# ORIGINAL REPORTS: DIABETES

## ETHNIC AND LANGUAGE DISPARITIES IN DIABETES CARE AMONG CALIFORNIA RESIDENTS

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**Objective:** We examined ethnic and language disparities in diabetes care and management among California residents with type 2 diabetes based on ethnicity and English-language proficiency.

**Methods:** Data were drawn from the 2007 California Health Interview Survey with a total of 3,531 Asian, Latino, and Caucasian adults with diabetes. Latino and Asian groups were subdivided by their limited English proficiency (LEP) level. Population-weighted regression analyses were conducted to examine group differences, controlling for socioeconomic and clinical variables.

**Results:** Latino English Proficient (EP) and Latino LEP respondents received fewer hemoglobin A1c checks (EP: b=−0.11, P<.05; LEP: b=−0.27, P<.01) than Caucasians. Latino and Asian LEP respondents checked their glucose less frequently than Caucasians (Latino LEP: b=−0.49, P<.05; Asian LEP: b=−0.79, P<.01). Asian LEP respondents were less likely to receive feet checks than Caucasians (Asian LEP: b=−.52, P<.001). Asian LEP respondents received significantly fewer feet checks than Asian EP respondents (P<.05).

**Conclusions:** Ethnic disparities in disease management exist among California residents. However, beyond ethnicity, English proficiency should be taken into account when examining diabetes management among minority groups. Diabetic Californians who belong to ethnic minorities and speak limited English, particularly Asians, are less likely to receive the standard of care for diabetes than English proficient Caucasians. From a policy perspective, care should be taken to ensure that adequate information about diabetes management is available in multiple languages for patients with limited English skills. (*Ethn Dis.* 2011;21(2):183–189)

**Key Words:** Diabetic Care, Ethnic Disparity, Language Proficiency

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## INTRODUCTION

Diabetes is the 7th leading cause of death in the United States,[1] and the annual healthcare cost for diabetes in the United States is approximately $174 billion, representing 8% of total US healthcare spending which makes up 16.2% of the nation's Gross Domestic Product.[2] Prevalence rates have continued to rise for the past decade, with ethnic minority populations suffering a disproportionate burden of disease.[3] In 2007, 23.6 million or 7.8% of the total population in the United States had diabetes and 12.2 million or 23.1% of those aged ≥60 years had diabetes. Moreover, each year 1.6 million new cases of diabetes are diagnosed in people aged ≥20 years.[2] According to the 2007 National Diabetes Fact Sheet by the Centers for Disease Control and Prevention, the prevalence of adults with diabetes in each ethnic subgroup was 6.6% among non-Hispanic Whites, 10.4% among Hispanics, 11.8% among non-Hispanic Blacks, and 7.5% among Asian Americans.[2] Ethnic minorities also have high rates of diabetes-related complications. For example, African Americans and Latinos have higher rates of renal disease and retinopathy than non-Hispanic whites.[4,5] The higher rates of diabetes prevalence and complications among ethnic minorities including Asian Americans may be the result of disproportionately poor control of diabetes[6–8] and poor adherence to the recommended diabetes practice guidelines for monitoring the progression of disease and detecting early signs of complications.[5,9]

While the reasons for the disparities in diabetes prevalence, diabetes care, and health outcomes (eg, rates of complications) are multifactorial (eg, healthcare access, lack of insurance, sociodemographic factors),[10–13] health studies with ethnic minorities suggest that language barriers may be an important contributing factor. Limited English proficiency (LEP) has been associated with less access to care,[14–16] less use of preventive services,[17–19] and poorer well-being, functioning, and clinical outcomes in patients with diabetes or hypertension, and cardiovascular diseases.[20,21] However, one study found that intermediate outcomes (hemoglobin A1c, albumin check, ophthalmology care) for LEP and English-speaking patients were similar.[22]

> *We sought to determine whether adherence to diabetes management care, as recommended by practice guidelines, was associated with ethnicity and English language proficiency among ethnic minorities.*

We sought to determine whether adherence to diabetes management care, as recommended by practice guidelines, was associated with ethnicity and English language proficiency among ethnic minorities. Adherence to these guidelines is crucial for optimal diabetes care to prevent suffering and costly complications. Most studies have examined African American or Latino populations,[5,23–31] and thus there exists a lack of health information on Asian Amer-

icans. California is the most diversely populated state and has the largest number of Asian immigrants.[32] Using data from the 2007 California Health Interview Survey (CHIS),[33] the purpose of this study was to: 1) describe demographic characteristics of English proficiency (EP) and LEP diabetic individuals among Latino and Asian Americans compared to non-Hispanic Whites; 2) compare diabetes management behaviors of EP and LEP Latino and Asian Americans, as recommended by practice guidelines, to their non-Hispanic White counterparts; and 3) examine the influence of English language proficiency on diabetes management behaviors within these two minority groups with high prevalence of diabetes.

