

Disparities in Diabetes Management Practice Between Racial and Ethnic Groups in the United States

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PURPOSE

The purpose of this study was to evaluate the association between race/ethnicity and self-management practices of people with diabetes.

METHODS

Analyses were based on data from the 2001 Behavioral Risk Factor Surveillance System. Contingency tables and multiple logistic regression were used to assess the data.

RESULTS

Frequency distributions of selected diabetes management variables significantly varied across levels of race/ethnicity. These differences persisted after adjusting for current age, age at diagnosis, gender, marital status, income, and education. Analyses revealed that Hispanics, compared with whites, were more likely to take oral agents to control their blood glucose, less likely to monitor their blood glucose daily, and less likely to check their feet for sores or irritation. There was no difference among the racial/ethnic groups use having participated in a diabetes education class.

CONCLUSIONS

Health literacy and cultural factors, including the influence of family, beliefs about diabetes, and access and utilization of health care, may influence Hispanic diabetes management behaviors. Understanding these influences is essential to the development of programs, policies, and other strategies that are culturally appropriate and relevant.

Diabetes is a public health problem of increasing magnitude. It is presently the sixth leading cause of death in the United States.¹ The prevalence of diagnosed diabetes increased 49% from 1990 to 2000,² and is expected to increase 165% from 2000 to 2050.³ The largest increase is projected to be among the elderly and blacks, followed by whites.³ Racial and ethnic groups are disproportionately affected by diabetes and complications associated with the disease. Specifically, compared with non-Hispanic whites, non-Hispanic blacks are 2 times more likely to develop diabetes, Hispanics are 1.9 times more likely, American Indians and Alaska Natives are 2.6 times more likely, and Native Hawaiians are 2.5 times more likely.⁴

The health and economic impact of diabetes is extensive. In the United States, diabetes is the leading cause of blindness, kidney failure, foot amputation, and complications in pregnancy.¹ The annual economic cost of diabetes in the United States is estimated at \$98 billion.⁵ In response to this public health burden, the diabetes care system includes both prevention and treatment that involves clinical management, diabetes self-management education, and participant self-management.⁶ Each component is critical to the management of diabetes and the prevention of complications.

Limited research has assessed the relationship between race/ethnicity and self-management behaviors among people with diabetes.^{7,8} This study evaluates the association between race/ethnicity and self-management of diabetes.

METHODS

Data from the Behavioral Risk Factor Surveillance System (BRFSS) are the basis for the analyses in this study. BRFSS is a cross-sectional surveillance survey. It involves a collaborative effort between the Centers for Disease Control and Prevention (CDC) and US states and territories to collect data on health behaviors and risk factors related to chronic diseases, injuries, and preventable infectious diseases among the adult population 18 years of age and older living in households.⁹

Researchers at the CDC are the primary authors of the BRFSS. The BRFSS consists of 3 modules of questions: core, optional, and state added. The core questions are standard questions asked by all states and include questions about health-related behaviors and

health conditions or health-related perceptions (eg, health status, health insurance, tobacco use, selected cancer screening procedures, and HIV/AIDS risks, along with demographics). Optional modules include questions related to a specific health topic (eg, physical activity, oral health, or skin cancer). In 2001, there were 14 optional modules. State-added questions are developed or acquired by the state and added specifically to their individual state questionnaire. Fixed core questions and optional modules included in the BRFSS first undergo evaluation and editing through pilot testing. The core questions along with the optional modules are then made available to participating areas in the BRFSS prior to the beginning of each year. State-added questions to the survey undergo evaluation and editing on the state level.

Interviews are conducted through computer-assisted telephone interviewing by state health employees or independent contractors. Interviewers receive training on the BRFSS questionnaire and procedures prior to being certified to conduct interviews. Supervisors systematically monitor interviews by listening to the interviewer and respondent, and/or through verification callbacks. English and Spanish versions of the BRFSS questionnaire are used. In states where other languages are prevalent, state health departments have the option of translating the survey into those languages. If an interviewer who speaks the language of the respondent is not present, that individual is excluded from the study.¹⁰

Participating areas in the BRFSS each use probability sampling of all households with telephones in their area. A disproportionate stratified sampling design is used in each area except Minnesota, which uses the Mitofsky-Waksberg sampling design, and Puerto Rico, which uses simple random sampling. A detailed description of these sampling procedures is provided elsewhere.¹¹

