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Food Insecurity and Low Self-efficacy are Associated with Health Care Access Barriers Among Puerto-Ricans with Type 2 Diabetes

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Abstract

Racial/ethnic minorities are disproportionately affected by barriers to health care access and utilization. The primary objective was to test for an independent association between household food insecurity and health care access/utilization. In this cross-sectional survey, 211 Latinos

(predominantly, Puerto-Ricans) with type 2 diabetes (T2D) were interviewed at their homes. Factor analyses identified four barriers for health care access/utilization: enabling factor, doctor access, medication access and forgetfulness. Multivariate logistic regression models examined the association between each of the barrier factors and food insecurity controlling for sociodemographic, cultural, psychosocial, and diabetes self-care variables. Higher food insecurity score was a risk factor for experiencing enabling factor (OR = 1.46; 95% CI = 1.17–1.82), medication access (OR = 1.26; 95% CI = 1.06–1.50), and forgetfulness (OR = 1.22; 95% CI = 1.04–1.43) barriers. Higher diabetes management self-efficacy was protective against all four barriers. Other variables associated with one or more barriers were health insurance, perceived health, depression, blood glucose, age and education. Findings suggest that addressing barriers such as food insecurity, low self-efficacy, lack of health insurance, and depression could potentially result in better health care access and utilization among low income Puerto-Ricans with T2D.

Keywords

Puerto-Ricans; Type 2 diabetes; Health care access barriers; Food insecurity; Self-efficacy

Introduction

Ethnic/racial health disparities are highly prevalent in the US [1]. The increased risk of poverty among ethnic/racial minorities [1] is a major public health concern as nationally representative data of US adults shows that economic status predicts mortality hazard ratio even after controlling for health risk behaviors, age, sex, and race [2]. Previous studies suggest that health care access and utilization barriers contribute significantly to these disparities [3]. Fiscella et al. [1] identified low socio-economic status, and minority racial/ethnic status as risk factors for low quality of preventive care, lack of access to specialty doctors, as well as lack of access to ambulatory or in-hospital care.

In the 1970 s, Anderson and Newman suggested that health care utilization by individuals could be a reflection of their behavior and environment surrounding them [4]. They posit that a variety of factors influence health care utilization including socio-demographic status, health beliefs, community resources such as doctor-patient ratio and cost of health services, and health status. Other barriers such as lack of English proficiency [5], and cultural factors [6] may also affect access and quality of care.

Previous studies suggest that self-reported poor general and functional health, mental stress [7], and physician diagnosed chronic diseases [7] including type 2 diabetes (T2D) [8] are significantly higher among individuals from food insecure households compared to others from food secure households. Adequate glycemic control has been shown to reduce the incidence of T2D associated micro and macrovascular complications [9]. Proper screening and timely treatment is essential to reduce the morbidity and mortality associated with the disease [10], which involve regular access to health care resources. Because of the competing demands between the need for food and the need for health care and access to medications, food insecurity (defined as lack of access to nutritionally adequate and safe foods for an active, healthy life, and lack of assured ability to acquire acceptable foods in socially acceptable ways [11, 12]) may be associated with lack of access to health care. Indeed, food insecurity is likely to be a major stressor that may end up compromising expenditures in health care and other basic human needs [13]. This may be especially true among low-income individuals with chronic diseases such as T2D. This is a serious public health concern among Latinos, the largest minority group in the United States [14], including Puerto Ricans as they experience a high prevalence of both food insecurity [15] as

well as T2D [16] and related complications [17]. And both conditions may be related to each other [18]. Common reported barriers for health care access/utilization among Latinos with T2D include lack of health insurance, money [19], transportation [20], proper communication [5], as well as forgetfulness [21]. However, to our knowledge no study has examined the independent role of food insecurity as a risk factor for lack of access to health care among Latinos with T2D. The objective of this study is to assess the independent influence of food insecurity on different health care access barriers adjusting for socio-demographic, cultural, psychosocial, and diabetes self-care variables in a sample of Puerto Ricans with T2D.

Methods

Sample and Setting

The Diabetes among Latinos Best Practices Trial (DIAL-BEST) was a randomized controlled study involving a sample of predominantly Puerto Rican adults with T2D. Details about study design and procedures have been reported elsewhere [22]. Participants from a 'Metabolic syndrome clinic' at Brownstone clinic, Hartford Hospital that provides primary care specifically for low income population were enrolled in the study. They were eligible to participate in the study if they : (1) were >21 year, (2) were living in Hartford County, (3) had HbA1c levels < 7%, and (4) had no medical conditions that completely limit their ability to perform physical activity (assessed by a physician at the clinic). A total of 211 participants were enrolled from December 2006 to February 2009. We obtained Institutional Review Board (IRB) approval from the University of Connecticut, Hartford Hospital and the Hispanic Health Council.

