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Oral Health Knowledge and Dental Visits in Community Living Older Adults in Rural Appalachia-West Virginia: A Cross-Sectional Analysis

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Abstract.

Introduction: The purpose of this study was to investigate the relationship between oral health knowledge and dental visits of older adults in an Appalachian county.

Methods: A cross-sectional study design was used. Surveys were returned from 205 older adults (50 years and above) from an Appalachian county. Questions were asked about oral health, last dental visit and sociodemographics.

Results: The variable of interest, oral health knowledge, was associated with dental visit. Having low oral health knowledge increased odds of having delayed a dental visit beyond a year (unadjusted odds ratio: 2.99; 95% Confidence interval: 1.70, 5.28). Even after considering the number of existing teeth, and controlling for age, sex, education and smoking, the association remained positive and independently significant (adjusted odds ratio: 2.25; 95% Confidence interval: 1.05, 4.82). Education was the only *sociodemographic* variable associated with last dental visit

Conclusion: The surveyed older adults have a need for increasing dental visits within the previous year. Increasing dental knowledge was associated with odds of increased dental visits. Improving dental knowledge may be a strategy to improve the number of older adults having a dental visit within the year.

Key Words: Older adults, Appalachia, Oral health

Introduction

Oral health issues, such as dental caries, periodontal diseases, oral cancer, chewing difficulty, and generalized oral pain, are the most frequently unmet needs of older Americans despite continued efforts to improve the oral and systemic health of this population[1]. More than a decade has passed since the US Surgeon General, David Satcher[2], presented his monumental report addressing the relationships of oral tissues with systemic consequences. The report sparked considerable dental research and clinical efforts to control dental caries and periodontal diseases. Notwithstanding the resulting evidence-based dental research results indicating the importance of dental care visits that were generated since then, dental care visits were reported to have declined for US adults during that period[3].

Some reported reasons were the cost of dental care (including the loss of dental benefits), and transportation difficulty to access dental care. Reductions and eliminations in adult Medicaid dental benefits have impacted many adults. For example, in Oregon, following Medicaid dental benefit elimination, the unmet dental needs of adults increased three times and emergency department visits for dental needs increased significantly[3,4]. Emergency department care in the US is a safety net for many people as it is provided as uncompensated and undercompensated care when an individual has no other option[5].

In contrast, researchers in a study of older adults (over age 51 years) used data from the Health and Retirement Study, 2006-2008 (during the US economic crisis), and determined that dental visits within the previous 2 years only changed if household wealth fell 50% or more, and there was no correlation of changes in household income and changes in seeking dental care during those two years[6]. The authors did state that their results were not sensitive enough to determine if the declines in wealth represented declines in home values. The distinction is important as the time frame of the study included the Great Recession in which home values plummeted, therefore household wealth would be significantly affected, while those who remained employed with a steady income may not have felt the impact if they were not in the process of selling their home.

Researchers reported in another study that older adults with lower household *income* were less likely to newly seek dental care and more likely to stop dental care visits[7].

It is important to understand the determinants of dental care visits in older adults due to the large number of adults approaching age 65 years. With 2004 as a baseline for projections to 2054, the US population of adults 65 years and older is expected to increase by 126%; adults 85 years and older are expected to increase by 315%; and adults 100 years and older are expected to increase by 956%[8]. By 2030, there will be an increase of more than a billion teeth in the US population[9]. Researchers have found many determinants that increase the likelihood that a person in the US will seek dental care. These include: income; insurance; health; education; race/ethnicity; and the presence of natural teeth[7, 8, 10]. In retirement, older adults may have fixed incomes and limited financial resources to meet dental care needs[8] and nearly ¾ have unmet dental needs[2]. However, the cohort of adults becoming older adults, the people approaching age 65 years, have more teeth, more implants, more periodontal care, more restorative care, and more prosthodontic care than their predecessors.

The role of dental beliefs, behaviors and knowledge are of particular interest as these are potentially modifiable factors that may positively influence dental care visits. Many areas of the US have regions of poor oral health and need to improve dental care. Appalachia is one such region. It has a high prevalence of caries, edentulism, and older citizens. For example, of the older adults, aged 65 years and above, living in West Virginia in 2012, 33.8% (95% CI:31.1-36.4) were edentulous; whereas the national median was 16.1%[11]. Similarly, older adults (ages 65 years and above) accounted for 16% of the population of West Virginia in 2010; whereas the national percentage was 13%[12]. Additionally, West Virginia has 1,040 general dentists and 176 specialty dentists, primarily located in non-rural areas. With 150,000 dentists in the US, the proportion of dentists in WV as compared with the nation is 1:150[14].

