HHS Public Access

Preventive Dental Care in Older Adults with Diabetes

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Abstract

Background—The association between poor oral health and diabetes is well documented. Therefore, preventive oral health is strongly indicated for individuals with diabetes. The purposes of this study were 1) to determine if there were a difference in preventive dental care utilization among older adults with diabetes from 2002 and 2011, and 2) to compare preventive dental care utilization of older adults with and without diabetes from 2002 and 2011.

Methods—The data were from the Medicare Current Beneficiary Survey. The sample included older, fee-for-service Medicare beneficiaries (ages 65 years and above). The key outcome was self-reported preventive dental care. In 2002, there were 8,725 participants; in 2011, there were 7,425 participants. Chi square and logistic regressions were conducted.

Results—In 2002, 28.8 % of participants with diabetes had preventive dental care. In 2011, this percentage increased to 36.0%. Similar results were seen among individuals without diabetes (42.9% in 2002 and 45.5% in 2011). The increase in preventive dental care was statistically significant for individuals with and without diabetes. The participants with diabetes, as compared with participants without diabetes, remained statistically less likely to have preventive dental care

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in adjusted logistic regression analysis with and without considering the interaction between observation year and diabetes (adjusted odds ratios= 0.73, and 0.86, respectively).

Conclusion—While the increase in preventive dental care is welcoming, older adults with diabetes continue to have significant preventive dental care need.

Practical Implication—Additional efforts are needed to encourage individuals with diabetes to obtain preventive dental care.

Keywords

Diabetes; Dental preventive care; Medicare utilization; older adults

Introduction

There is a well-documented association of periodontitis (the destruction of tissue supporting teeth) and diabetes which is a growing public health concern.[1–7] Individuals with diabetes are at high risk for periodontal disease.[8] Several researchers have indicated that improved oral health leads to improved diabetes control.[9–11]

On the tooth level, periodontal destruction is primarily due to the interaction between inflammation (the body's response) and the microbial biofilm on the tooth/supporting tissue, as well as the biological activity of the microorganisms themselves in the biofilm. The anaerobic Gram-negative bacteria such as the red complex bacteria (for example, *Porphyromonas gingivalis, Tannerella forsythia, and Treponema denticola*) the orange complex bacteria (for example, *Prevotella intermedia*) and *Aggregatibacter actinomycetemcomitans* are of particular concern.[12]

The chronic induction of inflammatory cells (lymphocytes, macrophages, and polymorphonuclear leukocytes) and cytokines is the proposed mechanism for periodontitis influencing diabetes, while similar factors associated with diabetes influence periodontitis. Individuals with diabetes have a higher prevalence of periodontitis.[13–17] As a result of the proposed feed-back loop, individuals with diabetes are encouraged to have routine preventive dental care to manage/prevent periodontal disease and its inflammatory consequences. Although one meta-analysis of periodontal maintenance (periodontal treatment and follow-up care) and glycemic control showed short-term, positive, significant results on hemoglobin A1-C,[18] another meta-analysis indicated that the evidence was insufficient to support a positive association.[19] The Committee on Research, Science, and Therapy of the American Academy of Periodontology (2000) in a position paper on diabetes and periodontal disease suggested that periodontal treatment has the potential to alter glycemic control. Although the relationship of periodontal treatment and glycemic control is not resolved, the relationship of diabetes and periodontitis has been established; therefore, routine preventive dental care visits are especially needed by individuals with diabetes for prevention of periodontitis, early detection of periodontitis, and treatment of periodontitis.[20] This need has been widely published over the previous decade, and the oral-systemic link was addressed nationally in a Report of the Surgeon General in 2000,[21] therefore an increase

in preventive dental care for all individuals, particularly of older individuals with diabetes is anticipated.