Data Collection

After obtaining written informed consent, data were collected using a pretested and validated questionnaire [23] applied at participants' homes with the help of one of the three bilingual (Spanish and English) interviewers. Fasting blood samples were also collected by the DIALBEST phlebotomists. Participants were compensated \$10 each for the interview and blood draw. Data were collected at baseline prior to randomization to the study intervention.

Dependent Variable

Participants were read 11 statements to assess to what extent they experienced commonly reported barriers for seeing a doctor regularly and for complying with prescribed medications. These questions were developed based on health care access/utilization barriers commonly reported by Puerto Ricans in Hartford. This questionnaire was pretested among five English- and five Spanish-speaking participants, and among five bilingual staff members at the Hispanic Health Council in Hartford, CT. Response options were "never, sometimes, or frequently". An example of a statement was "I miss my doctor's appointments because I have no money". Similar statements on barriers such as lack of health insurance, transportation and specialty referral, comprehension difficulties, and forgetfulness were also included. With regard to medication compliance, participants were asked to respond to the following statement: "I do not take my medication because I have no money (or no health insurance, no transportation to get them, do not understand how to take them, forgot to take them)". The Cronbach's alpha for the 11-item health care barriers module was 0.77 suggesting that it included multiple dimensions that needed to be identified through factor analysis.

Independent Variables

Demographic and Socio-economic Variables—Socio-demographic variables included age, gender, ethnicity, marital status, monthly per capita income, education, employment status, household possessions (e.g. telephone, cell phone, and car), payment method for diabetes medications, health insurance status, and household food security. Based on their self identification, participants were categorized as either Puerto-Ricans/ Puerto-Rican Americans or ‘other’ Latinos (Dominican Republic, Nicaragua, Mexico, Peru, Columbia, and Cuba). Additionally, we categorized the participants based on their educational status as having no/some schooling or ‘higher’ education (high school graduate/ trade-technical or college education). Food security was assessed with a short form (five items) of the U.S. household food security survey supplement module (US-HFSSM) [24]. The score ranged from zero to five, with five indicating severe food insecurity (Cronbach’s alpha = 0.89).

Psychosocial Variables—Social support was measured using the 11 item- ‘Multidimensional Scale of Perceived Social Support questionnaire’ probing for the support given by family and friends [25, 26]. The three-point scale response options ranged from “never available” to “always available”, with the total social support score ranging from zero to 22 (Cronbach’s alpha = 0.87).

Depression symptoms were measured using the Center for Epidemiologic Studies (CES-D) Scale [27], a reliable and valid tool among Latinos including Puerto Ricans [28–30]. The scale consists of 20 items that ask how often each of a series of depressive symptoms was experienced over the past week. Response options ranged from ‘none of the time’ to ‘most or all the time’, with total scores ranging from zero to 60 (Cronbach’s alpha = 0.88).

Cultural Variables—Participant’s place of birth, language(s) spoken, acculturation and amount of time residing in US were assessed. According to their place of birth the participants were classified as either born in Puerto-Rico/US or ‘other’ countries (Dominican Republic, Columbia, Cuba, Chile, Honduras, Mexico, and Peru). Acculturation was measured with a modified 21-item version of the Acculturation Rating Scale for Mexican Americans-II (ARSMA), scale 1 [31]. Although this scale was originally developed for Mexican Americans, Cuellar et al. [32] suggested that it may also be used among other Latino groups. This scale has indeed been previously used with Puerto-Ricans [33] and is one of the most comprehensive and commonly used Latino acculturation scales [34]. Using ARSMA’s recommended method, we generated cut-off scores to classify individuals into five acculturation categories ranging from strongly Mexican oriented to strongly Anglo oriented. Because of the small sample sizes in the first and last categories, participants were reclassified into the following categories: (1) Lower (levels 1 and 2), (2) Medium (level 3), and (3) Higher (level 4 and 5) acculturation levels.

Clinical Variables—Clinical factors included biomarkers [fasting plasma glucose (FPG), glycosylated hemoglobin (HbA1c) levels], and self-reported health status.

