

Use of Dental Health Services within the Past Year among Adults at Risk of Diabetes in the Alabama Black Belt

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Abstract

Objective: We evaluated the use of dental health services within the past year among adults at risk of diabetes in the Alabama Black Belt. **Methods:** Data for this cross-sectional study was collected in 2005-2006 through the Flying Sparks project. In addition to descriptive statistics and univariate analysis (Chi-square), we used multiple logistic regression analysis to examine the association between dental care use and diabetic status. **Results:** 1355 individuals responded the survey (mean age 51 years). 67.9% were females and 89.5% African-Americans. 16.7% reported history of diabetes. Overall, 54.5% of individuals had visited a dentist within the past year. Adults with diabetes were less likely than those without diabetes to have seen a dentist (13.4% vs 86.6%, $p < 0.01$). Females were more likely to visit a dentist in the past year (adjusted OR = 1.4, 95% CI 1.11 - 1.90) than males. African-Americans were less likely than whites to have seen a dentist (adjusted OR = 0.6, 95% CI 0.43 - 0.97). Lower levels of education and household income were associated with a greater likelihood of not seeing a dentist in the previous year. After controlling for gender, health insurance, race, education, report of limited community health services, routine medical check-up within past year, and annual household income, individuals with diabetes were significantly less likely than those without diabetes to have seen a dentist within the preceding year (OR = 0.6, 95% CI 0.43 - 0.84). **Conclusions:** Individuals with history of diabetes in the Alabama Black Belt should be encouraged to have annual dental visits as part of a comprehensive diabetes care plan.

Keywords

Diabetes; Disparities; Rural; Use of Dental Services

1. Introduction

Diabetes mellitus affects 5% of the world's population and its prevalence is doubling every year [1]. Although the true prevalence of diabetes is unknown, it is estimated, taking into consideration both diagnosed and undiagnosed cases, that around 9.6% of the United States (US) adult population (approximately 16 million) has diabetes [2]. This number is projected to increase to over 40 million in the next 25 years [3]. Southeastern states have the highest rates of diabetes, which is more prevalent in minority and older populations [4] [5].

Alabama's Black Belt includes some of the poorest counties in the United States. The area is home to a large proportion of Alabama's African American population and has low-density settlement, high unemployment, high number of single-parent households, high teen birth rates, and poor access to education and health-care services. For counties within the Alabama's Black Belt, diabetes constitutes a crucial health issue [6]-[8].

Some of the most well-known complications of diabetes include macro vascular complications like cardiovascular disease, and micro vascular disease like nephropathy, peripheral vascular disease, neuropathy and retinopathy [1]. However, oral manifestations like periodontitis, are also important complication of diabetes [9] [10]. Periodontal disease has two stages: gingivitis (initial stage), and periodontitis (bone infection). Diabetes increases the risk of periodontitis, which can be exacerbated by smoking, older age, gender (male), and obesity [11] [12]. Previous studies have shown that periodontitis is three times more common in diabetics than in non-diabetics [13].

The relationship between diabetes and periodontitis seems to be two-way, where diabetes can lead to poor oral health (increased periodontitis) and periodontitis can contribute to poor glycemic control [13]. Periodontitis is thought to affect diabetes through inflammation due to bacterial infection in tissue surrounding the teeth, which increases insulin resistance that in turn results in poor glycemic control. This insulin resistance effect seems to be reversed after periodontitis treatment and consequently glycemic control is improved [1] [2]. Other oral conditions more common in diabetic patients are caries, xerostomia, mucosal lesions, taste impairment, sialosis, oral candidiasis, and oral lichen planus [1]. However, the associations between those conditions and diabetes are less strong and more conflicting than the association between diabetes and periodontitis [10].

Conforming to research findings demonstrating the association between diabetes and oral disease (periodontitis), leading organizations in diabetes care, like the Centers for Disease Control and Prevention (CDC) and the American Diabetes Association have put forth treatment guidelines for people with diabetes, recommending dental visits at least every 6 months [2]. In addition, the objective 5.15 of the Healthy People 2010 is to increase the percentage of people with diabetes who have at least one annual dental examination [4].

It has been observed that adults with diabetes receive oral health care at a lower rate than adults without diabetes [1]. In addition, people with diabetes see the dentist less than they see other health specialists as part of their optimum comprehensive diabetes care [1].

Our aim is to evaluate the use of dental health services within the past year among adults in the Alabama Black Belt region [14] which is characterized by high levels of poverty and a majority African American population with limited access to health care [15]. To our knowledge this is the first study that attempts to assess the level of oral health usage in individuals at risk of diabetes in Alabama.

