The Association of English Ability and Glycemic Control among Latinos with Diabetes

Arshiya A. Baig, MD, MPH; Cara A. Locklin, MPH; Edward Foley, MD, MPH; Bernard Ewigman, MD, MSPH; David O. Meltzer, MD, PhD; Elbert S. Huang, MD, MPH

Objective: Language barriers may be significant contributors to diabetes disparities. We sought to assess the association of English speaking ability with glycemic control among Latinos with diabetes.

Methods: We analyzed 167 Latinos from a cross-sectional survey of adults with type 2 diabetes. The main outcome was HbA1c ≥7.0%. The main predictor was self-reported English speaking ability. Adjusted analyses accounted for age, sex, education, annual income, health insurance status, duration of diabetes, birth in the United States, and years in the United States.

Results: In unadjusted analyses, point estimates for the odds of having a high HbA1c revealed a U-shaped curve with English speaking ability. Those who spoke English very well (OR=2.32, 95% CI, 1.00–5.41) or not at all (OR=4.11, 95% CI 1.35–12.54) had higher odds of having an elevated HbA1c than those who spoke English well, although this was only statistically significant for those who spoke no English. In adjusted analyses, the U-shaped curve persisted with the highest odds among those who spoke English very well (OR=3.20, 95% CI 1.05–9.79) or not at all (OR 4.95, 95% CI 1.29–18.92).

Conclusions: The relationship between English speaking ability and diabetes management is more complex than previously described. Interventions aimed at improving diabetes outcomes may need to be tailored to specific subgroups within the Latino population. (*Ethn Dis*. 2014;24[1]:28–34)

Key Words: Diabetes, Latinos, English Language

From Department of Medicine, University of Chicago (AAB, DOM, ESH); and College of Nursing, University of Illinois at Chicago (CAL); Macneal Hospital, Berwyn, IL (EF); Department of Family Medicine, University of Chicago (BE).

Address correspondence to Arshiya A. Baig, MD, MPH; Section of General Internal Medicine, Department of Medicine; University of Chicago; 5841 S. Maryland Ave. MC 2007; Chicago, IL 60637; 773.834.4760; 773.834.2238; abaig@uchicago.edu

Background

Latinos are the largest ethnic minority in the United States and suffer from significant disparities in diabetes prevalence and control.[1–3] These observed disparities may be attributable to Latinos' high rates of uninsurance, difficulties in affording health care, lack of resources to engage in lifestyle modifications, and language barriers.[4–8] Language barriers, in particular, may be significant contributors to Latino diabetes disparities.

Language barriers have been shown to impact health through various pathways. For example, among insured Latinos, those with poor or fair English language proficiency are more likely than those with good or excellent proficiency to lack continuity of care, have long waits to see a health care provider, and have difficulty receiving information and advice by phone.[9] Studies have also noted that non-English speakers have lower patient satisfaction scores, poorer patient-provider communication, and less use of preventive services than English speakers.[4,10,11] In terms of diabetes self-care, non-English speakers have been found to have less knowledge regarding chronic diseases and to monitor their home blood glucose less frequently than English speakers.[12,13]

Considering the obstacles that language barriers present, studies have assessed the association between English language ability and glycemic control, but have surprisingly found no link between the two. A large study of patients in a managed care setting demonstrated no difference in glycosylated hemoglobin between English speaking and non-English speaking Latinos.[13] In a similar vein, several other studies have demonstrated that glycemic control was not related to ability to speak English in Latinos.[8,14,15] Delving deeper into the relationship, one study found that limited English proficiency was an independent predictor for poor glycemic control among US Latinos in a large managed care setting, however the effect was attenuated by language-concordant care.[16] An important limitation of these studies is that language proficiency of Latinos has been typically evaluated as a binary variable. Latinos have been categorized as speaking English or Spanish, as having low English proficiency or not, or having low or high language acculturation. Given the heterogeneity of the Latino population and complexity of language fluency, the association between glycemic control and language may be better assessed when accounting for the full range of English speaking ability.[17]

In our study, we had access to a sample of Latinos with diabetes and the opportunity to examine the association of glycemic control across a continuum of English speaking ability. Specifically, we assessed: 1) differences in diabetes

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control and complications among Latinos by self-reported English speaking ability; and 2) differences in self-care among Latinos by self-reported English speaking ability. Understanding how varying English language ability affects diabetes control will allow us to tailor interventions more effectively to specific subsets of Latinos with diabetes.