Fasting blood (2 ml) was collected and fasting plasma glucose (FPG) was measured using a YSI-2300 stat plus glucose and lactate analyzer (YSI life sciences, Yellow Springs, OH) in duplicate. HbA1c was measured from capillary blood using an FDA approved and National Glycohemoglobin Standardization Program certified instrument that accurately measures HbA1c in home settings—‘A1cNow INView’ device (Metrika Inc., Sunnyvale, CA).

Self rated health was assessed by asking the standard question ‘how would you rate your overall health?’[35]. Response options were “excellent, very good, good, fair, and poor.”

Diabetes-self Care Factors—The ‘seriousness’ subscale of the diabetes attitude scale (DAS-3) [36] and the short version of the diabetes knowledge test [37] was used to measure participants’ perceived ‘seriousness’ and knowledge of diabetes, respectively. Self-efficacy was measured using the self-efficacy subscale of the Multidimensional Diabetes Questionnaire (MDQ) [38].

Statistical Analyses

We used the Statistical Program for the Social Sciences for Windows (SPSS v.19.0; IBM Corporation, New York). Principal component analyses (PCA) with varimax rotation [39] was used for identifying the main factors derived from the health care barriers module. The four components with an eigenvalue of >1.0 , explaining a cumulative variance of 69.1%, were retained in the analyses [39]. Factor loadings of >0.4 were used to interpret the factors’ ‘meaning’. For each barrier the factor score mean was used as cut-off to classify participants into two categories. The dichotomized factor scores were then used as dependent variables in bivariate and multivariate analyses. Means or proportions of independent variables were compared for each of the four (barrier) factors (dependent variables) separately using the independent t tests or Chi-square test, when appropriate. The four factors identified through PCA (Table 1) were labeled: (1) Enabling factor barrier (lack of money and insurance associated with both visit to a doctor and medication intake), (2) Doctor access barrier (transportation, understands doctor, obtains referrals), (3) Medication access barrier (transportation, understanding the use of medication) associated with medication intake, (4) Forgetfulness barrier (forgetting medical appointment, medication intake) (Table 1). Independent variables that were significantly ($P < 0.05$) or marginally significantly ($P < 0.1$) associated with the dependent variables (Table 2) were entered into four multivariate logistic regression (LR) models corresponding to enabling (factor 1), doctor access (factor 2), medication access (factor 3) and forgetfulness (factor 4) barriers. Backward stepwise elimination procedures were used. If the 95% confidence interval (CI) excluded one, that association was considered statistically significant. Model fitness was determined using the Hosmer–Lemeshow goodness of fit test.

Results

Participants’ Characteristics

The majority of the DIALBEST participants were women (74%) of Puerto-Rican origin (94%) with mean age 56.4 years. Mean monthly per capita income was \$446. The majority of the respondents did not attend or finish high school (75%), and were unemployed (84%). Almost 86% of the participants were insured with 97% of them reporting government sponsored health insurance (Medicare or Medicaid), a type of insurance that provides very limited access to specialized care [40–42]. About two-thirds (66%) of the participants spoke Spanish only. Mean FPG and HbA1c were 10.6 mmol/l and 9.6%, respectively (Table 2).

Multivariate Analyses

Higher food insecurity score was a risk factor for experiencing the ‘enabling factor’ barrier (OR = 1.46; 95% CI = 1.17–1.82). Additionally, health insurance (OR = 0.08; 95% CI = 0.03–0.26), lower (OR = 0.15; 95% CI = 0.05–0.48) and medium (OR = 0.25; 95% CI = 0.09–0.71) acculturation status (vs. higher), excellent/very good self perceived health (vs. good/fair/poor; OR = 0.23; 95% CI = 0.06–0.82), and higher diabetes related self-efficacy (OR = 0.87; 95% CI = 0.80–0.96) decreased the risk against experiencing the ‘enabling factor’ barrier (Table 3).

The variables that decreased the risk against the doctor access barrier were social support (OR = 0.93; 95% CI = 0.87–0.99) and diabetes related self-efficacy (OR = 0.90; 95% CI = 0.83–0.98) (Table 3).

Higher food insecurity was a risk factor for experiencing the medication access barrier (OR = 1.26; 95% CI = 1.06–1.50). In addition, participants with no/some schooling (vs. higher education; OR = 0.43; 95% CI = 0.20–0.91), higher glucose levels (OR = 0.89; 95% CI = 0.81–0.97), and higher diabetes related self-efficacy (OR = 0.91; 95% CI = 0.85–0.98) were less likely to report experiencing the medication access barrier (Table 3).