The 2001 BRFSS questionnaire included an optional module on diabetes that individuals completed if they responded affirmatively to the question "Have you ever been told by a doctor that you have diabetes?" Forty-six states and territories adopted this module. States that did not include the module were Delaware, Illinois, Indiana, Louisiana, Mississippi, Missouri, North Carolina, and Oregon. Questions from the

Table 1.*Selected Diabetes-Related Questions from the Behavioral Risk Factor Surveillance System (BRFSS)*

1. Have you ever taken a course or class in how to manage your diabetes yourself?
2. How old were you when you were told you have diabetes?
3. Are you taking diabetes pills?
4. Are you taking insulin?
5. About how often do you check your blood for glucose or sugar? Include times when checked by a family member or friend, but do not include times when checked by a health professional.
6. About how often do you check your feet for any sores or irritations? Include times when checked by a family member or friend, but do not include times when checked by a health professional.
7. A test for hemoglobin "A one C" measures the average level of blood sugar over the past 3 months. About how many times in the past 12 months has a doctor, nurse, or other health professional checked you for hemoglobin A one C?
8. When was the last time you had an eye exam in which the pupils were dilated? This would have made you temporarily sensitive to bright light.
9. Blood cholesterol is a fatty substance found in the blood. Have you ever had your blood cholesterol checked?
10. Vigorous activities cause large increases in breathing or heart rate while moderate activities cause small increases in breathing or heart rate. In a usual week, do you do vigorous activities for at least 10 minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate?
11. About how many times in the past 12 months have you seen a doctor, nurse, or other health professional for your diabetes?

module that relate to diabetes self-management behaviors are presented in Table 1. Categories of race/ethnicity are white, non-Hispanic white (hereafter referred to as white), black, non-Hispanic black (hereafter referred to as black), Hispanic, Asian/Pacific Islander, American Indian/Alaska Native, and other. Additional variables considered include current age, age at diagnosis, gender, marital status, education, and income.

The National 2001 BRFSS data demonstrated that 14 633 individuals (6.76%) had diabetes, not including gestational diabetes; 11 674 of these individuals completed additional questions in a module on diabetes. The authors further restricted the data to the racial/ethnic groups identified in the previous paragraph, deleting 107 individuals in the other/non-Hispanic category; 230 multiracial, non-Hispanic individuals; and 120 individuals who did not know, were unsure of, or refused to indicate their race/ethnicity. The remaining 11 217 individuals (8129 whites, 1185 blacks, 1327 Hispanics, 277 Asians/Pacific Islanders, and 299 American Indians/Alaska Natives) comprised the study population. Weighted percentages were computed to compensate for respondents' probability of selection, nonresponse, and disproportionate selection of subgroups of the population compared with the state's population distribution.

Researchers at the CDC process the survey data received from each state and territory. These data are available for public use. In this study, the authors used these data to assess correlates of diabetes management using contingency tables and multiple logistic regression.¹² Contingency tables were summarized using counts and percentages, and evaluated for statistical significance using the Chi-square test for independence.¹³ The beta coefficients in the logistic regression models were assessed using the *t* statistics with robust standard errors, which are appropriate with BRFSS data.¹⁴ Two-sided confidence intervals were used based on the 0.05 level. Statistical analyses were conducted using the Statistical Analysis System (SAS) software, version 8.2 (SAS Institute, Cary, NC), and SUDAAN software, version 8.1 (RTI International, Research Triangle Park, NC).

RESULTS

Frequency distributions of selected diabetes management variables significantly varied across race and ethnicity (Table 2). Among all racial/ethnic groups, approximately half of the respondents reported having enrolled in a class to manage their diabetes, with the exception of Hispanics. More respondents indicated that they take oral agents or diabetes pills than those reporting that they take insulin. Blacks were most likely to be

Table 2.