METHODS

We analyzed a subset of 167 adults with diabetes who self-identified as Latino or Hispanic from a cross sectional survey of 676 adults with type 2 diabetes recruited at clinics in the Chicago area from May 2004 to May 2006.[18] One of the objectives for the larger study was to evaluate the ethnic differences in medication concerns that may contribute to differences in adoption and adherence to diabetes treatments. The dataset was collected using face-to-face interviews with diabetic patients aged ≥18 years who had an ICD-9 billing code of 250.xx in from 2004 to 2006. All participants attended clinics affiliated with an academic medical center or physician offices affiliated with a suburban hospital. Patients with type 1 diabetes and those with <17 points on the Mini-Mental State Examination were excluded. Patients were interviewed in English or Spanish based on their personal preference. The study protocol was approved by the University of Chicago and MacNeal Hospital Institutional Review Boards.

Measures

To determine race/ethnicity, participants self-identified their race (eg, African American, Caucasian, Asian, Native American) and ethnicity (Hispanic, Latino, or Spanish). For this analysis, we included only those who defined their ethnicity as Hispanic, Latino or Spanish (n=176). Our main outcome of interest was a baseline glycosylated hemoglobin (HbA1c) ≥7.0% which we refer to as higher glucose control.[19] The HbA1c was the most recent lab value within one year prior to the date of the interview. The major exposure of interest was English speaking ability, which was categorized as speaking English very well, well, not very well, or not at all. English speaking ability was self-reported by the participant.

In addition to race/ethnicity and language, patients reported their country of birth, how long they had lived in the United States, their educational attainment, annual income, type of health insurance and prescription drug plan, duration in years of diabetes, comorbidities, health status, height, weight and current medications. The SF-12 was used to assess current health-related quality of life.[20] Patients also reported their current diabetes self-care activities, including changing diet since receiving their diabetes diagnosis, days of healthy eating and physical activity in the past seven days, number of home blood sugar checks in past seven days, adjusting medications according to home blood sugar checks, and willingness to take more medications.[21] From chart review, lipid panel and systolic blood pressure were extracted.

Statistical Analysis

All analyses were performed using SAS statistical software (Release 8.1; SAS Institute, Cary, NC). In unadjusted analyses, we examined the significance of English speaking ability on glucose control, diabetes-related complications, and self-care behavior. We used chi-squared tests for categorical variables and t-tests for continuous variables. We then constructed a multivariable logistic regression model for glucose control. For the adjusted analyses, our main outcome was HbA1 ≥ 7% and the main predictor was English ability. Speaking English well was used as the referent variable in the model. We included covariates based on whether or not they had a significant relationship with English ability. Our final model included age, sex, having health insurance, time in the United States, being born in the United States, education, income, and duration of diabetes. To assess diet as a potential mediator of the relationship between English ability and glycemic control, we ran a separate model that included days of healthy eating in the past week.

In sensitivity analyses, we repeated the above analyses with different HbA1c thresholds for the outcome (≥ 8% and ≥ 9%). The US Census considers persons who report speaking English not at all, not well, or well as having limited English proficiency while those who report speaking English very well as proficient.[22] To relate our findings to those of older studies, we used US Census definition to create a dichotomous variable for English proficiency with one group having limited English proficiency (combination of well, not well and not at all) and one group having English proficiency (very well). We ran the multivariable model for HbA1c ≥ 7 using the dichotomous variable for limited English proficiency (LEP).