Higher food insecurity (OR = 1.22; 95% CI = 1.04–1.43) and depression scores (OR = 1.04; 95% CI = 1.01–1.06) were risk factors for forgetting to attend doctor's appointments and taking medications. On the other hand, older age (OR = 0.97; 95% CI = 0.94–0.99) and higher diabetes related self-efficacy (OR = 0.92; 95% CI = 0.86–0.98) decreased the risk against the forgetfulness barrier (Table 3).

Discussion

Our study examined the independent influence of food insecurity as a barrier to health care access and utilization in an understudied socio-economically disadvantaged population. Our findings are novel not only because this question had not been previously examined among Latinos with T2D but also because it focused on four different dimensions of barriers for health care access and utilization (enabling factor, doctor-access, medication-access, forgetfulness). Indeed, our multivariate results indicate that food insecurity is a strong risk factor for lack of enabling factors and medication access, and for forgetting doctor's appointments and taking medications. Because we controlled for key socio-economic, demographic, cultural, and mental health factors it is unlikely that this result is explained by confounders. Our finding is consistent with another cross-sectional analysis of the 2002 National Survey of America's Families (NSAF) reporting that household food insecurity was independently associated with postponed medical care and medication fill/refill [43]. It is possible that food insecure households need to prioritize the use of limited resource to gain access to food at the expense of medical care. It is also possible that the consistent association between food insecurity and mental health problems (depression) [44] may lead to forgetfulness. Because food insecurity may also be a consequence and not the cause of lack of access to health care (i.e. increased expenses associated with medical care exacerbating food insecurity) it is important that longitudinal cohort studies of chronic diseases include valid measures of food insecurity and health care access such as the ones used in our study.

Our findings confirm the role of health insurance for regular doctor's visits and/or adherence to prescribed medications. Lack of health insurance substantially explains disparities in health care access between Latinos and non-Hispanic Whites [19]. Even though uninsured DIALBEST participants were provided free medical services from Hartford Hospital, other associated expenses such as laboratory services and medications were usually not covered resulting in barriers not only for seeing a doctor but also for medication adherence. In our study, the percentage of DIALBEST participants (14%) without insurance was lower compared to the national average for Latinos (32.4%) [45]. Several factors may contribute to this finding. Firstly, we enrolled participants from a primary care clinic which gives medical services to low income patients who are likely to be eligible for government sponsored insurance programs for low income families. Secondly, 27% of our participants were elderly (> 65y) who are more likely to have insurance coverage due to Medicare availability.

Apparently, participants with higher acculturation perceived experiencing more enabling barriers. Exploratory analyses did not reveal a significant association between acculturation and income or insurance status. We hypothesize that highly acculturated Puerto Ricans with T2D coming from a low socio-economic background may be more aware that lack of adequate health insurance and/or income are key reasons for not being able to have adequate health care access.

Social support from family and friends was inversely associated with doctor access barriers. However social support did not decrease the risk against medication access or forgetfulness. It is possible that better diabetes management associated with high social support is related to better coping resources (such as social support) to life stress events [46].

Participants with high diabetes related self-efficacy were less likely to experience enabling factor, doctor-access, medication-access and forgetfulness barriers. The diabetes self-efficacy questionnaire used in our study measured participants' confidence to address various self-management aspects such as diet, exercise, weight management, blood glucose self monitoring, glucose control, and medication adherence. Patient initiated behaviors have an important role in diabetes management [47]. Previous studies have found that the confidence to self-manage often translates into improved diabetes self-management behaviors [48, 49]. Thus, our finding of the possible protective effects of high self-efficacy on perceived barriers even after adjusting for potential confounders is highly relevant. It is possible that reported glycemic improvements in patients with high self-efficacy [47] could be indirectly mediated by clinically relevant reductions in barriers for doctor's visits or medication adherence.

Participants with lower levels of education were less likely to experience the medication access barrier. Participants with higher education were also more likely to be at higher risk of depression ($P = 0.08$) and to have low social support ($P = 0.03$) (data not shown). These results suggest that if individuals with low income and diabetes have relatively higher levels of education but at the same time are more likely to be depressed and have low social support then they may be more likely to perceive medication access barriers. In addition, the Brownstone clinic at Hartford Hospital provided free diabetes medication for study participants with no insurance. Provision of free medication to a subgroup of participants may have altered their perception of medication access barriers and may have introduced a bias. Further studies are warranted to better understand this relationship.

Unexpectedly, participants with high FPG reported lower medication access barriers. It could be that these participants had other risk factors contributing to high FPG levels, such as high carbohydrate intake or inadequate physical activity [50]. Alternatively it is possible that individuals whose diabetes is more advanced may have more access to medications because of poor diabetes control. However, there was no association between HbA1c levels and medication access barriers. Longitudinal studies are needed to better understand this finding.