## METHODS

### Data Source

We used data from the adult portion of the 2007 California Health Interview Survey (CHIS 2007) which represents the state's noninstitutionalized population (aged ≥18).[33] The CHIS is the largest multiethnic, multilinguistic state health survey in the United States. It has been conducted bi-annually since 2001 by the University of California, Los Angeles Center for Health Policy Research, the California Department of Public Health, and the Public Health Institute to collect extensive information on health status, health conditions, health-related behaviors, health insurance coverage, access to healthcare services, and other health-related issues for all age groups living in California. The 2007 CHIS is the fourth collection cycle and was conducted between July 2007 and early March 2008.[33]

The CHIS was conducted in five languages: English, Spanish, Chinese (Mandarin and Cantonese dialects), Vietnamese, and Korean. These languages were selected based on the results of 2000 Census data. Latino and Asian

populations are predominant immigrant groups in the United States, particularly in California.[34] The survey questionnaires were culturally adapted for Latino and Asian groups. The overall response rate for the 2007 CHIS is a composite of screener completion rates (35.5% in the landline sample, 30.5% in cell-only households). Detailed information about the sampling and weighting methods can be found in the CHIS 2007 Methodology Series, posted on the CHIS website.[33]

### Sample

The sample included 3,531 CHIS 2007 respondents who had been told they had type 2 diabetes. Type 1 diabetes requires intensive management and the process of care is strictly regimented, while patients with type 2 diabetes have more freedom to choose how closely they monitor and manage their condition. Because we were particularly interested in racial and English proficiency differences in how adults with diabetes choose to monitor and manage their care, we restricted the sample to type 2 diabetics only.

### Dependent Variables

In the 2007 CHIS, there were 9 questions regarding diabetes. We selected four questions among these that indicate if diabetic adults received standardized diabetic care. Our four outcome variables were: 1) number of times doctor checked for hemoglobin A1c in the last 12 months; 2) number of times the respondent checked his/her glucose per month; 3) number of times the respondent's doctor checked feet for any sores or irritations in the last 12 months; and 4) whether the respondent had received an eye examination with dilated pupils in the last 12 months.

### Independent Variables

The sample was divided into five groups representing ethnicity and English proficiency status. Participants

were first divided into three ethnic groups: Latino, Asian, and White. Next, Latino and Asian diabetics who reported speaking English very well or well were coded as English proficient (EP) while those who reported speaking English not well or not at all were coded as limited English proficient (LEP). Caucasian diabetics, who were all English proficient, served as a reference group. Only 17 White respondents indicated limited English proficiency and these individuals were excluded from the sample. Thus, we compared five ethnic and English proficiency groups – Latino EP, Latino LEP, Asian EP, Asian LEP, and White EP.

As covariates for our main analyses, we included age, sex, marital status, length of time in the United States, income, health insurance status, perceived health, presence of comorbid conditions (eg, high blood pressure, heart disease, or heart failure/congestive) and diabetes treatment (ie, insulin or pills).

### Statistical Analyses

The data were analyzed using STATA 10 (Stata Corp, College Station, TX). Chi-square tests and bivariate regressions were used to examine unadjusted racial and English proficiency differences in demographic variables (Table 1). To address our main research questions, we used linear regressions (ordinary least squares for continuous dependent variables) and logistic regressions (for the dichotomous eye exam variable) to examine racial and English proficiency differences in diabetes management behaviors, adjusting for the covariates presented in Table 1. Because the continuous dependent variables (ie, hemoglobin checks, glucose checks, and feet checks) were highly positively skewed, we employed natural log transformations prior to running the analyses.[25,35,36] In the regression models for these dependent variables, the regression coefficients (β) can be interpreted as percent changes in the dependent vari-