*Bivariate Analyses Among Diabetes Cases of Race/Ethnicity by Select Diabetes Management Variables**

Variable	White	Black	Hispanic	Asian/Pacific Islander	American Indian/Alaska Native	Chi-square P value
Ever taken a class to manage diabetes?						
Yes	53.5	55.2	39.7	47.1	63.3	
No	46.5	44.8	60.3	52.9	36.7	< .001
Now taking diabetes pills?						
Yes	66.5	68.0	71.8	81.2	61.2	
No	34.5	32.0	28.2	18.8	38.8	.0106
Now taking insulin?						
Yes	27.1	31.7	19.1	11.9	33.9	
No	72.9	68.3	80.9	88.1	66.1	< .001
Frequency of checking blood glucose						
Daily	45.3	43.8	35.0	53.7	53.9	
Weekly	25.5	27.1	16.6	31.7	27.4	
Monthly	8.9	11.9	10.4	4.8	4.8	
Never	20.3	17.2	38.0	9.8	13.9	< .001
Frequency of checking feet for sores/irritations						
Daily	71.5	75.3	57.6	69.5	79.2	
Weekly/Monthly	13.4	13.9	13.5	11.8	5.5	
Never	15.1	10.8	28.9	18.7	15.3	< .001
Times checked A1C						
1 to 2	40.3	37.9	34.5	31.1	33.9	
3 to 4	36.3	36.3	29.7	46.8	39.3	
5+	8.6	12.7	8.8	6.2	10.6	
None/Never heard of	14.7	20.3	27.0	15.9	16.2	< .001
Last eye exam where pupils were dilated						
Within last year	73.6	70.0	65.6	77.2	62.8	
One or more years ago	22.6	22.7	22.2	13.5	29.2	
Never	3.9	7.3	12.2	9.3	8.0	< .001
Cholesterol checked						
Ever	95.8	90.1	90.0	92.5	87.9	
Never	4.2	9.9	10.0	7.5	12.1	< .001
Vigorous physical activity						
Yes	23.6	21.0	23.8	41.0	16.0	
No	76.4	79.0	76.2	59.0	84.0	0.078

*Percentages are weighted.

taking insulin while Asians/Pacific Islanders were least likely. Hispanics were least likely to report that they check their blood glucose on a daily basis. In contrast, whites were most likely to have had an A1C test, a measure of average glycemia over the past 2 to 3 months. Among nearly all racial/ethnic groups, approximately three fourths checked their feet for sores and irritations daily, except for Hispanics, who reported doing this just over half of the time. Whites and Asians/Pacific Islanders were most likely to have had a dilated eye exam within the last year and Hispanics and American Indians/Alaska Natives were least likely. All racial/ethnic groups reported having had their cholesterol previously checked, with whites being the most likely to have done so. American Indians/Alaska Natives were least likely to vigorously exercise, whereas Asians/Pacific Islanders were most likely to be active.

adjusted odds ratios and 95% confidence intervals of the selected diabetes management behaviors according to race/ethnicity are shown in Table 3. Adjustments were made for current age, age at diagnosis, gender, marital status, education, and income in the multiple logistic regression model. Compared with whites, Hispanics were significantly less likely to have taken a course on how to manage their diabetes, take insulin, check their glucose daily, check their feet for sores or irritations, check their A1C, have a dilated eye exam, and check their cholesterol. Hispanics, along with blacks and Asians/Pacific Islanders, were more likely to take pills to control their diabetes. Asians/Pacific Islanders were significantly less likely to take insulin. Whites were more likely than the other racial/ethnic groups to have their cholesterol checked and have a dilated eye exam, and American Indians/Alaska Natives were less likely to exercise vigorously.

The percentage of patients who had not seen a doctor, nurse, or other health professional for their diabetes in the past 12 months was also significantly associated with race/ethnicity: 9.3% for whites, 8.6% for blacks, 13.3% for Hispanics, 8.1% for Asians/Pacific Islanders, and 8.1% for American Indians/Alaska Natives (Chi-square $P < .001$). This variable was included in

the multiple logistic regression models to determine its association with the diabetes management variables. Patients who saw a doctor, nurse, or some other health professional for their diabetes in the past 12 months, compared with those who had not, were significantly more likely to have taken part in each of the diabetes management behaviors except for vigorous physical activity (data not shown). The data also revealed that participation in the diabetes management behaviors increased with the number of times that participants had seen a doctor, nurse, or other health professional for their diabetes.