Older participants were less likely to forget medication intake and/or doctor visits. Further analyses did not show association between age and depression score ($r = -0.02$, $P = 0.7$), a predictor of forgetfulness barrier in our study sample. Interestingly, age and perceived seriousness of diabetes score were positively correlated ($r = 0.31$, $P < 0.001$). We posit that high perceived diabetes seriousness score is associated with higher self motivation among individuals with type 2 diabetes to take better care of their condition.

Previous studies have suggested that depressed individuals may suffer from deteriorated cognitive function which may be associated with forgetfulness [51, 52]. However,

confirmatory evidence on this relationship is lacking. Our results suggest that it is important to further examine this relationship among Puerto-Ricans with type 2 diabetes.

To summarize, the ‘enabling’ health care access barrier was predicted by socio-demographic (health insurance and food insecurity), cultural (acculturation), clinical (self-rated health) and diabetes self care (self-efficacy) variables. Doctor access barrier was predicted by psycho-social (social support) and diabetes self care (self-efficacy) variables. Medication access barrier was associated with socio-demographic (education and food insecurity), clinical (glucose) and diabetes self care (self-efficacy) factors. Forgetfulness barrier was associated with socio-demographic (age and food insecurity), psychosocial (depression) and diabetes self care (self-efficacy) factors (Table 4).

Limitations

Additional potential health care access/utilization barriers such as geographic location, long waiting time or side-effects of medication were not measured. Participants were predominantly female Puerto Ricans with type 2 diabetes, thus limiting generalization to other populations. Analyses were cross-sectional precluding us from understanding the temporal sequence of associations.

Implications and Conclusions

Our study confirms for the first time an independent association between household food insecurity and three out of four dimensions of health care access/utilization barriers among Puerto-Ricans with T2D. Low diabetes management self-efficacy was associated with higher perceived barriers for all dimensions of health access/utilization examined. Findings from our study also provide a better understanding about factors associated with commonly reported reasons for skipping a doctor’s visit or lack of medication adherence. As hypothesized, depression predicted forgetfulness barrier. Our findings suggest that addressing barriers such as food insecurity, lack of health insurance, and depression could potentially result in better health care delivery among low income Puerto-Ricans with T2D. Furthermore, increasing diabetes management self-efficacy is likely to empower patients to gain improved access to quality health care.

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Table 1

Factor loadings for original health care access barrier variables after varimax rotation, among Puerto-Ricans with type 2 diabetes

	Factor 1	Factor 2	Factor 3	Factor 4
<i>Visit to a doctor</i>				
Health insurance barrier	0.868	0.058	-.109	-.063
Money barrier	0.772	0.006	0.304	0.137
Transportation barrier	0.131	0.632	-.185	0.401
Comprehensibility barrier	-.008	0.777	0.304	-.024
No specialty referrals-barrier	0.055	0.769	0.207	0.049
Forgetfulness barrier	-.012	0.147	0.101	0.820
<i>Nonadherence to medication</i>				
Health insurance barrier	0.851	-.135	0.267	0.053
Money barrier	0.753	0.364	-.089	0.027
Transportation barrier	0.202	0.274	0.691	0.151
Comprehensibility barrier	0.027	0.103	0.845	0.173
Forgetfulness barrier	0.063	0.005	0.202	0.723
<i>Variance</i>	30.0%	18.4%	11.3%	9.4%

Maximum factor loadings in each barrier category in bold type

Table 2

Associations between participants' characteristics, and 'health access and utilization barrier' among Puerto-Ricans with type 2 diabetes