Researchers using 2009 Medical Expenditure Panel Survey data indicated 30.7% of adults ages 65 years and above sought preventive dental care.[22] Researchers using Behavioral Risk Factor Surveillance System data found a steady rise in preventive dental care utilization by older adults from 58.9% in 1995 to 63.9% in 2008,[23] and researchers using the 2010 Behavioral Risk Surveillance System data, researchers indicated that 57.2%-81.7% of adults had any type of dental visit in the past year.[24]

The purposes of this study were 1) to determine if there was a difference in preventive dental care utilization among older adults with diabetes from 2002 (when the diabetes-periodontal disease association was not widely known) and 2011 (when the association had been widely published in peer-reviewed journals), and 2) to compare preventive dental care utilization of older adults with and without diabetes from 2002 and 2011.

Methods

Data source

The data for this study were from the 2002 and 2011 Medicare Current Beneficiary Survey (MCBS), which is a nationally representative, continuous survey of the Medicare population (both institutionalized and non-institutionalized) in the United States sponsored by the Centers for Medicare and Medicaid Services.[25] The survey is designed with a multistage, stratified, random sampling design for multiple purposes and is conducted by the researchers at the Office of Enterprise Data and Analytics with a contract with the National Organization for Research at the University of Chicago.[25] Representation for the samples is based on primary sampling units (a geographic unit that is a cluster representative of counties or cities), and person level.[25] The researchers provide weights for the representation to be reflective of the nation's Medicare population. Patients are surveyed 13 times over 4 years.[25] There are approximately 16,000 participants, with approximately 4,000 new participants and 4,000 completed participants each year.[25] The questionnaire includes demographic, socioeconomic, dwelling, income, health status, physical status and similar questions.[25] The survey is linked to Medicare and Medicaid claims data. The collected files are assigned as Access to Care files or Cost and Use files (both having linked claims data).[25] Details of the survey are available at http://www.cms.hhs.gov/mcbs.

West Virginia University Institutional Review Board acknowledges this study (protocol 1601969410).

Key dependent/outcome variable

The outcome variable, preventive dental care utilization was based on whether or not participants reported having an oral examination or dental prophylaxis during the calendar year (yes, no). It is a conservative measure of unmet dental needs, as for some individuals one oral examination or dental prophylaxis would not be sufficient since the American Dental Association (ADA) recommends *at least* one dental visit per year. It also has the strengths and weaknesses of self-reported data. We note that this is a conservative measure

as some individuals may need more than one oral examination or dental prophylaxis during a calendar year.

Key independent variables

The key independent variables of interest were type 2 diabetes mellitus status and the year of observation (2002 versus 2011). Type 2 diabetes mellitus was identified from self-reports to interviewers who queried the respondents as to whether they had ever been diagnosed with diabetes using a standardized questionnaire. In data collection and use, diabetes identification from self-report is routinely used,[26–29] however the severity and nature of the disease are not available from the data set.

Other variables

Other independent variables considered in the analyses as risk factors for unmet preventive dental care were determined using the Andersen model for healthcare utilization in which predisposing characteristics, enabling resources, personal health practices, and perceived health status were considered.[30] These included the demographic variables of sex (male, female), race/ethnicity (White, African American, Latino, other), age in years (65–69, 70–74, 75–79, 80 and above), and metropolitan status (metropolitan, non-metropolitan). The socioeconomic variables included education (less than high school, high school, some college, college degree and above), and poverty (less than 200% of the federal poverty level, 200% and above). Chronic diseases and conditions which were considered were: heart disease (yes, no); hypertension (yes, no); and mental conditions (yes, no). Perceived health status was a self-reported response of excellent, very good, good, fair, or poor. Activities of daily living difficulties (none, 1–2, 3 or more) were used to identify functional status. Smoking (yes, no) was considered as a lifestyle choice/personal health care practice. Participants were asked specifically if they had dental insurance coverage (yes, no) as Medicare does not cover dentists' fees.

