each additional day of participation in exercise/physical activity, BMI decreased by 0.5 kg/m². Perception of neighborhood problems was associated with a 2.9 kg/m² increase in BMI compared to their counterparts.

DISCUSSION

In this study, we found that perceived neighborhood problems were independently associated with less participation in exercise and elevated BP and BMI. Exercising did not appreciably attenuate the positive association between neighborhood perception and BMI. We also found that depressive symptoms were independently associated with perception of neighborhood problems. We did not find a significant association between perception of neighborhood problems and levels of A1C and LDL-c. as measured. Our main findings are in agreement with Brown et al.'s conceptual framework that predicts that neighborhood problems are associated with health-related outcomes for persons with diabetes.

This is the first study that we are aware of that examines the association between perceived neighborhood problems and diabetes outcomes among rural Latinos. Obesity and diabetes are serious health problems in this population. This study adds to the few existing studies of neighborhood perception among those who already have diabetes. [1, 15, 18, 19, 40, 41] Our results are in agreement with a similar study that focused on patients with diabetes in managed care that linked perception of neighborhood problems with health behaviors [15], and extend those finding to include these results for rural Latinos with diabetes. Latinos are now the largest minority group in the country and face disparities in diabetes care. [10–14] This study focuses on understudied and vulnerable patients in care at a large migrant health center and makes a unique contribution to the literature.

Our finding that neighborhood perception is independently associated with depressive symptoms is in agreement with studies of other populations. [42–44] Income and receipt of recommended processes of care [41] were not associated with perception of neighborhood. Because our sample of patients have access to culturally and linguistically appropriate care (35 year-old migrant center) [45] and represents a compressed portion of the SES gradient (rural low-income Latinos), we think that this was due to lack of variation in the sample and is therefore not surprising.

This study has limitations. The cross-sectional design does not allow for inference of casual relationships. We used self-reports which are subject to recall bias and socially desirable answers. Our results cannot be generalized to all patients with diabetes, other chronic conditions or all Latinos. We focused on one rural agricultural region and the results may also not be generalized to other farmworker communities or agricultural regions in the country. We cannot entirely discount reverse directionality of the associations observed or that poor health leads to perceived neighborhood problems. There is evidence that neighborhood environment contributes to health, [3] but the mechanism remains unclear. Perceived neighborhood problems may not reflect objective differences across neighborhoods, [46] but previous studies have found that perceived neighborhood problems correlate well with objective measures of neighborhood such as census tract indices of SES disadvantage status. [15, 47–50] Subjective measures of neighborhood [51] are better suited for studying its relationship with individual behaviors such as exercising and healthy eating. [42, 52–54]

Our results have policy and research implications. Studies indicate that individual factors and health care do not explain the entire disparities gap for racial-ethnic minorities and that the context of residential place contributes significantly. [55] Addressing social determinates of health are particularly important targets for interventions in this rural population. A CBPR approach allowed us to reach this understudied population. [27, 28]

There is a need for the implementation of place-based or community-based health interventions that simultaneously address individual and system-based factors to improve health behaviors that affect health outcomes among vulnerable patients with diabetes.

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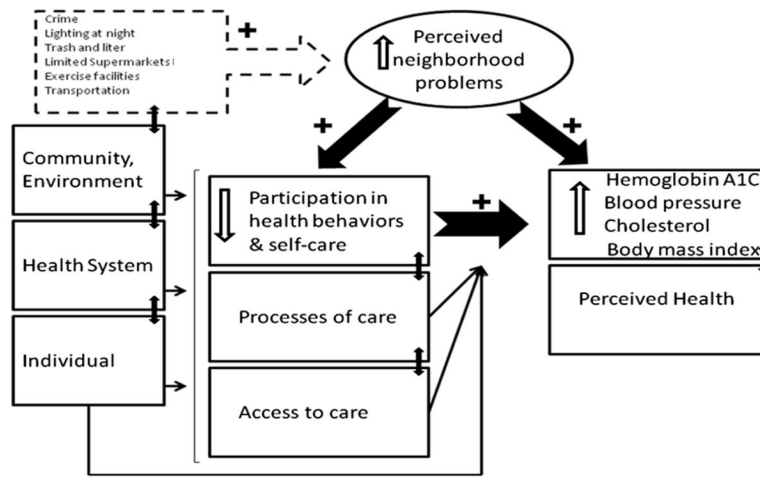


Figure 1. Conceptual Framework Source: Brown, A.F., et al., *Socioeconomic position and health among persons with diabetes mellitus: a conceptual framework and review of the literature.* Epidemiol Rev, 2004. 26: p. 63–77.

Table 1

Associations between patient characteristics and perceived neighborhood problems among rural Latinos with diabetes (N=250)

	Perceived Neighborhood Problems*		
	No problems (n= 131)	One or more problems (n= 119)	P [†]
Age, years, %			
18–39	11.6	10.7	0.50
40–49	26.4	24.8	
50–59	22.5	32.2	
60–69	21.7	19.0	
70	17.8	13.2	
Female, %	56.8	61.7	0.44
Married/Living with someone, %	78.1	74.8	0.35
Education, years, %			
0–6	62.6	65.2	0.82
7–11	19.2	16.0	
12	18.1	18.8	
Income, yearly, %			
\$0–12,499	34.9	27.1	0.68
\$12,500–17,499	22.9	25.9	
\$17,500–24,999	20.5	25.9	
\$25,000 or more	21.7	21.2	
Birthplace, %			
U.S.	18.5	17.7	0.73
Mexico	78.5	77.3	
Other country	3.1	5.0	
Years in the U.S., mean (SD)	30.7 (15.9)	29.6 (16.3)	0.59
Years in current community, mean (SD)	15.8 (13.6)	13.4 (11.4)	0.15
Live in single family home or house, %	84.0	79.8	0.40
Household size, mean (SD)	4.4 (3.3)	4.1 (1.8)	0.54
Neighborhood satisfaction [‡] , %			
Very satisfied	23.2	14.0	0.001
Satisfied	72.2	68.6	
Dissatisfied/Very dissatisfied	4.7	17.4	
Self-assessed health status [‡] , %			
Poor	7.4	14.4	0.18
Fair	66.1	64.4	
Good/Very Good/Excellent	26.5	21.2	
PHQ-2 score [§] , mean (SD)	1.6 (.7)	2.0 (1.0)	<0.001