Appalachia is located along the ridges of the Appalachian Mountain chain and is 42% rural. It is unknown if increased dental knowledge and attitudes would improve dental visits in Appalachia. The purpose of this study is to examine dental visit and oral health knowledge using data collected from older adults in Appalachia-West Virginia. The research hypothesis is that greater dental knowledge is positively related to having had a dental visit within the previous year for older adults in Appalachia-West Virginia. The rationale for the study is that the greater the dental knowledge that an individual has acquired, the more likely dental visits become a priority and the person is more likely to actively seek dental care, both for restorative and preventive care.

Materials and Methods

Study Design and Participant Population

This study had West Virginia University Institutional Review Board approval (130802312). The researchers used a cross-sectional study design in which 205 community living older adults were recruited as a convenient sample in a county in West Virginia. The criteria for study participants were aged 50 years and older, and community living. Age 50 years was selected as it the age at which older adults are eligible for senior citizen services in Appalachia-WV. After receiving consent from the participants, they completed a paper questionnaire concerning their last dental visit and questions relating to oral health knowledge. The choice options for the last dental visit were: within the year; 1-3 years ago; and more than 3 years ago. Due to the distribution of the data; the data were dichotomized into the categories of within the year and more than 1 year. Statements with Likert-style options to strongly agree, agree, neutral, disagree, and strongly disagree choices were used to determine knowledge. The statements were developed by experts using the vernacular of the participants within the local region. The questionnaire was reviewed for validity for application to the age group by individuals who are specialists working with that age group, leaders within the community, and members of the Appalachia-West Virginia community. The statements requiring a positive response were: "Gum disease may be related to heart disease;" "Gum disease may be related to dia-

betes;" "A soft toothbrush is best;" "Cleaning a child's teeth is important," "Bacteria involved in decay can pass between people through saliva such as in sharing food;" "Someone wearing dentures should still see a dentist yearly;" and "A good job brushing your teeth takes at least 2 minutes." The answers were considered correct if a participant indicated "strongly agree," or "agree." A false statement, "Fluoride is added to water to disinfect it," was coded as correct if a participant indicated "strongly disagree" or "disagree."

Having at least 62% correct responses (5-8 correct answers) was defined as having high oral health knowledge and having 0-4 correct responses was defined as having low oral health knowledge. The rationale for using 62% was that in academic grading standards, this percentage is considered a minimally passing grade. Analyses were planned for the overall, summary score; and each question's responses were evaluated and presented in tabular form. Participants received a soft toothbrush or denture brush, toothpaste, flossers, a pencil and informational brochures as incentives for completing the survey.

Statistical Analysis

The data were inputted into the REDCap (Research Electronic Data Capture) electronic data capture tool at West Virginia University[15]. It is available to capture and validate data, provide audit trails, control and automate data exportation, and to import data[15]. The statistical analyses were conducted using SAS version 9.3 (SAS Institute, Carey, NC). Frequency, chi square and logistic regression were completed.

Results

Descriptive Results

There were 205 participants of 370 (55.41%) people who received the survey at a county-wide event of older adults in a county in West Virginia. The participants were primarily non-Hispanic white (98.1%); women (73.7%); never smokers (75.1%); and had a high school education or above (75.7%). The sample characteristics are presented in Table 1. There were 97 participants who reported having a recent dental visit (within the previous year).

In Table 2, the bivariate relationships of dental visit and sample characteristics are presented. There was a significant relationship between high oral health knowledge and having a dental visit within the previous year (p=0.0001). The other significant relationship was between higher levels of education and having a dental visit within the previous year (p=0.0018).

The data for the number of participants with accurate responses to the questions posed to establish dental knowledge are presented in Table 3. There were 44.4% participants responding correctly in agreement to "Gum disease may be related to heart disease." There were 34.6% correct responses to "Gum disease may be related to heart disease." There were 47.8% correct responses to "A soft toothbrush is best." 76.6% of participants indicated that "Cleaning a child's teeth is important." There were 30.2% correctly answering the fluoride is not added to water to disinfect it. There were 44.4% accurately responding that "Bacteria involved in decay can pass between people through saliva such as in sharing food." 65.5% responded that "Someone wearing dentures should still see a dentist yearly." And, 79.0% correctly agreed that "A good job brushing your teeth takes at least 2 minutes."