Statistical Analysis

The data were analyzed with Rao Scott Chi Square analyses and logistic regression analyses using SAS 9.3® (Cary, NC) software. MCBS has a complex survey design; therefore, data weights and strata based on the primary sampling unit (PSU) clusters (which were provided by the researchers conducting the MCBS to allow for generalizations to the national population of Medicare beneficiaries) were used in the analyses of the data. Weights refer to the number of records it represents in a population. Without proper adjustments to weights at PSU and strata level, the variance estimates are more likely to have downward bias, indicating importance of a variable, when in fact, the variable may not be important. See http-s://www.cms.gov/Research-Statistics-Data-and-Systems/Research/MCBS/downloads/2008_Appendix_A.pdf for more information of sample survey design details.

Results

Sample Description

A detailed sample description is presented in Table 1. The eligible sample in 2002 included 8,725 participants; and the eligible sample in 2011 included 7,425 participants. There were

more females than males in both years (57.7%, 56.2%, respectively). In 2002 and 2011, the race/ethnicity distributions and age distributions in the samples were similar. Based upon chi-square tests, there were significantly fewer people in 2002 than in 2011 with dental insurance (5.2%, 12.2%, respectively) and diabetes (19.5%, 25.3%, respectively). Additional categories with significant differences in the sample are detailed in Table 1.

Ten-year differences in preventive dental care utilization

The details of the percent changes in differences in preventive dental care utilization between 2002 and 2011 are presented in Table 2. Overall, 40.1% of participants had preventive dental care utilization in 2002 and this increased to 43.2% in 2011 ($p<.001$). Among individuals with diabetes, there was also a significant increase in preventive dental care utilization from 28.8% in 2002 to 36.0% in 2011, an increase of 7.2 percentage points. Among individuals without diabetes, there was an increase of 2.6 percentage points, from 42.9% in 2002 to 45.5% in 2011. Comparisons of preventive dental care utilization by observation year revealed that for many subgroups, there were not significant increases in preventive dental care utilization comparing 2002 and 2011.

Logistic regression on Preventive Dental Care Utilization

The results of logistic regression analysis on preventive dental care utilization are presented in Table 3. With regard to diabetes and preventive dental care utilization, after adjustments for: observation year, dental insurance, sex, race/ethnicity, age, marital status, education, poverty levels, health status, smoking and obesity, participants with diabetes were significantly less likely to have preventive dental care than participants who did not have diabetes (adjusted odds ratio = 0.86). Interaction analyses between observation year and diabetes supported the significant associations.

Discussion

The foci of this study were 1) to determine if there was a difference in preventive dental care utilization among older adults with diabetes from 2002 and 2011, and 2) to compare preventive dental care utilization of older adults with and without diabetes from 2002 and 2011. For both individuals with diabetes and individuals without diabetes, preventive dental care utilization increased. For individuals with diabetes, there was an increase of 7.2 percentage points in preventive dental care utilization. For individuals without diabetes, there was an increase of 2.6 percentage points in preventive dental care utilization. However, participants with diabetes, as compared with participants without diabetes, remained statistically more less to have preventive dental care utilization in adjusted logistic regression analysis with and without considering the interaction between observation year and diabetes (adjusted odds ratios= 0.73, and 0.86, respectively).

There are few other studies in the literature with which to compare the differences of preventive dental care utilization among older adults with diabetes considering past and current preventive care utilization. In a 2009 Medical Expenditure Panel Survey study there were 30.7% of older adults who sought preventive dental care,[22] a value *below* our 2011 value of 36.0%; and in a Behavioral Risk Factor Surveillance System study, preventive

dental care in 2008 was 63.9%,[23] a value *above* our 2011 value. Similar results to ours are from a study of adults with diabetes where researchers found that adults with diabetes had lower odds of visiting a dentist for any reason.[31] Our study adds to the literature information specific to preventive dental care utilization and diabetes occurring in 2002 compared with that occurring in 2011.