DISCUSSION

A primary goal of Healthy People 2010 is to eliminate health disparities among subgroups of the population.¹ This study shows that disparities exist in diabetes management practices among racial/ethnic groups in the United States, and that these disparities remained after adjusting for current age, age at diagnosis, gender, marital status, income, and education. Overall, Hispanics were significantly less likely to have positive self-management behaviors. These results are consistent with those reported by Harris and colleagues¹⁵ indicating that blood glucose monitoring is less common among Mexican Americans than whites. In addition, Hispanics were significantly less likely to have seen a doctor, nurse, or other health professional for their diabetes in the past 12 months, which probably indirectly lowered their diabetes management behavior. Understanding why this occurs may have important implications for Hispanics in terms of disability and death associated with diabetes.

The individual's health literacy level may influence his/her diabetes management behaviors. *Health literacy* is defined as "a constellation of skills, including the ability to perform basic reading and numerical tasks required to function in the health care environment."^{16(p 553)} Williams and colleagues¹⁷ reported that patients with lower health literacy scores also had less knowledge of diabetes. Additionally, only half of the patients with inadequate literacy knew the symptoms of hypoglycemia compared with 94% with adequate literacy. Language skills, although just one aspect of literacy,

Table 3.*Adjusted Odds Ratios of Selected Diabetes Management Variables**

Diabetes Management Variable: Race/Ethnicity	Odds Ratio	95% Confidence Interval
Taking a class to manage diabetes		
White	1.0	Referent
Black	1.2	0.9, 1.4
Hispanic	0.6	0.5, 0.8
Asian/Pacific Islander	0.6	0.3, 1.2
American Indian/Alaska Native	1.5	0.9, 2.6
Now taking diabetes pills (yes vs no)		
White	1.0	Referent
Black	1.3	1.1, 1.7
Hispanic	1.6	1.2, 2.1
Asian/Pacific Islander	3.0	1.5, 6.1
American Indian/Alaska Native	1.0	0.6, 1.9
Now taking insulin (yes vs no)		
White	1.0	Referent
Black	1.1	0.8, 1.4
Hispanic	0.5	0.4, 0.7
Asian/Pacific Islander	0.3	0.1, 0.8
American Indian/Alaska Native	1.0	0.6, 1.8
Check feet for sores/irritation (daily vs otherwise)		
White	1.0	Referent
Black	1.3	1.0, 1.7
Hispanic	0.6	0.4, 0.8
Asian/Pacific Islander	1.0	0.5, 2.0
American Indian/Alaska Native	1.5	0.8, 2.8
Check A1C (yes vs otherwise)		
White	1.0	Referent
Black	1.0	0.7, 1.3
Hispanic	0.7	0.5, 0.9
Asian/Pacific Islander	0.8	0.3, 2.1
American Indian/Alaska Native	1.1	0.6, 2.1
Cholesterol checked (ever vs never)		
White	1.0	Referent
Black	0.6	0.4, 0.9
Hispanic	0.6	0.4, 0.9
Asian/Pacific Islander	0.4	0.1, 1.6
American Indian/Alaska Native	0.5	0.2, 1.0
Vigorous physical activity (yes vs no)		
White	1.0	Referent
Black	0.9	0.7, 1.1
Hispanic	1.1	0.8, 1.5
Asian/Pacific Islander	1.4	0.7, 2.7
American Indian/Alaska Native	0.6	0.4, 0.9

*Odds ratios are adjusted for current age, age at diagnosis, gender, marital status, education, and income.

may influence access to and use of healthcare services. Language ability has been reported as a barrier to adequate access to health care, particularly among children.¹⁸ In turn, lack of adequate health care results in lower levels of self-management behaviors. Low health literacy has been associated with poor glycemic control and increased prevalence of self-reported complications due to poor control, including retinopathy.^{19,20}

Cultural beliefs might also explain, in part, the lack of self-management behaviors among Hispanics. By definition, the term *Hispanic* is used to include all people from Spanish-speaking countries, not taking into consideration differences in cultural beliefs, values, education, socioeconomic status, or acculturation.²¹ *Latino* is a term used to represent all people from Latin American countries, each of which has individual cultural traditions, beliefs, languages, etc.²¹ Therefore, a limitation in trying to explain cultural beliefs as they relate to diabetes management is that the Hispanic culture is not only one culture but a composite of many cultures. However, 3 factors appear to be similar in Hispanic culture that may influence diabetes management behaviors.