Independent variables	All	Enabling factor barrier		Doctor-access barrier		Medication-access barrier		Forgetfulness barrier	
		Below mean	Above mean	Below mean	Above mean	Below mean	Above mean	Below mean	Above mean
<i>Age, mean ± SD (n)</i>	56.4 ± 11.8 (211)	57.4 ± 12.0 (163)	53.2 ± 10.1 (41) [†]	56.7 ± 11.9 (174)	55.6 ± 11.4 (30)	55.7 ± 12.6 (146)	56.9 ± 11.4 (58)	58.3 ± 11.4 (102)	54.8 ± 11.9 (102) [†]
<i>Gender, % (n)</i>									
Male	27.0 (55)	70.9 (39)	29.1 (16) [*]	78.2 (43)	21.8 (12) [*]	745.5 (41)	25.5 (14)	49.1 (27)	50.9 (28)
Female	73.0 (149)	83.2 (124)	16.8 (25)	87.9 (131)	12.1 (18)	70.5 (105)	29.5 (44)	50.3 (75)	49.7 (74)
<i>Ethnicity, % (n)</i>									
PR & PR American	88.2 (180)	90.8 (148)	78.0 (32) [†]	87.9 (153)	90.0 (27)	87.7 (128)	89.7 (52)	85.3 (87)	91.2 (93)
Other Latinos	11.8 (24)	9.2 (15)	22.0 (9)	12.1 (21)	10.0 (3)	12.3 (18)	10.3 (6)	14.7 (15)	8.8 (9)
<i>Marital status, % (n)</i>									
Single	27.0 (55)	27.6 (45)	24.4 (10)	26.4 (46)	30.0 (9)	24.0 (35)	34.5 (20) [*]	24.5 (25)	29.5 (30)
Married/living together	29.9 (61)	27.6 (45)	39.0 (16)	31.0 (54)	23.3 (7)	34.2 (50)	19.0 (11)	32.4 (33)	27.5 (28)
Separated/widowed/divorced	43.1 (88)	44.8 (73)	36.6 (15)	42.5 (74)	46.7 (14)	41.6 (61)	46.6 (27)	43.1 (44)	43.1 (44)
<i>Income per capita, mean ± SD (n)</i>	445.4 ± 279.6 (207)	452.7 ± 257.1 (160)	414.4 ± 363.4 (40)	434.5 ± 267.6 (170)	505.1 ± 346.4 (30)	435.4 ± 261.4 (143)	469.4 ± 326.2 (57)	465.5 ± 297.7 (99)	425.1 ± 263.5 (101)
<i>Education, % (n)</i>									
No/some schooling	74.5 (152)	79.1 (129)	56.1 (23) [†]	74.7 (130)	73.3 (22)	79.5 (116)	62.1 (36) [†]	74.5 (76)	74.5 (76)
Higher education	25.5 (52)	20.9 (34)	43.9 (18)	25.3 (44)	26.7 (8)	20.5 (30)	37.9 (22)	25.5 (26)	25.5 (26)
<i>Employment, yes, % (n)</i>	15.7 (32)	14.7 (24)	19.5 (8)	14.9 (26)	20.0 (6)	15.8 (23)	15.5 (9)	18.6 (19)	12.7 (13)
<i>Telephone, yes, % (n)</i>	77.0 (157)	76.7 (125)	78.0 (32)	77.6 (135)	73.3 (22)	78.8 (115)	72.4 (42)	77.5 (79)	76.5 (78)
<i>Cellphone, yes, % (n)</i>	64.7 (132)	64.4 (105)	65.9 (27)	66.1 (115)	56.7 (17)	68.5 (100)	55.2 (32) [*]	61.8 (63)	67.6 (69)
<i>Car, yes, % (n)</i>	49.0 (100)	50.3 (82)	43.9 (18)	50.6 (88)	40.0 (12)	52.1 (76)	41.4 (24)	50.0 (51)	48.0 (49)
<i>Diabetes medications</i>									
Free	49.0 (100)	85.3 (139)	57.5 (23) [‡]	87.7 (143)	75.0 (30) [†]	71.8 (70)	70.0 (28)	47.2 (77)	60.0 (24)
Co-pay/full payment	49.0 (100)	14.7 (24)	42.5 (17)	12.3 (20)	25.0 (10)	28.2 (46)	30.0 (12)	52.8 (86)	40.0 (16)
<i>Health insurance, yes, % (n)</i>	85.8 (175)	91.4 (149)	63.4 (26) [‡]	87.4 (152)	76.7 (23)	86.3 (126)	84.5 (49)	81.4 (83)	90.2 (92)