2. Materials and Methods

2.1. Setting and Sample Selection

Our sample comes from data abstracted through the Flying Sparks project. The Flying Sparks is a large-scale, multi-community project administered through the University of Alabama at Birmingham (UAB), which aims to explore the determinants of community adoption, ownership, and enhancement of community health advisor intervention strategies on rural, isolated, and predominantly African American communities in the Black Belt region of Alabama [16].

Adult members over 18 years of age of twenty-one communities from seven Black Belt counties (Dallas, Lowndes, Marengo, Monroe, Perry, Sumter and Wilcox) in West-central Alabama (**Figure 1**) completed 1380 in-person interviewer-administered surveys. The communities were defined as geographic locations or church memberships (at least 200 members each) that shared common values and had a sense of mutual support. The UAB Institutional Review Board approved this protocol.

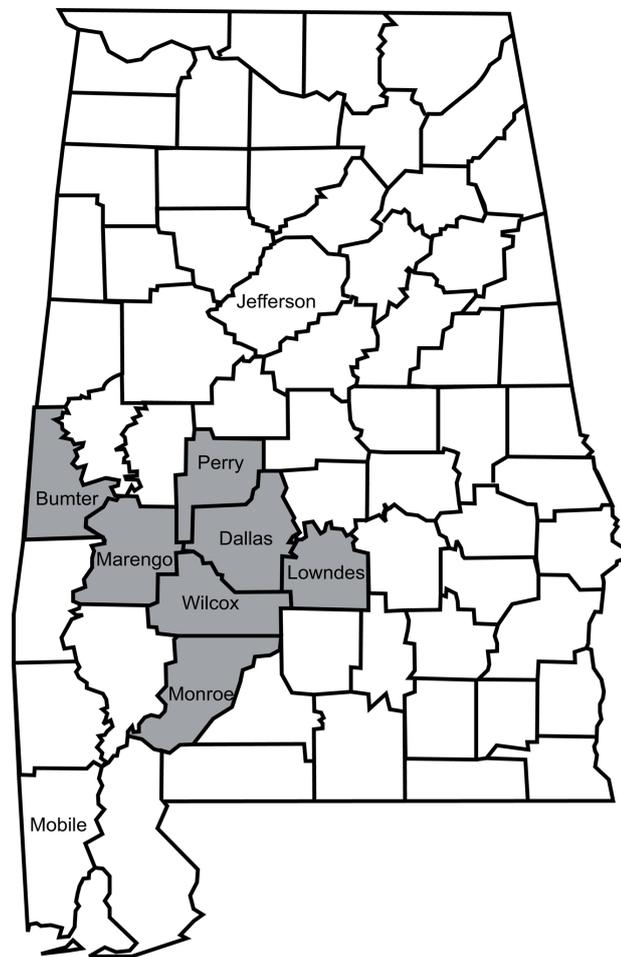


Figure 1. Map of Alabama—highlighted in gray the location of study population.

2.2. Data Collection

Interviews were conducted by interviewers who were trained on proper interviewing techniques, survey specific procedures, and human subjects' protection. Interviewers were hired from the communities to facilitate respondent cooperation. The protocol in geographic communities was for interviewers to approach the selected household, enumerate the adults, select one randomly, and complete the interview. In church communities, a team of interviewers conducted surveys with groups of respondents after church services. Respondents received a \$10 gift card for completing the survey. Interviewing resulted in a final sample size of 1355 from 17 geographic communities and 4 church communities. The response rate was 77.0% in geographic communities.

2.3. Questionnaire Development

A 122 item questionnaire was constructed from selected health questions from the Center's for Disease Control and Prevention's 2004 Behavioral Risk Factor Surveillance System (BRFSS), the World Bank social capital questionnaire [17], and newly developed items. Questions from the BRFSS focused on health conditions, access to care, hypertension, cholesterol, diabetes, exercise, nutrition, weight control, tobacco use, cancer screening, and demographics. Questions from the World Bank social capital questionnaire focused on groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, and empowerment and collective action. Newly developed questions covered stress, disease knowledge, and interest in health programs. The current study will focus on information related to oral health care and diabetes.

2.4. Description of the Dependent Variable

In the questionnaire, visiting the dentist was measured by the questions “How long has it been since you last visited the dentist or a dental clinic?” The possible answers were: 1) Within the past year, 2) Within the past 2 years, 3) Within the past 5 years, 4) More than 5 years ago, 5) Never. For the purpose of this study, the outcome variable was dental visit within the past year—0 to 12 months ago—which was coded Yes/No.