Although not the focus of this study, we found that the proportion of individuals with dental insurance coverage increased between 2002 and 2011, however the percentage of preventive dental care utilization for this group remained unchanged. Individuals without dental insurance coverage were less likely to have preventive dental care as compared to individuals with dental insurance coverage (adjusted odds ratio = 0.31). Policies to provide dental insurance coverage may be beneficial. Experts have recommended a focus of including oral health care into all health policies.[32] Preventive dental care is a significant need for older adults with diabetes. Unmet preventive dental care needs can lead to increased dental and potentially increased medical costs.

Our study has several strengths. We used a large, national database. The analyses were conducted controlling for multiple risk factors. This was possible due to the large number of participants. The analyses were completed with data weights and strata considered in the analyses.

Study limitations include the potential for misclassification bias due to the use of questionnaires for the self-report of several key variables. Diabetes self-report was not confirmed with a medical diagnosis of diabetes. Likewise there were no data available on the severity of diabetes. Preventive dental care was based upon the self-report of having an oral examination or dental prophylaxis during the calendar year. There were no data available on the clinical oral health of the participants.

The impact of overreporting or underreporting is difficult to determine. Therefore, the direction of misclassification bias in this study is unknown and a study limitation. While the design and statistical sciences behind the stability of surveys such as a long-running Medicare Current Beneficiary Survey will give reasonable confidence in the quality of reporting, the question of low quality reporting will be overcome by the significant majority of accurate reporting.

Policy recommendations

In terms of policy recommendations, there is a need for additional efforts to encourage individuals with diabetes to obtain preventive dental care. Healthcare professionals who treat patients with diabetes, such as endocrinologists, dieticians, and home healthcare workers have a role in recognizing the need to refer patients for preventive dental care. Specific professional guidelines for such referrals may be useful in addressing the need.

Conclusions

Positive inroads have been made for older adults to seek preventive dental care, but older adults with diabetes are in particular need for preventive dental care. Additional efforts are needed to encourage individuals with diabetes to obtain preventive dental care.

Acknowledgments

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Table 1

Overall Sample Description Medicare Current Beneficiary Survey, 2002 and 2011

	2002		2011		Significance
	Number	Weighted column Percent	Number	Weighted column percent	
ALL	8,725	100.0	7,425	100.0	
Diabetes Mellitus					***
Yes	1,695	19.5	1,859	25.3	
No	7,030	80.5	5,566	74.7	
Sex					
Women	5,035	57.7	4,159	56.2	
Men	3,690	42.3	3,266	43.8	
Race/Ethnicity					
White	7,036	81.1	5,849	79.3	
African American	739	8.0	620	7.7	
Latino	617	7.1	620	8.3	
Other	323	3.8	318	4.7	
Age in Years					***
65–69 years	1,561	20.1	1,410	23.6	
70–74 years	2,149	28.2	1,651	26.6	
75–79 years	1,886	23.9	1,526	20.5	
80 and above	3,129	27.9	2,838	29.3	
Metropolitan Status					
Metropolitan	6,333	76.8	5,528	77.2	
Non-Metropolitan	2,389	23.2	1,897	22.8	
Education					***
Less than High School	2,833	30.8	1,768	22.1	
High School	3,097	36.1	2,588	34.5	
Some College	1,202	14.1	1,145	16.0	
College	1,560	19.0	1,903	27.4	
Poverty					***

	2002		2011		
	Number	Weighted column Percent	Number	Weighted column percent	Significance
Less than 200% FPL	4,594	50.8	3,544	45.2	
GE 200% FPL	4,131	49.2	3,881	54.8	
Dental Insurance					***
Yes	420	5.2	811	12.2	
No	8,305	94.8	6,614	87.8	

Note: This study is based on older Medicare Beneficiaries, age 65 years and above, continuously enrolled in fee-for-service Medicare and alive during the observation year (that is, the participant did not drop out of Medicare coverage).

Asterisks represent significant differences in characteristics between years 2002 and 2011 based on chi-square tests.