	Perceived Neighborhood Problems*		
	No problems (n= 131)	One or more problems (n= 119)	<i>P</i> [†]
Insurance, any, %	59.1	55.5	0.57
Years with diabetes, mean (SD)	9.4 (8.1)	10.3 (9.9)	0.40
Insulin use, %	19.9	21.9	0.70
Body mass index (BMI) kg/m ² , mean (SD)	32.4 (8.0)	35.8 (10.5)	0.004
Number of ER visits, // mean (SD)	0.57 (1.6)	0.54 (1.5)	0.88
Number of primary care visits, // mean (SD)	0.57 (2.3)	3.8 (3.1)	0.64

* 1) crime in area, 2) access to recreational or exercise facilities, 3) trash or litter, 4) lighting at night, 5) access to public transportation, and 6) access to a supermarket;

[†] calculated using χ^2 statistical test;

[‡] assessed with one global health item;

[§] range: 1–4; best = 1; mean for the two PHQ-2 questionnaire items, Cronbach's alpha 0.85;

// mean number of visits during the last 12 months;

** range 1–7; best =7, days of participation in self-care activity/behavior over the last week

SD=standard deviation

Table 2

Unadjusted percentages of patients with control of measures for diabetes outcomes, care, and health behaviors by perceived neighborhood problems among Latinos with diabetes (N=250)

	Perceived Neighborhood Problems [†]		
	No problems	One or more problem	P-value [‡]
Clinical Outcomes			
Hemoglobin A1C <9%	80.3	76.2	0.43
LDL-cholesterol < 130 mg/dL	87.9	84.2	0.41
Blood pressure < 140/80 mmHg	90.2	80.7	0.02
Body Mass Index (BMI) < 30 kg/m ²	41.7	23.3	0.001
Health Care (receipt of processes of care)[§]			
Aspirin, or recommended aspirin by provider	75.2	77.3	0.72
LDL-cholesterol test checked	82.2	83.1	0.81
A1C test checked	56.8	54.1	0.65
Foot exam	39.7	42.0	0.71
Flu vaccine	43.1	50.4	0.35
Eye exam	58.5	51.3	0.25
Health Behaviors			
Participation in Self-Care Activities, [*] mean (SD)			
Physical activity & exercise	3.57	2.91	0.03
Healthful eating plan	5.54	4.93	0.02
Self-foot exams	1.46	0.57	<0.001
Glucose checks	4.61	4.87	0.43
Medication adherence	6.89	6.73	0.12

* In the last seven days

[†] 1) crime in area, 2) access to recreational or exercise facilities, 3) trash or litter, 4) lighting at night, 5) access to public transportation, and 6) access to a nearby supermarket. Cronbach's alpha = 0.86.

[‡] calculated using chi square statistical test

[§] during the last 12 months

Table 3

Adjusted odds ratios of control of outcomes by perceived neighborhood problems among rural Latinos with diabetes (N=250)

<i>Perceived Neighborhood problems</i> *	<i>BP < 140/80 mmHg</i> AOR (95% CI)	<i>A1C < 9%</i> AOR (95% CI)	<i>LDL-c < 100 mg/dL</i> AOR (95% CI)	<i>BMI < 30 kg/m²</i> AOR (95% CI)
One or more problems	0.45 [†] (0.22, 0.92)	0.71 (0.37, 1.37)	0.89 (0.52, 1.51)	0.43 [‡] (0.24, 0.77)
No problems	ref	ref	ref	ref

Note: adjusted for age, gender, education, income, years with diabetes, insulin use, number of co-morbidities, and PHQ-2 mean score

* 1) crime in area, 2) access to recreational or exercise facilities, 3) trash or litter, 4) lighting at night, 5) access to public transportation, and 6) access to a supermarket; Cronbach's alpha=0.86

[†] p < 0.05

[‡] p < 0.01

AOR = adjusted odds ratio; 95% CI = confidence intervals; BP = blood pressure; BMI = body mass index; ref= reference category

Adjusted linear regression for BMI as a function of perceived neighborhood problems, health behaviors, and depressive symptoms, and other variables among rural Latinos with diabetes (N=250)

Table 4

	Model 1		Model 2		Model 3	
	β	SE	β	SE	β	SE
Health Behaviors						
Exercise/physical activity	-0.58	0.23	-0.47	0.23	-0.49	0.24
Perception of Neighborhood*						
No problems	---	---	-2.98	1.22	-2.85	1.24
One or more problem	---	---	ref	---	ref	---
Depressive Symptoms [†]	---	---	---	---	0.43	0.79
R ²	0.119		0.138		0.144	

All models adjusted for age, gender, education, income, number of co-morbidities, years with diabetes, and insulin use

Bold = P-value < 0.05

* perceived problems = 1) crime in area, 2) access to recreational or exercise facilities, 3) trash or litter, 4) lighting at night, 5) access to public transportation, and 6) access to a supermarket; Cronbach's alpha=0.86

[†] measured with PHQ-2

β = beta coefficient

SE=standard error

ref = reference category