2.5. Description of the Independent Variables

The primary predictor variable was history of diabetes (coded Yes/No). We defined people with diabetes as individuals who responded “Yes” to the question, “Have you ever been told by a doctor that you have diabetes?” Potential explanatory variables included gender, age, health insurance, race, education, limited community health services, routine medical check-up within past year, current tobacco use of any type, and annual household income.

2.6. Statistical Methods

In addition to descriptive statistics and univariate comparisons of proportions between categorical variables using χ^2 testing, we used multiple logistic regression analysis to examine the association between dental care use and diabetic status while simultaneously controlling for possible confounders and other correlates, including gender, age, health insurance, race, education, limited community health services, routine medical check up within past year, current tobacco use of any type, and annual household income. Explanatory variables with a p -value < 0.10 in univariable models were included in the multivariable model. Statistical significance for all χ^2 tests and multivariable model parameters was set at a two-sided alpha level of 0.05. Analyses were conducted using SPSS Systems for Windows, version 18.

3. Results

The final sample for this study consisted of 1355 individuals who ranged in age from 18 to 105 years (mean = 50.8 ± 16.93). Individuals who responded to the survey primarily were females (67.9%) and African-American (89.5%). One-fourth (24.9%) of the study participants reported annual household income less than \$10,000 dollars. Overall, 54.5% of individuals in the sample had visited a dentist within the past 12 months, while 76.1% had a routine medical checkup within the past year. Seventeen percent (16.7%) of the individuals reported a diabetes history. Adults with diabetes were less likely than those without diabetes to have seen a dentist within the preceding 12 months (13.4% vs 86.6%, respectively, $p < 0.01$; **Table 1**).

Because of probable confounding factors affecting the association between use of dental services and diabetic history, we used multiple logistic regressions to adjust for these factors (**Table 2**). After controlling for gender, health insurance, race, education, report of limited community health services, routine medical check-up within past year, and annual household income, individuals with diabetes were significantly less likely than those who did not have diabetes to have seen a dentist within the preceding year (OR = 0.6, 95% CI 0.43 - 0.84). Females were more likely to have seen a dentist in the past year (adjusted OR = 1.4, 95% CI 1.11 - 1.90) than males. African-Americans were less likely than whites to have seen a dentist in the past year (adjusted OR = 0.6, 95% CI 0.43 - 0.97). In addition, lower levels of education and household income were associated with a greater likelihood of not seen a dentist in the previous year (**Table 2**).

4. Discussion

Nine out of the 10 states with the highest diabetes incidence (10.3 - 12.8 per 1000 population) in the US are from the Southern region [18]. Within the US South region it is the Black Belt, a geographic area that is characterized by high poverty, low levels of education, and limited access to health care. Diabetes is a major health issue in the Alabama Black Belt, where the combination of poverty, along with the limited access to health care in some communities, exacerbates the already established health care disparities in the region [1] [8].

As expected and consistent with the socio-demographic characteristics of the Black Belt region [6]-[8], our sample was predominantly African-American with one-fourth of the study participants reporting annual household income less than \$10,000 dollars. Even though an important proportion of individuals in our study (76.1%)

Table 1. Characteristics of adults in the Alabama Black Belt examined for use of dental service within the past year (N = 1355).