First, the family and family influence are very important in Hispanic culture. Specifically, family support is very important to Latino health practices.²² Among Hispanic patients with diabetes, Fisher and colleagues²³ found that family structure was linked to disease management behaviors. Specifically, they discovered better disease management among families that were well organized, had clear traditional sex roles, were optimistic about life, and had spouses who exhibited adequate communication and conflict resolution skills. A study of Latinos from 4 diverse communities found that family support was important in ensuring patient compliance with diabetes management behaviors.²⁴ Similarly, the role of women within the family is important. Oomen and colleagues²⁵ indicated that among Hispanic women buying special foods to accommodate a diabetic lifestyle or spending extra money for medication is viewed as selfish behavior. In contrast, self-denial and going without something for the good of the family is considered honorable. Thus, if the family is not supportive of the lifestyle changes that are necessary for people with diabetes, the management practices may not continue.

A second factor that may influence management behaviors among Hispanics is beliefs about diabetes as a disease. A study of Mexican Americans found that many believed that diabetes could not be controlled.²⁶ Seventy-eight percent of non-Mexican-American Latinos surveyed responded that diabetes was God's will.²⁷ Additionally, some Hispanics feel that it is not necessary to visit the doctor when you are feeling well.²⁸ These erroneous and fatalistic beliefs may influence whether Hispanics engage in practices that can help mediate complications resulting specifically from unmanaged diabetes.

The third factor that is common among Hispanics is a lack of access to and utilization of healthcare services.^{28,29} Philis-Tsimikas and Walker³⁰ reported that 2 major barriers to effective diabetes management were access to care and coverage. Factors that influence access and utilization are health insurance coverage and having a primary provider. Solis and colleagues,²⁹ found, when studying health screening practices, that most Hispanics did not have a regular provider. However, having a regular provider correlated with using a health maintenance organization or private clinic, and having a routine place for health care. Hispanics are generally loyal to their healthcare provider, and if the provider leaves the area, the patient will stop going for care.²⁸

Although understanding common beliefs or practices about a particular culture can be helpful in developing and delivering health-related programs, health professionals must be careful to avoid stereotyped views of Hispanic or Latino cultures. For example, not all Hispanic people eat a traditional Hispanic or Mexican diet. As individuals become *acculturated*, meaning that they adopt the cultural norms of the dominant group,³¹ dietary practices change to reflect the new culture (eg, American). Studies show that Mexican-born immigrants tend to eat healthier diets, including eating more fruits, vegetables, and grains, than second-generation or third-generation Mexican Americans born in the United States.³¹⁻³³

Some potential limitations of BRFSS data may include sampling error (ie, random variation that could result from only a subset of the entire population being identified) and nonsampling error (ie, incorrect interpretation of questions by respondents, variations in interviewer techniques, nonresponse, and coding errors).

Error may also occur because telephone surveys exclude certain population segments from the sampling frame (ie, households without telephones). Estimated percentages of households without telephone service nationally differed according to race/ethnicity: 2.4% for whites, 6.7% for blacks, 6.2% for Hispanics, 11.6% for American Indians and Alaska Natives, 1.5% for Asians, 3.6% for Pacific Islanders, and 6.6% for other racial groups.³⁴ It is also not known the extent to which interviews were not conducted due to language barriers. The large sample sizes used by the BRFSS should minimize sampling error. Error is further minimized through interviewer monitoring, verification of callbacks, assessing quality assurance indicators, and data editing.¹⁰ These potential limitations should be considered when interpreting and generalizing the results.

IMPLICATIONS

Studies confirm that culture influences the effectiveness of health care, including diabetes treatment.^{25,35,36} Therefore, 3 recommendations are provided.

The first recommendation is to incorporate cultural sensitivity into health-related programs or interventions (eg, using a preferred language in writing and speech, and assessing cultural influences and modifying treatments or interventions based on findings). Kreuter and colleagues³⁷ used 5 categories (peripheral, evidential, linguistic, constituent-involving, and sociocultural) to describe potential strategies that can make health promotion programs and materials more culturally appropriate. Peripheral strategies involve using words, graphics, or colors to appeal to a particular group. For example, a booklet about healthy food choices could include pictures of Hispanic people, bright colors, and a title such as “Healthy Cooking Hints for Hispanics with Diabetes.” Evidential strategies incorporate evidence of the impact of a health issue on a particular group, thereby increasing their perceived vulnerability, (eg, communicating that American Indians are more likely to develop diabetes). Providing educational materials or programs in a native or preferred language is an example of a linguistic strategy. In the Hispanic community, engaging community health workers, called *promotoras*, is central to constituent-involving strategy. These individuals can help with linguistic strategies as well as provide insight into cultural beliefs and practices. Finally, sociocultural strategies

take a broader perspective. The goal is to develop a deeper understanding of cultural values, beliefs, norms, and behaviors, which are then incorporated into the development and implementation of health promotion programs.