Independent variables	All	Enabling factor barrier		Doctor-access barrier		Medication-access barrier		Forgetfulness barrier	
		Below mean	Above mean	Below mean	Above mean	Below mean	Above mean	Below mean	Above mean
<i>Food insecurity, mean ± SD (n)</i>	1.9 ± 2.0 (211)	1.6 ± 1.9 (163)	3.0 ± 1.9 (41) [‡]	1.8 ± 1.9 (174)	2.6 ± 2.1 (30) [‡]	1.6 ± 1.9 (146)	2.6 ± 2.1 (58) [‡]	1.4 ± 1.8 (102)	2.4 ± 2.0 (102) [‡]
<i>Social support, mean ± SD (n)</i>	12.0 ± 6.1 (211)	12.4 ± 6.0 (163)	10.7 ± 6.2 (41)	12.4 ± 6.0 (174)	9.7 ± 6.3 (30) [‡]	12.5 ± 6.2 (146)	10.8 ± 5.5 (58) [*]	13.1 ± 5.8 (102)	11.0 ± 6.1 (102) [‡]
<i>Depression, mean ± SD (n)</i>	21.7 ± 13.0 (211)	20.8 ± 13.0 (163)	24.1 ± 12.5 (41)	21.1 ± 13.1 (174)	23.3 ± 12.2 (30)	20.6 ± 13.0 (146)	23.4 ± 12.7 (58)	25.0 ± 11.7 (102)	18.0 ± 13.2 (102) [‡]
<i>Place of birth, % (n)</i>									
PR/US	91.7 (187)	93.9 (153)	82.9 (34) [‡]	91.4 (159)	93.3 (28)	91.1 (133)	93.1 (54)	88.2 (90)	95.1 (97) [*]
Other countries	8.3 (17)	6.1 (10)	17.1 (7)	8.6 (15)	6.7 (2)	8.9 (13)	6.9 (4)	11.8 (12)	4.9 (5)
<i>Languages spoken, % (n)</i>									
English and Spanish	33.8 (69)	30.1 (49)	48.8 (20) [‡]	33.3 (58)	36.7 (11)	31.5 (46)	39.7 (23)	33.3 (34)	34.3 (35)
Spanish	66.2 (135)	69.9 (114)	51.2 (21)	66.7 (116)	63.3 (19)	68.5 (100)	60.3 (35)	66.7 (68)	65.7 (67)
<i>Acculturation, % (n)</i>									
Lower	35.8 (73)	38.7 (63)	24.4 (10) [‡]	35.1 (61)	40.0 (12)	37.7 (55)	31.0 (18)	38.2 (39)	33.3 (34)
Medium	37.7 (77)	39.3 (64)	31.7 (13)	38.5 (67)	33.3 (10)	37.0 (54)	39.7 (23)	34.3 (35)	41.2 (42)
Higher	26.5 (54)	22.1 (36)	43.9 (18)	26.4 (46)	26.7 (8)	25.3 (37)	29.3 (17)	27.5 (28)	25.5 (26)
<i>Length of stay in the US, mean ± SD (n)</i>	25.8 ± 12.7 (204)	26.4 ± 12.9 (158)	24.1 ± 12.1 (40)	25.8 ± 12.5 (174)	26.8 ± 14.1 (30)	26.1 ± 13.3 (142)	25.6 ± 11.4 (56)	25.3 ± 13.8 (100)	26.6 ± 11.6 (98)
<i>Fasting plasma glucose, mean ± SD (n)</i>	10.6 ± 4.7 (211)	10.4 ± 4.4 (163)	10.8 ± 5.9 (41)	10.4 ± 4.5 (174)	10.9 ± 5.8 (30)	10.9 ± 5.0 (146)	9.5 ± 3.9 (58) [*]	9.8 ± 3.7 (146)	11.2 ± 5.5 (58) [*]
<i>HbA1c, mean ± SD (n)</i>	9.6 ± 1.8 (211)	9.5 ± 1.8 (163)	9.8 ± 1.9 (41)	9.6 ± 1.8 (174)	9.3 ± 1.8 (30)	9.6 ± 1.8 (146)	9.4 ± 1.6 (58)	9.5 ± 1.8 (102)	9.5 ± 1.8 (102)
<i>Self reported health, % (n)</i>									
Excellent/very good	25.1 (51)	29.0 (47)	9.8 (4) [‡]	26.0 (45)	20.2 (6)	30.3 (44)	12.1 (7) [‡]	31.7 (32)	18.6 (19) [‡]
Good/fair/poor	74.9 (152)	71.0 (115)	90.2 (37)	74.0 (128)	80.0 (24)	69.7 (101)	87.9 (51)	68.3 (69)	81.4 (83)
<i>Diabetes attitude-seriousness, mean ± SD (n)</i>	9.9 ± 2.7 (210)	9.9 ± 2.7 (163)	9.5 ± 2.8 (40)	9.8 ± 2.6 (174)	10.0 ± 2.9 (30)	9.9 ± 2.7 (145)	9.8 ± 2.7 (58)	9.8 ± 2.9 (101)	9.9 ± 2.4 (102)
<i>Diabetes knowledge, mean ± SD (n)</i>	5.2 ± 2.0 (211)	5.4 ± 2.0 (163)	4.9 ± 2.1 (41)	5.4 ± 1.9 (174)	4.9 ± 2.2 (30)	5.2 ± 1.9 (146)	5.3 ± 2.1 (58)	5.4 ± 1.9 (102)	5.4 ± 1.9 (102)
<i>Self-efficacy, mean ± SD (n)</i>	28.1 ± 4.8, (211)	28.7 ± 4.7 (163)	25.7 ± 4.9 (41) [‡]	28.5 ± 4.7 (174)	25.8 ± 4.9 (30) [‡]	28.6 ± 5.0 (146)	26.8 ± 4.2 (58) [‡]	29.1 ± 4.2 (102)	27.1 ± 5.2 (102) [‡]