Characteristics	Dentist visit within the past year		All Patients n (%)	p-value
	No	Yes		
History of Diabetes				
Yes	145 (19.3)	79 (13.4)	224 (16.7)	<0.01
No	605 (80.7)	509 (86.6)	1114 (83.3)	
Gender				
Male	278 (36.8)	157 (26.2)	435 (32.1)	<0.01
Female	478 (63.2)	442 (73.8)	920 (67.9)	
Age in years (mean \pm SD)	51.9 \pm 17.24	49.5 \pm 16.51	50.8 \pm 16.93	<0.01
Health Insurance				
Yes	566 (75.2)	503 (84.3)	1069 (79.2)	<0.01
No	187 (24.8)	94 (15.7)	281 (20.8)	
Race				
Caucasian	55 (7.5)	83 (14.3)	138 (10.5)	<0.01
African-American	679 (92.5)	499 (85.7)	1178 (89.5)	
Education				
Less than High School	88 (11.7)	31 (5.2)	119 (8.8)	<0.01
High School	512 (68.1)	319 (53.6)	831 (61.7)	
More than High School	152 (20.2)	245 (41.2)	397 (29.5)	
Limited Community Health Services				
Yes	304 (41.8)	196 (34.0)	500 (38.3)	<0.01
No	424 (58.2)	381 (66.0)	805 (61.7)	
Routine Medical Check-up within Past Year				
No	247 (32.8)	76 (12.7)	323 (23.9)	<0.01
Yes	507 (67.2)	521 (87.3)	1028 (76.1)	
Current Tobacco Use of Any Type				
No	564 (74.6)	499 (83.3)	1063 (78.5)	<0.01
Yes	192 (25.4)	100 (16.7)	292 (21.5)	
Employed				
Yes	234 (43.3)	326 (55.4)	650 (48.6)	<0.01
No	425 (56.7)	262 (44.6)	687 (51.4)	
Annual Household Income				
<10,000	221 (29.7)	111 (18.9)	332 (24.9)	<0.01
10,000 to 19,000	208 (27.9)	147 (25.1)	355 (26.7)	
20,000 to 29,999	113 (15.2)	89 (15.2)	202 (15.2)	
\geq 30,000	203 (27.2)	239 (40.8)	442 (33.2)	
Total Number of Patients	599 (44.2)	756 (54.5)	1355 (100.0)	

Table 2. Logistic regression displaying socio-demographic determinants of use of dental services within the past year among underserved populations at risk for diabetes in the Alabama Black Belt (N = 1080).

Predictors	Unadjusted model Crude OR ²	Adjusted model		p-value
		Adjusted OR ²	ORes OR ² 95% CI ³	
History of diabetes				
No (ref ⁴)	1.0	1.0		
Yes	0.6	0.6	0.43 - 0.84	<0.01
Gender				
Male (ref ⁴)	1.0	1.0		
Female	1.6	1.4	1.11 - 1.90	<0.01
Race				
White (ref ⁴)	1.0	1.0		
African-American	0.5	0.6	0.43 - 0.97	<0.05
Education				
More than High School (ref ⁴)	1.0	1.0		
High School	0.4	0.5	0.51 - 0.39	<0.01
Less than High School	0.2	0.3	0.16 - 0.45	<0.01
Routine medical check up within past year				
No (ref ⁴)	1.0	1.0		
Yes	3.3	3.3	2.37 - 4.49	<0.01
Annual Household Income				
≥30,000 (ref ⁴)	1.0	1.0		
20,000 to 29,999	0.7	0.8	0.58 - 1.22	0.36
10,000 to 19,999	0.6	0.7	0.54 - 1.02	0.07
<10,000	0.4	0.6	0.40 - 0.81	<0.01

¹Model: Use of dental services-yes/no (reference group). Variables included in the model: history of diabetes, gender, health insurance, race, education, limited community health services, routine medical check-up within past year, annual household income; ²Odds ratios, significant association ($p < 0.05$); ³Confidence Interval; ⁴Reference group.

had a routine medical checkup, only 54.5% had visited a dentist within the past 12 months. These results may reflect the lack of coordination between the medical and dental personnel and the need of a combined approach towards diabetes management. Only 13.4% of our study population with self-reported diabetes visited the dentist, while 86.6% of people without diabetes visited the dentist. In addition, when looking at people with self-reported diabetes, only 34% of them had seen the dentist in the past 12 months, one of the lowest reported percent of dentist visit among diabetic patients [1] [19].

In a study from the United Kingdom (UK) conducted on individuals with mostly type 2 diabetes (66% of the study population), 43% of the diabetic patients had seen the dentist in the past year [1]. Although our study population reported lower percentage of people using dental health services, it is worth pointing out that there are socio-economic, cultural, and health care system structure differences between these two populations (US vs UK). In addition, it is important to mention that knowledge of increased risk for periodontal disease in the UK cohort was very low (33%), compared to the high percent that knew about their high risk for other diabetes complications (e.g.: eye disease, circulatory problems, and kidney problems) in the same population (all higher than 94%) [1].

Differently from our findings, in a study of two primary African American communities in North Carolina, 67% of people with diabetes had had an annual dental examination. These communities were located in urban areas, while our study population in Alabama is primarily rural, and a higher proportion of our study population re-

ported no health insurance coverage compared to the North Carolina (NC) study (20% versus 15%). In addition, there is no mention in the study of income levels or the possible effect of social desirability bias in the NC study. Even though in the NC study a higher percentage of diabetic patients have reportedly seen the dentist in the last year, there were findings that suggest that that population's overall diabetes care is still not optimal. For example, in that study, only 18% received all measured services such as yearly HbA1c (blood test that reflects blood glucose levels over a period of time), foot examination, dilated eye exam, blood lipids measurement, blood pressure check, dental examination, and formal diabetes education, as part of their diabetes care [19].