A culture-based approach requires diabetes educators to increase their familiarity with the culture through investment and involvement with the target population. Activities may include taking courses, participating in research, participating in community events, or reading literature about the cultural beliefs, attitudes, practices, and values of a specific culture. Hispanic culture and health care in the United States is described well in *Quality Health Services for Hispanics: The Cultural Competency Component*.²⁸ Practitioners must incorporate this new knowledge into daily practice. For example, effective practitioners would not ignore or refute alternative beliefs but incorporate them into treatment.³⁸

Developing and implementing diabetes interventions based on cultural norms and values can be effective and result in the desired health outcomes. For example, a pilot study was conducted with Mexican Americans with diabetes who lived along the Texas-Mexico border.³⁹ This community-based diabetes education and group support intervention was based on Mexican American culture and included Mexican American healthcare providers, including a bilingual nurse, a registered dietitian, and a community health worker. In addition to Spanish-language education materials, the intervention included participation by family members and provided information about how to revise favorite recipes to be healthier. The intervention was successful at improving diabetes knowledge and fasting blood glucose and A1C levels. As a follow-up to this pilot study, a prospective, randomized, repeated-measures study was conducted.³⁵ Again, statistically significant changes were found with respect to diabetes knowledge, and fasting blood glucose and A1C levels.

In a randomized controlled trial in the Hague, Netherlands, diabetes nurses and dietitians provided intensive diabetes education using culture-specific materials.⁴⁰ General diabetes information was provided in the Surinam-Hindi language and nutrition information was based on South Asian cooking. The outcome of this trial was improved A1C levels.

Project Dulce is another culturally sensitive program that has shown positive results.³⁰ This comprehensive program included 2 primary components: health promotion and education, and clinical care. The health promotion component consisted of a 12-week, culturally sensitive diabetes education course delivered by community health workers, or promotoras; a registered nurse/certified diabetes educator and a dietitian provided the clinical care. The results showed satisfaction with treatment, improved diabetes-related knowledge, increased belief that patients could control their health, and a decrease in beliefs about ineffective culture-based remedies.

The second recommendation is that diabetes educators consider including community health workers, or promotoras, as part of the healthcare team. This approach has been effective at increasing access to care and compliance with treatment.^{41,42} Generally, these lay health workers are trusted and respected members of the community who act as a link between the healthcare system and the community. Their responsibilities include, but are not limited to, patient education, outreach, and case management.^{41,42} Although use of promotoras appears to be promising, limited research has been conducted to evaluate this approach in managing diabetes.⁴³

The third recommendation is that healthcare providers encourage people with diabetes to take a diabetes education class. Diabetes self-management education is an integral part of the entire diabetes care system.⁶ In fact, “diabetes self-management education is the cornerstone of care for all individuals with diabetes who want to achieve successful health-related outcomes.”^{44(p 5140)} Effective diabetes self-management

education programs can complement the clinical care that people with diabetes receive from healthcare providers. The process of self-management education can include clinical patient education, group sessions, home visits by lay health workers, computer-aided instruction,⁴⁵ or self-directed programs.

Patients are more likely to participate if their provider recommends and supports such educational opportunities. Results from this study indicate that only half of the respondents reported having participated in a diabetes education class. However, a positive association was observed between visits to the healthcare provider and having completed a diabetes education class (data not shown). This finding reinforces the fact that healthcare providers are key partners in the process of diabetes management. Encouraging healthcare providers to talk with their patients about completing diabetes education courses is one step toward achieving the Healthy People 2010 objective to increase the proportion of people who receive formal diabetes education.¹

Achievement of nearly all diabetes-related objectives in Healthy People 2010 depends, in part, on appropriate self-management and preventive care practices. As reported in this study, disparities in management behaviors exist between racial/ethnic groups. Understanding the influence of literacy, culture, and environment on diabetes knowledge, attitudes, and self-management behaviors is essential to the development of appropriate interventions. Literature shows that diabetes interventions that are based on cultural norms and values can be effective and result in the desired health outcomes.

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