Multivariable Results

Logistic regression results are presented in table 4. The unadjusted odds ratio for delaying dental visits beyond a year and low oral health knowledge is 2.99 (95% Confidence Interval: 1.70, 5.28; p=0.0002). In the model controlling for sex, age, education, smoking status, and existing teeth, the adjusted odds ratio for delaying dental visits beyond a year and low oral health knowledge is 2.25 (95% Confidence Interval: 1.05, 4.82; p=0.0019).

Discussion

Low oral health knowledge of older adults from a county in Appalachia was related with increased odds of having delayed a dental visit beyond a year (unadjusted odds ratio: 2.99; 95% Confidence interval: 1.70, 5.28). Even after considering the number of existing teeth, and controlling for age, sex, education and smoking, the association remained positive and independently significant (adjusted odds ratio: 2.25; 95% Confidence interval: 1.05, 4.82). This study adds to the literature the

recognition of the need to increase oral health education among the older adults in Appalachia. This is a concern for their health. It is also a concern for the health of the young children that many of the older adults watch. There were only 76.6% of the participants who strongly agreed or agreed that cleaning a child's teeth is important.

Huang, et al., in a study of older adults with diabetes indicated that lack of dental care was associated with worse health related quality of life[16]. Although similar studies are required for older adults in general, there is a need for older adults to receive routine annual/biannual or even more frequent dental care. Having increased oral health knowledge may be an important factor in improving the behavior. Research concerning older adults' oral health knowledge, particularly for rural older adults, is lacking.

Although not the focus of this study, there was a significant positive association of having dental visits within the previous year and never smoking. This sample of older adults had only 6.3% current smokers, whereas the all-age statewide average for current smoking was 26.5%, and the older adult (65 years and above) average for current smoking was 9.5%[17]. A 2010 national study reported that the state with the lowest smoking prevalence was Utah with 9.1%, and the state with the highest smoking prevalence was West Virginia with 26.8%[18]. The West Virginia participants in this study live in a state with high tobacco use. Most of the participants overcame social pressures to smoke and have remained tobacco free throughout their life. Future research may be useful in determining the resources that helped them to be never-smokers.

Although not queried in this study as a potential predictor, the impact of cost of dental care has been previously identified as a potential factor in seeking dental care. The median household income of the county residents was $43,000 (2007-2011) and the per capita income in 2011 dollars was $20,438[19]. The participants in this study represented the county as a whole. Oral health care remained a priority for 47.3% of these participants despite any financial constraints. Additionally, the county has only 5 practicing full-time equivalent dentists available to the 33,520

county residents, corresponding to 6,704 potential patients per dentist[20]. Business analyses indicate that the national average ratio of patients to dentists is 1,800:1[14].

A possible limitation of this study is an assumption that the rural participants of one Appalachian county represent rural Appalachia as a whole. The rural county selected was randomly selected from the rural counties in close proximity to the University. The researchers presented the study at a county-wide event which increased the potential for representation from a wide geographic area and large target population sample size. These efforts in turn afford the researchers an ability to draw valid conclusions for this target population on a larger scale for a broader population application. The data distribution may appear skewed, but the sample represents the population of older adults in Appalachia-West Virginia. Since the sample size had a greater than 9:1 breakdown in the variable, race/ethnicity, it was not possible to do sub-group analysis upon race/ethnicity.

Having a dental visit within the previous year is an unmet need for many older adults. This study indicated dental knowledge increased the odds of having the need met. There were 76.6% of older adults in this study who demonstrated knowledge about the importance keeping a child's teeth clean. There were 79.0% answering correctly about the length of time to brush one's teeth; and there were 44.4% responding correctly to the statement that there is a relationship between "gum disease and heart disease." The responses indicate there is considerable room for improvement in dental knowledge. Additionally, improving dental knowledge may be a strategy to improve the number of older adults having a dental visit within the year. There is a need for dental health education efforts to be continued as the population grows older. Much effort is directed in the education of children as well as in the provision of school-wide sealant programs and fluoride rinse programs. However, older adult education with an emphasis on the correlation between optimal dental health and optimal systemic health is also needed.

There then remains the question of how to best provide the oral health care education to older adults. This question is one that must be answered through ad-

ditional research to insure that effective techniques and resources (both financial and personnel resources) are utilized.