FPL: Federal Poverty Line; GE: Greater than or Equal

***
p < 0.001;

**
0.001   p < 0.01;

*
0.01   p < 0.05

Table 2

Recipients of Preventive Dental Care and Percentage Change / Medicare Current Beneficiary Survey, 2002 and 2011

	2002		2011		%Change	Significance
	Number	Weighted percent	Number	Weighted percent	2011% minus 2002%	
ALL	**3392**	**40.1**	**3074**	**43.1**	**3.0**	**
Diabetes Mellitus						
Yes	477	28.8	643	36.0	7.2	***
No	2915	42.9	2431	45.4	2.6	*
Sex						
Women	1956	40.2	1766	44.3	4.1	***
Men	1436	40.0	1308	41.5	1.5	
Race/Ethnicity						
White	3064	44.7	2687	47.5	2.8	*
African American	87	13.0	114	20.9	7.9	***
Latino	138	23.1	173	29.1	6.0	*
Other	96	31.4	89	29.0	−2.4	
Age in Years						
65–69 years	639	42.2	583	44.1	1.9	
70–74 years	883	41.7	752	46.6	4.9	**
75–79 years	780	42.0	645	43.1	1.1	
80 and older	1090	35.4	1094	39.0	3.6	**
Metropolitan Status						
Metropolitan	2639	42.7	2460	45.9	3.2	**
Non-Metropolitan	753	31.7	614	33.6	1.9	
Education						
Less than High School	518	18.6	280	16.3	−2.3	*
High School	1240	40.3	963	38.2	−2.1	
Some College	609	51.3	574	51.1	−0.2	
College	1019	66.7	1250	66.3	−0.4	
Poverty						

	2002		2011		%Change	
	Number	Weighted percent	Number	Weighted percent	2011% minus 2002%	Significance
Less than 200% FPL	1122	24.7	854	24.7	0.0	
GE 200% FPL	2270	56.0	2220	58.3	2.3	
Dental Insurance						
Yes	382	76.8	616	78.1	−0.7	
No	3070	38.1	2458	38.5	0.4	

Note: This study is based on older Medicare Beneficiaries, aged 65 years and above, continuously enrolled in fee-for-service Medicare and alive during the observation year (that is, the participant did not drop out of Medicare coverage).

Asterisks represent significant differences in preventive dental care by observation year for each characteristic based on chi-square tests.

[1] Percentage Change is the difference of the weighted percent of year 2011 minus the weighted percent of year 2002;

FPL: Federal Poverty Line; GE: Greater than or Equal.

***
  p < 0.001;

**
  0.001   p < 0.01;

*
  0.01   p < 0.05

Table 3

Adjusted Odds Ratios (AOR) Standard Errors (SE) and and 95% Confidence Intervals (CI) from Logistic Regressions of Selected Characteristics on "Preventive Dental Care Utilization" among older Medicare Beneficiaries Medicare Current Beneficiary Survey, 2002 and 2011

	Significance	Adjusted Odds Ratio	95% CI
Observation Year			
2011		reference	
2002	*	0.89	[0.82, 0.97]
Diabetes Mellitus			
Yes	**	0.86	[0.78, 0.94]
No		reference	
Dental Insurance			
Yes		reference	
No	***	0.31	[0.26, 0.38]

Note: This study is based on older Medicare Beneficiaries, age 65 years and above, continuously enrolled in fee-for-service Medicare and alive during the observation year (that is, the participant did not drop out of Medicare coverage).

Asterisks represent significant differences in "preventive dental care" between the comparison and the reference group based on the logistic regressions.

The adjusted model controlled for sex, race/ethnicity, age, marital status, education, poverty status, presence of dental insurance, health status (presence of heart disease, hypertension, or mental health conditions in the past year, perceived general health status and functional status), smoking, and obesity.

***
p < 0.001;

**
0.001 p < 0.01;

*
0.01 p < 0.05