**Table 1. Demographic characteristics of adults with diabetes, based on data from the 2007 California Health Interview Survey, by ethnic group and English proficiency\* (N=3,531)**

| Characteristic | White | Latino | | Asian | | Total |
|---|---|---|---|---|---|---|
| | All (EP) (n=2,665) | EP (n=314) | LEP (n=218) | EP (n=224) | LEP (n=110) | (n=3,531) |
| Age in years, mean (SE)† | 62.8 (.40) | 55.3 (1.0) | 51.1 (1.3) | 58.7 (1.4) | 65.1 (1.3) | 59.6 (.43) |
| Female, % | 43 | 26 | 15 | 44 | 47 | 37 |
| Married, % | 64 | 63 | 62 | 73 | 88 | 66 |
| Immigrant to US, %† | 8 | 37 | 98 | 74 | 100 | 36 |
| Family income, as % of poverty level† | | | | | | |
|   <100% FPL | 8 | 14 | 43 | 10 | 32 | 16 |
|   100%–199% FPL | 17 | 29 | 45 | 16 | 34 | 24 |
|   200%–299% FPL | 16 | 27 | 8 | 13 | 17 | 16 |
|   ≥300% FPL | 59 | 31 | 4 | 60 | 17 | 45 |
| High school education or above, %† | 90 | 72 | 18 | 97 | 72 | 76 |
| Has health insurance, %† | 97 | 90 | 60 | 95 | 93 | 90 |
| Good or excellent perceived health, %† | 56 | 54 | 17 | 55 | 30 | 49 |
| Has a comorbid condition (heart disease or high blood pressure, %)† | 71 | 67 | 46 | 65 | 59 | 66 |
| Taking insulin or pills for diabetes, % | 81 | 79 | 75 | 83 | 90 | 80 |

\* Percentages and standard errors are adjusted by population weights.
† P<.001, indicating significant group differences in demographic characteristics.
  EP, English proficiency; FPL, federal poverty level; LEP, limited English proficiency; SE, standard error.

able for a change in the dummy variable from 0 to 1 by employing the following equation: $100*(e^{\beta} - 1)$.[37] In other words, after exponentiating the beta coefficient and subtracting one, the resulting coefficient, when multiplied by 100, represents the percent change in the dependent variable between each ethnic/English proficiency group and White respondents, who served as the reference group. As an example, in the first regression equation, examining hemoglobin checks, the beta coefficient of $-.11$ for Latino EP respondents can be interpreted as Latino EP respondents reporting, on average, 11% fewer hemoglobin checks compared to white respondents.

We were also interested in testing associations between English proficiency and diabetes management behaviors within each minority group. Thus, following each regression analysis, we conducted planned comparisons employing Bonferroni corrected *P*-values. These analyses assessed differences in diabetes management behaviors between limited English and English proficient individuals within each of the two ethnic minority groups, Latino and Asian.

To accommodate the complex survey design used in CHIS 2007 and to ensure valid estimates of means, standard errors, confidence intervals, and significance tests, all analyses were adjusted using replicate weights provided by CHIS 2007.[33] These weights are based on estimates from the California Department of Finance and the American Community Survey.

## RESULTS

Table 1 presents descriptive information for diabetic adults across ethnic and English proficiency groups (English proficient; EP vs. limited English proficient; LEP). Analyses were conducted to compare demographic characteristics across the five ethnic/English proficiency groups (White, Latino EP, Latino LEP, Asian EP, and Asian LEP). These analyses revealed significant differences among groups in age, length of residence in the United States, income, education, insurance, perceived health, and comorbidity (P<.001). The variables presented in Table 1 were included as covariates in the main regression models.

Table 2 presents diabetes management measures across ethnic and English proficiency groups. Overall, respondents reported about 2 hemoglobin checks per year (range=0–50, median=2), 36 glucose checks per month (range= 0–240, median=30), and 2 feet checks per year (range=0–52, median =1). About 72% of the sample reported receiving a dilated eye exam in the past year.

Table 3 presents adjusted regression coefficients (or, for the eye exam variable, odds ratios) and 95% confidence intervals by ethnic and English proficiency group, with White respondents serving as the reference group. Latino EP and Latino LEP respondents received fewer hemoglobin checks per year (mean=1.9, P<.05 for Latino EP and mean=1.1, P<.01 for Latino LEP) relative to Whites (mean=2.4). Latino LEP and Asian LEP individuals performed fewer glucose checks per month (mean = 24.2, P<.05 for Latino LEP