^a PR Puerto-Rican

* $P < 0.1$
† $P < 0.05$
‡ $P < 0.01$

Table 3

Multivariate analyses of factors associated with 'higher health care access and utilization barrier' among Puerto-Ricans with type 2 diabetes

	<i>n</i>	Odds ratio	95.0% CI	
			Lower	Upper
Factor 1: enabling factor barrier ^a				
<i>Health insurance</i>				
Yes	174	0.08	0.03	0.26
No	28	1	–	–
<i>Food insecurity</i>	202	1.46	1.17	1.82
<i>Acculturation level</i>				
Lower	72	0.15	0.05	0.48
Medium	76	0.25	0.09	0.71
Higher	54	1	–	–
<i>Self perceived health</i>				
Excellent/very good	51	0.23	0.06	0.82
Good/fair/poor	151	1	–	–
<i>Self-efficacy</i>	202	0.87	0.80	0.96
Factor 2: doctor-access barrier ^b				
<i>Gender</i>				
Male	55	2.10	0.88	4.98
Female	149	1	–	–
<i>Diabetes medication</i>				
Free	163	0.43	0.17	1.10
Co-pay/full payment	40	1	–	–
<i>Social support</i>	204	0.93	0.87	0.99
<i>Self-efficacy</i>	204	0.90	0.83	0.98
Factor 3: medication-access barrier ^c				
<i>Marital status</i>				
Single	55	1.65	0.74	3.71
Married/living together	61	0.44	0.18	1.04
Separated/widowed/divorced	88	1	–	–
<i>Education</i>				
No/some schooling	152	0.43	0.20	0.91
Higher education	52	1	–	–
<i>Cell phone</i>				
Yes	132	0.55	0.28	1.10
No	72	1	–	–
<i>Food insecurity</i>	204	1.26	1.06	1.50
<i>Glucose</i>	204	0.89	0.81	0.97
<i>Self-efficacy</i>	204	0.91	0.85	0.98

	<i>n</i>	Odds ratio	95.0% CI	
			Lower	Upper
Factor 4: forgetfulness barrier ^d				
<i>Age</i>	203	0.97	0.94	0.99
<i>Health insurance</i>				
Yes	175	2.57	0.99	6.65
No	28	1	–	–
<i>Food insecurity</i>	203	1.22	1.04	1.43
<i>Depression symptom score</i>	203	1.04	1.01	1.06
<i>Self-efficacy</i>	203	0.92	0.86	0.98

Logistic regression: backward stepwise elimination procedure

^aThe following variables were removed from the model: age, gender, languages spoken, ethnicity, education, place of birth, and payment method for diabetes medication. Hosmer–Lemeshow goodness of fit test *P*value = 0.15

^bThe following variable(s) were removed from the model: food insecurity. Hosmer–Lemeshow goodness of fit test *P*value = 0.70

^cThe following variable(s) were removed from the model: social support. Hosmer–Lemeshow goodness of fit test *P*value = 0.14

^dThe following variable(s) were removed from the model: age, place of birth, glucose, social support, and diabetes seriousness. Hosmer–Lemeshow goodness of fit test *P*value = 0.72

Table 4

Risk and protective factors for health care access/utilization among Puerto-Ricans with type 2 diabetes:
summary of findings

	Barrier			
	Enabling factor	Doctor access	Medication access	Forgetfulness
<i>Demographic and socio-economic</i>				
Age				–
Education			+	
Health insurance	–			
Food insecurity	+		+	+
<i>Psychosocial</i>				
Depression				+
Social support		–		
<i>Cultural</i>				
Acculturation	+			
<i>Clinical</i>				
Fasting plasma glucose			–	
Self reported health	–			
<i>Diabetes self</i>				
Self	–	–	–	–

– protective factor; + risk factor