RESULTS

The dataset included a total of 676 adults with type 2 diabetes. Of these patients, 167 were of Hispanic origin by self-report. The patients were categorized into English speaking ability. In the sample, 38% reported speaking English very well, 21% reported speaking well, 26% reported speaking not very well and 14% did not speak English at all. Table 1 lists patient characteristics by English-speaking ability. Patients who spoke English very well were younger in comparison to all other groups; they also were more likely to have graduated high school and less likely to have an income <$25,000. Comorbidities and complications did

Table 1. Characteristics of Latino adults with type 2 diabetes by English speaking ability, *N*=167

Demographics	English Speaking Ability				
	Very Well (*n*=64)	Well (*n*=35)	Not Very Well (*n*=43)	Not At All (*n*=24)	*P*
Age (years)	51 (15)	59 (11)	58 (10)	55 (9)	.009
Age (years)					.0009
<45	39	9	9	13	
45–54	23	31	26	38	
55–64	14	31	47	29	
≥65	23	29	19	21	
Male	53	60	33	42	.07
Born in the United States	80	26	0	0	<.0001
In the United States >30 years	84	91	63	42	<.0001
High school graduate	76	57	30	8	<.0001
Annual income <$25,000	28	37	56	67	.002
Health insurance					
Any	97	100	88	92	.10
Private	77	83	58	50	.01
Medicare	13	29	28	25	.15
Medicaid	11	9	21	33	.03
Prescription drug plan	94	94	88	88	.61
Health characteristics					
Duration of diabetes, years	7.9 (6.0)	10.2 (8.2)	8.6 (6.7)	9.3 (7.7)	.74
BMI[a]	33.3 (5.2)	29.8 (6.5)	29.9 (6.9)	31.4 (5.4)	.16
HbA1c	8.0 (1.9)	6.9 (1.1)	7.4 (1.6)	8.6 (1.9)	.004
HbA1c <7	42	63	49	29	.06
Low-density lipoprotein (LDL) (mg/dL)	107 (36)	98 (27)	97 (34)	111 (35)	.36
LDL <100 mg/dL	59	63	51	46	.50
Systolic blood pressure (mm Hg)	126 (15)	125 (21)	126 (17)	128 (18)	.83
Systolic blood pressure <130 mm Hg	53	63	51	50	.70
SF-12 Physical composite score	47 (10)	47 (10)	47 (10)	46 (9)	.91
SF-12, Mental health composite score	47 (12)	50 (10)	47 (12)	45 (11)	.44
Number of diabetes-related medications[b]	3(2)	3(2)	3 (2)	3 (2)	.98
Comorbidities and complications					
Hypertension	64	54	51	54	.56
Hypercholesterolemia	56	71	65	67	.47
Diabetic eye disease	16	20	33	42	.04
Diabetic kidney disease	9	6	7	25	.07
Peripheral neuropathy	42	40	51	50	.69
Heart disease	22	17	21	33	.52
Stroke	3	11	2	0	.11

Data are mean (SD) or %.

[a] Due to missing values, we were only able to calculate BMI for *n*=32 who spoke English very well, *n*=17 who spoke well, *n*=14 who spoke not very well, and *n*=4 who spoke not at all.

[b] Includes insulin, oral hypoglycemics, antihypertensives, lipid lowering agents, and aspirin.

not differ by English speaking ability except for diabetic eye disease that was more prevalent among those who did not speak English at all (42%, *P*=.04). Mean duration of years of diabetes and number of diabetes-related medications did not differ across groups.

Table 2 describes patient self-care behaviors across language ability. Change in diet, days of physical activity, and home glucose testing did not vary across language ability. Days of healthy diet differed by English speaking ability. Those who spoke English not very well had the most days of healthy eating in the past 7 days (5.4 ± 2.3) compared to those who spoke English very well (4.0 ± 2.4), well (4.7 ± 2.3), and not at all (4.2 ± 3.0, *P*=.02).

HbA1c levels formed a U-shaped curve across the range of English ability whether HbA1c was treated as a continuous or dichotomous variable. Participants who spoke English very well (8.0 ± 1.9) and not at all (8.6 ± 1.0), the two extreme categories, had higher mean HbA1c levels compared to those who spoke English well (6.9 ± 1.1) and not very well (7.4 ± 1.6). Similarly, the point estimates for the odds of having a HbA1c ≥7.0% formed a U-shaped curve across English ability (Table 3). Those who spoke English

Table 2. Self-care behavior among Latino adults with type 2 diabetes by English speaking ability