**Table 2. Ethnic and English proficiency differences in diabetes management behaviors among adults with diabetes, based on data from the 2007 California Health Interview Survey\* (N=3,531)**

| Diabetes Management Behaviors | White | Latino | | Asian | | Total |
|---|---|---|---|---|---|---|
| | All (EP) (n=2,665) | EP (n=314) | LEP (n=218) | EP (n=224) | LEP (n=110) | (N=3,531) |
| A1c checks/year | | | | | | |
| Mean (SE) | 2.5 (.1) | 1.9 (.1) | 1.1 (.2) | 2.4 (.2) | 2.6 (.4) | 2.2 (.1) |
| Median | 2 | 2 | 0 | 2 | 2 | 2 |
| Range | 0–50 | 0–12 | 0–24 | 0–26 | 0–12 | 0–50 |
| Glucose checks per month | | | | | | |
| Mean (SE) | 39.9 (1.1) | 36.6 (3.0) | 24.2 (4.5) | 36.6 (7.0) | 21.5 (3.7) | 35.9 (1.2) |
| Median | 30 | 30 | 30 | 30 | 9 | 30 |
| Range | 0–240 | 0–210 | 0–180 | 0–240 | 0–150 | 0–240 |
| Feet checks last year | | | | | | |
| Mean (SE) | 2.4 (.1) | 2.3 (.3) | 1.8 (.2) | 1.7 (.2) | 1.1 (.2) | 2.2 (.1) |
| Median | 1 | 1 | 1 | 1 | 0 | 1 |
| Range | 0–52 | 0–24 | 0–12 | 0–15 | 0–12 | 0–52 |
| Dilated eye exam in past year | | | | | | |
| % (SE) | 73.8 (1.7) | 67.6 (3.6) | 66.7 (5.9) | 70.1 (3.9) | 81.6 (4.3) | 71.8 (1.3) |

\* All descriptive statistics are adjusted by population weights.
EP, English proficiency; LEP, limited English proficiency; SE, standard error.

and mean=21.5, $P<.01$ for Asian LEP) than Whites (mean=39.9). Asian LEP individuals received fewer feet checks per year (mean=1.1, $P<.001$) than Whites (mean=2.4). Finally, no significant differences were found in the odds of receiving a dilated eye exam in the past year in both LEP groups compared to Whites.

The multiple regression analyses examined diabetes management behaviors of the different ethnic/English proficiency groups compared to White respondents. However, also of interest were differences within each minority group between English proficient and limited English proficient respondents. Thus, after each regression model, planned comparisons employing Bonferroni corrected *P*-values examined differences between English proficient and limited English proficient respondents within the Latino and Asian minority groups. Results revealed no differences between proficient and limited English Latino and Asian respondents in number of hemoglobin checks per year, number of glucose checks per month, or the likelihood of having a dilated eye exam within the past year.

For number of feet checks, results indicated that Asian LEPs received significantly fewer feet checks per year than their Asian English proficient counterparts [$F(1, 78)=12.98$, $P<.05$].

## DISCUSSION

Our results showed that ethnic disparities exist in diabetes care/management behaviors among Latino, Asian, and Caucasian adults in California, and that these differences were associated with English language proficiency. After adjusting for the sociodemographic and clinical variables, Latinos overall received fewer A1C checks per year than Caucasians, and Latino LEP respondents had even less frequent A1C checks than Latino EP respondents compared to Caucasians. Both Latino LEP and Asian LEP respondents reported fewer glucose checks per month compared to Caucasians. Finally, Asian LEP respondents reported fewer feet checks per year than Caucasians.

The findings from this study are consistent with previous studies indicat-

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ing that language barriers are associated with lower quality of care, and that ethnic minorities with chronic diseases who are LEP are at increased risk of being in fair or poor health compared with English only speakers.[34] It is not clear how language specifically impacts quality of care as measured by the four diabetes maintenance care parameters in our study. However, those who do not speak English may have difficulty in accessing the healthcare system even with insurance, getting updated health information, navigating complex medical delivery systems to obtain adequate care, and being able to understand and

Table 3. Multivariate analyses for ethnic and English proficiency differences in diabetes management behaviors, adjusted,* California Health Interview Survey, 2007 (*N*=3,531)

| Diabetes management behaviors | White | Latino EP | | Latino LEP | | Asian EP | | Asian LEP | |
|---|---|---|---|---|---|---|---|---|---|
| | | Coef (β) | 95% CI | Coef (β) | 95% CI | Coef (β) | 95% CI | Coef (β) | 95% CI |
| Hemoglobin checks per year† | reference | −.11§ | −.21, .00 | −.27‖ | −.45, −.08 | .03 | .09, .16 | .03 | −.22, .28 |
| Glucose checks per month† | reference | .04 | −.22, .30 | −.49§ | −.96, −.03 | −.26 | −.57, .04 | −.79‖ | −1.31, −.28 |
| Feet checks (per year)† | reference | .07 | −.06, .20 | −.05 | −.27, .17 | −.13 | −.25, .00 | −.52¶ | −.74, −.29 |
| Eye exam in the past year (0=no)‡ | reference | 1.07 | .68, 1.69 | 2.07 | .93, 4.62 | .86 | .49, 1.50 | 2.07 | .90, 4.77 |