Non-Hispanic blacks are more likely to present with severe oral disease, oral disadvantages and extractions, less filling and crowns or bridges, than non-Hispanic whites [20]. African-Americans with diabetes exhibit poorer glycemic control and higher blood pressure than Caucasians with diabetes, and higher risk for diabetes complications [19]. Going to the dentist once a year would be beneficial for the Alabamian population living in the Black Belt region (which is at higher risk for diabetes complications), since the oral cavity may exhibit the first signs and symptoms of and undiagnosed or poorly controlled diabetes [2].

Strengths and Limitations

The present study is a large cohort with a high coverage of the Alabamian population in the Black Belt region (spanning seven counties). As part of the project, an extensive questionnaire with questions in many areas such as demographic information, health care usage, knowledge beliefs and attitudes related to health was administered by well-trained local interviewers. To our knowledge this is the first study that attempted to assess the dentist visit in the Alabamian population living in the AL Black Belt region.

However, as in any research study, there are also some limitations. For example, we did not collect any clinical data to support the diabetes or periodontal diseases status. Diabetes status variable was collected as a self-reported variable, which may be prone to recall, and misclassification biases. However, self-reported diabetes status has been previously classified as having a good-to-excellent reliability and validity.⁴By using self-reported diabetes status, we are probably underestimating the true prevalence of diabetes in our study since many people are unaware of their diabetes status. The American Diabetes Association [1] estimates that 1/3 of people with diabetes are unaware of their status. In addition, we did not collect data on gestational diabetes; however, the number of pregnant women in this study was very low.

Recall bias and social desirability bias in relation to oral health behavior (answering to the question: "Have you been to the dentist in the past year?") could have been a limitation of our study. However, in the present study as in previous studies, the response to this question was low, suggesting social desirability bias did not play a decisive role on our analysis.

We did not restrict our analysis to only dentate persons. However, tooth loss is more common among diabetic patients [4]. By not excluding people with no teeth we possibly include people with more end stage periodontitis in our analysis. We did not collect data on whether the person's health insurance included dental insurance. Lack of dental coverage might have constituted a great impediment for them to see the dentist on regular bases. Due to the percentage of low income individuals in this population, many would be eligible for Medicaid, which in Alabama covers very basic dental services only for children. In addition, for the people who have seen the dentist in the past year we have no information on what type of dental services they received. The service gap might be important if those services did not include periodontal examination.

5. Conclusions

Findings from this study suggest that individuals with diabetes in the Alabama Black Belt are less likely than individuals without diabetes in the same areas to visit a dentist. This pattern persisted even after adjusting for gender, health insurance, race, education, report of limited community health services, routine medical check-up within past year, and annual household income. Following guidelines currently in place, and as part of a comprehensive diabetes care plan, annual visits to the dentist to be examined for periodontal disease or any other oral condition that can interfere with their glycemic control, would probably decrease the prevalence and severity of periodontitis. The result would be a positive impact on glycemic control and diabetic complication development in this high-risk population for diabetic complications, which would not only potentially improve their oral health but also positively impact their diabetes control.

More studies are needed in trying to better understand what the perceived barriers to visiting the dentist are

since such a low percentage of patients with diabetes in this population had seen the dentist in the last year. Access to dental services should be increased in these areas in order to possibly reduce health disparities and improve quality of care. In addition, it is important that physicians and dentists educate their diabetic patients about the relationship between poor oral health and increased risk for diabetic complications.

With the historical passage of the US federal health care reform legislation (the Patient Protection and Affordable Care Act and the Health Care & Education Affordability Act of 2010), diagnosis of diabetes is no longer a lawful reason to be denied insurance or forced to pay more for coverage, ending a previous system that promoted such discrimination. Unfortunately, the oral health provisions of the bill require dental coverage to be offered as part of any essential benefits package only for children under the age of 21. For adults, the dental benefits are still optional for states to provide or not. Even though the benefits of the health reform will positively impact the pediatric population rather than adults in terms of dental care, this bill represents a big step to improving the overall diabetes management, since it is blurring the divide between health and dental care, two coverages that traditionally were purchased separately in private plans.

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