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Table 1 Sample Characteristics of community living older adults from an Appalachian County, 2013 N=205

	Number	%
Dental visits		
Within the previous 12 months	97	47.3
Not within the previous 12 months	108	52.7
Sex		
Male	51	24.9
Female	151	73.7
Missing	3	1.5
Race/ethnicity		
Non-Hispanic white	201	98.1
Other	2	1.0
Missing	2	1.0
Age		
50-59	17	8.3
60-64	20	9.8
65-69	50	24.4
70-74	43	21.0
75-79	26	12.7
80 and above	18	8.8
Missing	19	9.3
Education		
Less than high school degree	33	16.1
High school graduate	102	49.8
More than high school	53	25.9
Missing	17	8.3
Teeth present		
27-32 teeth	73	35.6
1-26 teeth	74	36.1
Edentulous	47	22.9
Missing	11	5.4
Smoking status		
Current smoker	13	6.3
Former smoker	30	14.6
Never smoker	154	75.1
Missing	8	3.4
Oral health knowledge		
High knowledge	98	47.8
Low knowledge	107	52.2

Table 2 Description of Sample Characteristics of community living older adults from an Appalachian County by Dental Visits, Appalachian county, 2013 N=205

	Number With dental Visit Within the year	*%*	*Number with No visit within the year*	*%*	*p-value*
Sex					.2552
Female	69	34.2	82	40.6	
Male	28	13.9	23	11.4	
Race/ethnicity					.1782
Non-Hispanic white	96	47.3	105	51.7	
Other	0	0	2	1.0	
Age					.3214
Less than 70 years	45	24.2	42	22.6	
70 years and above	44	23.7	55	29.6	
Education					.0018
Less than high school	7	3.7	26	13.8	
High school	49	26.1	53	28.2	
More than high school	32	17.0	21	11.2	
Smoking status					.1405
Current smoker	3	1.5	10	5.1	
Former smoker	13	6.6	17	8.6	
Never smoker	78	39.6	76	38.6	
Oral Health knowledge					.0001
High knowledge	60	29.3	38	18.5	
Low knowledge	37	18.1	70	34.2	

Chi Square test p-values

Table 3 Accurate Responses to dental questions from community living older adults from an Appalachian County, 2013 N=205

	Number	%
Gum disease may be related to heart disease.		
Strongly agree	36	17.6
Agree	55	26.8
Gum disease may be related to heart disease.		
Strongly agree	28	13.6
Agree	43	21.0
A soft toothbrush is best.		
Strongly agree	47	22.9
Agree	51	24.9
Cleaning a child's teeth is important.		
Strongly agree	116	56.6
Agree	40	20.0
Fluoride is added to water to disinfect it.		
Strongly disagree	21	10.2
Disagree	41	20.0
Bacteria involved in decay can pass between people through saliva such as in sharing food.		
Strongly agree	30	14.6
Agree	61	29.8
Someone wearing dentures should still see a dentist yearly.		
Strongly agree	47	22.9
Agree	71	42.6
A good job brushing your teeth takes at least 2 minutes.		
Strongly agree	79	38.5
Agree	83	40.5

Table 4 Odds Ratios and 95% Confidence Intervals from Logistic Regression on Delayed Dental visits and Oral health knowledge community living older adults from an Appalachian County, 2013 N=205

	Unadjusted Odds ratio	95% CI	p-value
Oral health knowledge			
Low vs. High	2.99	[1.70, 5.28]	.0002

	Adjusted Odds ratio	95% CI	p-value
Oral health knowledge			
Low vs. High	2.25	[1.05, 4.82]	.0019
Sex			
Male vs. Female	0.77	[0.51, 4.93]	.5132
Age			
70 and older vs. less than 70	1.03	[0.48, 2.21]	.9442
Education			
Less than HS vs. more than HS	1.49	[0.51, 4.93]	.5132
HS vs. more than HS	0.96	[0.42, 2.23]	.9295
Smoking status			
Current smoker vs Never smoker	2.65	[0.56, 12.49]	.2190
Former smoker vs Never smoker	1.05	[0.36, 3.10]	.9280
Existing teeth			
1-26 vs. 27-32 teeth present	4.00	[1.73, 9.29]	.0012
Edentulous vs. 27-32 teeth present	8.34	[2.75, 25.26]	.0002

HS: high school