* Adjusted for age, sex, marital status, length of time in the United States, income, education, health insurance status, perceived health, presence of comorbid conditions, and diabetes treatment. All estimates are adjusted by population weights.
† Dependent variable transformed using $\ln(Y_i + 1)$.
‡ Coefficients (β) presented are odds ratios.
§ *P*<.05,
‖ *P*<.01,
¶ *P*<.001.
EP, English proficiency; LEP, limited English proficiency.

follow recommended treatment regimens given by their healthcare providers.[38,39] Thus, language barriers may place an extra burden on disease management among ethnic minorities with diabetes and make them especially susceptible to poor outcomes.

Results from this study also suggest that the negative impact of language disparities on optimal diabetes management may be more pronounced in Asian LEP than Latino LEP individuals. This may be due to the fact that in California most health information is available in Spanish language and Spanish translation is readily available in healthcare facilities, whereas for Asians (who are made up of multiple ethnicities), translation services and ethnic specific language materials are rarely available, with the exception of a few major Asian subgroups. For this reason, Latino LEP individuals may have less difficulty than Asian LEP in accessing mainstream health care and health information, which may translate to better adherence to standard diabetes care.

Standards of care for patients with diabetes by the American Diabetes Association emphasize the importance of regular A1c checks, glucose checks, eye checks, and feet checks to monitor glucose control, complications, and comorbid conditions.[9] With the exception of glucose checks per month, adherence to recommendations requires, in most cases, the provider's order for blood tests and referral to specialty care. Language barriers may limit patients' ability to request recommended check-ups, even if they are aware of these recommendations. Even after the provider's order, following recommendations may be challenging for LEP individuals with diabetes because they may not understand or be able to follow often complex directions for tests and referrals. Limited English proficiency may pose a major barrier to accessing the referred specialty clinics if the clinics do not have native language translation available, and this may be truer for Asians who are made up of multiple ethnic subgroups and speak multiple languages.

In this study, language was significantly associated with diabetes management behaviors after demographics and comorbidities were statistically controlled, suggesting that English language proficiency has an impact on diabetes management care regardless of certain sociodemographic, clinical, and comorbid conditions. Although demographic factors were not of primary interest in this study, an interesting finding was noted in that among Latinos, 24% of nonimmigrants were LEP, whereas among Asians, 0% of nonimmigrants were LEP. A potential explanation for this counterintuitive finding may be related to education and poverty since only 18% of Latino LEP respondents reported a high school education or higher, and the majority of Latino LEP respondents reported an income under 200% of the federal poverty level. Comparison analyses with prior years' CHIS data sets may help further explain this finding.

Both Latino and Asian immigrants are fast growing sectors of the US population and the incidences of type 2 diabetes in both groups are rapidly rising. Based on the findings from this study, clinical implications for healthcare providers are: 1) language is associated with adherence to diabetes maintenance care and therefore may have an impact on outcomes among ethnic minorities. Health information in ethnic languages and translation services should be an integral part of quality health services to ethnic minorities with type 2 diabetes for optimal disease management; 2) Particular attention needs to be paid to Asian Americans whose resources for language support are extremely limited. This culturally and linguistically diverse group with high diabetes prevalence may be at increased risk for poor

diabetes management because of language proficiency disparities.

This study has several limitations. First, CHIS data were based on participants' self-report. In addition to recall bias inherent to self-reported measures, respondents may have been modest and may have rated their English language proficiency lower than their actual level. Thus, without objective language tests, responses may be subject to bias. Second, since the 2007 CHIS was a cross-sectional survey in one ethnically diverse state, causality cannot be established and generalizations to other geographic locations may not be made. Third, we were unable to directly examine relationships among English language proficiency, diabetes management behaviors, and diabetes outcomes since information on hemoglobin A1c levels of respondents are not available in the CHIS dataset. Therefore, we cannot address whether there is a direct relationship between language proficiency and glucose outcomes or whether the differences in the four diabetes management parameters are associated with glucose outcomes in Latinos and Asians.

Despite these limitations, this study contributes to existing knowledge about the importance of language proficiency in diabetes care and management in ethnic minorities. The study findings have both clinical and health policy implications in that language assistance should be a part of quality diabetes care provided to ethnic minorities with type 2 diabetes and that the policies to support the implementation of such assistance should be considered in an effort to close the gap of health disparities in diabetes care among ethnic minorities.

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