Self-care behavior	English Speaking Ability				
	Very Well (*n*=64)	Well (*n*=35)	Not Very Well (*n*=43)	Not At All (*n*=24)	*P*
Changed diet since diabetes diagnosis, %	91	89	83	79	.47
Days of healthy diet in past seven days, mean (SD)	4.0 (2.4)	4.7 (2.3)	5.4 (2.3)	4.2 (3.0)	.02
Days of physical activity in last seven days, mean (SD)	3.5 (2.8)	3.5 (2.8)	3.8 (2.8)	3.5 (2.0)	.94
Blood sugar checks in the last seven days, mean (SD)	3.4 (3.3)	3.9 (3.7)	3.3 (3.1)	2.3 (2.9)	.49
Adjusts meds according to blood sugar, %	11	17	9	13	.74
Not willing to take more medicines, %	14	6	16	8	.46

very well (OR=2.32, 95% CI, 1.00–5.41) or not at all (OR=4.11, 95% CI 1.35–12.54) had higher odds of having an elevated HbA1c than those who spoke English well, although this was only statistically significant for those who spoke no English. For the group that did not speak English very well, the odds of a high HbA1c did not differ statistically (OR=1.77, 95% CI 0.71–4.40) from the referent.

In adjusted analyses (Table 3), the U-shaped curve persisted. Latinos who spoke English very well (OR= 3.20 95% CI 1.05–9.79) and those who did not speak English at all (OR=4.95, 95% CI 1.29–18.92) were more likely to have a HbA1c ≥7.0% compared to those who spoke English well. The odds of having higher HbA1C did not differ statistically for those who reported speaking English not very well (OR=2.19, 95% CI .76–6.36) compared to those who spoke English well. Age, sex, number of years in the United States, education attainment, annual income, and having health insurance were not statistically associated with higher HbA1c levels. Longer duration of diabetes was significantly associated with higher HbA1C levels (OR 1.07, 95% CI 1.02–1.13). Inclusion of the variable, days of healthy eating, did not markedly change model results.

In the sensitivity analyses predicting a HbA1c ≥8.0% and ≥9.0%, the point estimates continued to form a U-shaped curve across English ability. Latinos who spoke English very well or not at all continued to have higher odds of having a HbA1c ≥8% and ≥9% compared to those who spoke English well. In the multivariable analysis for HbA1c ≥ 7% when the language indicator variables were replaced with a dichotomous variable for LEP, LEP was not significantly associated with having a HbA1c ≥ 7%.

DISCUSSION

The ability to speak any language has many levels of competence and sophistication; despite this truth, studies of English language ability in the setting of health care have typically considered it as having two forms, ability or no ability. In our study we were able to examine the relationship between English language ability and diabetes control with greater granularity. We found that English ability had a U-shaped relationship with glycemic control. Latinos who spoke English very well and those who did not speak English at all were more likely to have a high HbA1c than Latinos who spoke English well.

Table 3. Unadjusted and adjusted odds ratios (OR) for HbA1c≥7 among Latino adults with type 2 diabetes, *N*=167

	Unadjusted OR (95% CI)	*P*	Adjusted OR (95% CI)	*P*
English ability				
Very well	2.32 (1.00–5.41)	.05	3.20 (1.05–9.79)	.04
Well	1		1	
Not very well	1.77 (.71–4.40)	.22	2.19 (.76–6.36)	.15
Not at all	4.11 (1.35–12.54)	.01	4.95 (1.29–18.92)	.02
Age	-		1.02 (.99, 1.05)	.26
Male	-		1.08 (.54, 2.16)	.82
Insurance (any kind)	-		1.90 (.43, 8.33)	.40
<30 years in United States	-		1.16(.47, 2.84)	.75
Born in the United States	-		.93 (.33, 2.62)	.89
High school graduate	-		.80 (.36, 1.79)	.59
Annual income <$25,000	-		.88 (.42,1.82)	.72
Duration of diabetes	-		1.07 (1.02,1.13)	.01

Latinos who spoke English very well and those who did not speak English at all were more likely to have a high HbA1c than Latinos who spoke English well.

Our finding of this U-shaped relationship between English ability and HbA1c is novel. In previous studies, categorizing Latino into two language categories may have obscured the underlying complexity of the relationship between English ability and glycemic control.[8,13–16] In an effort to emulate the approach of prior studies, when we categorized participants into two discrete groups, having LEP or not, we found no significant association with HbA1c and English proficiency. Yet when English ability was divided into a range of abilities, the U-shaped curve emerged.

The presence of the U-shaped curve raises multiple questions regarding the simple notion that English fluency confers health care benefits.[23,24] Latinos who speak English well, but not fluently, may still have community, cultural, family, and religious ties that promote health and positively impact glycemic control.[25,26] Other factors, such as differences in patient activation, social support, diabetes self-efficacy, diabetes self-empowerment and access to local resources, may also need to be further explored to understand why some Latinos have a comparative advantage in glycemic control and how these mediate the effect of language.[25–28]

Latino patients who spoke English fluently were more likely to have elevated glucose compared to those who spoke English well. We suspect that English speaking ability may be a marker of acculturation and current lifestyle. Our unadjusted analyses demonstrated a difference in healthy dietary habits across English ability. Latinos who spoke English well had better dietary habits than those who spoke English fluently. Differences in dietary habits may partly be due to lower levels of acculturation into American dietary habits for non-fluent English speakers.[29] Fluent English speakers may have higher rates of adoption of poor diet and exercise habits which may lead to higher rates of obesity and poorer control of diabetes, thus diminishing the advantage gained from their English fluency.[25,29,30] More systems oriented and healthy policy interventions may be necessary to provide improved access to healthy foods and more opportunities for exercise to address the barriers that fluent English speakers face in managing their diabetes.[31] Provider and patient intervention may be necessary to encourage behavior modification and maintain healthy lifestyles for this group.[31] Furthermore, while our study found patients' dietary habits varied by English ability, the adjusted analyses did not demonstrate a significant effect of diet on glucose control. Since our study assessed diet using only one question, further studies may consider assessing Latino patients' dietary habits more comprehensively to better examine differences by patient English ability and acculturation status.

The respondents who spoke no English also had higher odds of having an elevated HbA1c than those who spoke English well. While other studies have not found this disadvantage among Spanish speakers, our finding may be intuitive since language barriers pose many obstacles to care. In other studies, even among insured Latinos, those with poor or fair English language proficiency were more likely to have difficulty receiving information and advice by phone, have lower patient satisfaction scores, and have poorer patient-provider communication than those with good or excellent proficiency.[4,9–11] Studies have found that Spanish-speaking patients make fewer comments and are more likely to be ignored in encounters with English-speaking physicians.[24] Non-English speakers also have less knowledge regarding chronic diseases and monitor their home blood glucose less frequently than English speakers.[12,13] Providing language-concordant care by encouraging the use of interpreters, increasing the number of Latino physicians, and providing cultural competency training to providers may be important interventions to deliver care to Latinos who have no or little English ability.[16,32–36]

Limitations

Our study results must be considered in the context of several limitations. Our sample is a small, convenience sample from one city and may not be generalizable to Latinos in other regions. While we were able to account for several acculturation variables, we were limited by the variables in the data in our ability to use other validated acculturation measures or to assess English language ability using other questions used in the literature.[37] The patient population was recruited from a clinical site where all the patients were insured and may not reflect the general Latino population with diabetes. The use of interpreters and language concordant providers may be critical in providing care to Spanish-speaking patients, however we were unable to assess provider language and use of professional interpreters in the clinical encounters. Additionally, we have no measures on medication adherence that may have impacted glycemic control. Lastly, we were unable to control for neighborhood characteristics and other social determinants, which may play an important role in health outcomes.[28]

CONCLUSIONS

Our findings highlight the complex interplay of language on glycemic control within a Latino population with

diabetes. Further studies are needed to elucidate the mechanisms by which language affects glycemic control and why certain individuals have a comparative advantage within one ethnic subgroup. Providers and policy makers may need to consider the diversity of the Latino population in designing interventions aimed at reducing diabetes disparities.

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AUTHOR CONTRIBUTIONS

Design and concept of study: Baig, Locklin, Ewigman, Meltzer, Huang
Acquisition of data: Locklin, Ewigman, Meltzer, Huang
Data analysis and interpretation: Baig, Locklin, Foley, Meltzer, Huang
Manuscript draft: Baig, Locklin, Foley, Ewigman, Meltzer
Statistical expertise: Baig, Locklin, Meltzer
Acquisition of funding: Locklin, Meltzer, Huang
Administrative: Baig, Locklin, Ewigman, Meltzer, Huang
Supervision: Baig, Locklin, Foley, Meltzer, Huang