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## Dental Care Utilization among Older Adults with Cognitive Impairment in the United States

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### Abstract

**Aim**—We examined the relationship between cognitive impairment and dental care utilization among older adults in the United States.

**Methods**—Three hundred twenty-nine older adults aged 70 and over in West Virginia USA were included in the present analyses. We performed multivariate ordinal regression analyses.

**Results**—Individuals with dementia were less likely to visit a dentist regularly and more time had passed since their last dental visit compared to individuals with normal cognitive function. However, the pattern of dental care utilization for those with cognitive impairment, not dementia (CIND) did not differ from individuals with normal cognition. A perceived greater social network and having dental insurance were associated with increased dental care utilization.

**Conclusions**—Less dental care utilization may contribute to the oral health problems often observed among individuals with dementia. Efforts to increase use of dental care should consider including cost-effective options for dental insurance. In addition, educating formal and informal caregivers on the importance of dental care may be beneficial, as these individuals are in the best position to facilitate dental care for individuals with dementia.

### Keywords

Cognitive impairment; dental care utilization; older adults

### Introduction

The number of Americans with Alzheimer's disease and other dementias will grow each year as the proportion of the U.S. population over age 65 continues to increase.<sup>1</sup> The socio-economic burden of caring for persons with dementia is growing alongside dementia's

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#### Disclosure statement

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increased prevalence;<sup>1</sup> medical care utilization is higher among individuals one to two years prior to diagnosis of dementia<sup>2</sup> and among those with Alzheimer's disease compared to those without dementia.<sup>3</sup> However, little is known about the relationship between dental care utilization and cognitive impairment among older adults.

Poor dental care in individuals with dementia has been documented<sup>4,5</sup> and is significantly related to periodontal disease, comorbidity such as pneumonia and heart disease, and decreased quality of life.<sup>6</sup> Although studies have reported system-level barriers such as limited dental coverage by Medicare and Medicaid,<sup>7</sup> person-level influences on access to dental services for people with cognitive impairment have not been thoroughly studied.

One key person-level barrier for dental care use is an individual's level of cognitive impairment. Individuals with dementia may not be able to express their dental care needs, such as tooth pain and discomfort, due to cognitive deficit.<sup>8</sup> One study showed that older adults who scored poorly on the Digit Symbol Substitution Test (DSST), a measure of processing speed and executive function, had less frequent use of dental care.<sup>9</sup> This study had the advantage of using the National Health and Nutrition Examination Survey a nationally representative dataset. But participants in the study did not have a thorough cognitive evaluation, so a diagnosis of dementia could not be assigned. To address this limitation, in the present study we examined the relationship between dental care utilization and cognitive function, determined by a comprehensive evaluation for cognitive impairment, in community dwelling older adults. Two hypotheses were:

1. Better cognitive function is positively related to dental care utilization.
2. After controlling for covariates including demographic characteristics, social support, and dental insurance, the positive relationship between cognitive function and dental care utilization will still remain.

## Methods

### Study Sample and Procedure

Data were collected from 336 community-dwelling older adults. The inclusion criteria for study participants were 1) age 70 years or older, 2) a resident of West Virginia USA, 3) not residing in a nursing home, and 4) at least four natural teeth. The sample for the present analyses included the 329 participants who had completed the cognitive evaluation and the dental care utilization questions.

This study was approved by the West Virginia University Institutional Review Board. A psychometrician administered to the participant a battery of neuropsychological measures that assessed verbal and visual memory, language, executive function, orientation, praxis, and reading ability. A proxy informant, usually a spouse or adult child, provided information about the participant's cognitive function, functional limitations, medical history, and medications. Two study psychologists reviewed all data collected and assigned the cognitive diagnoses.<sup>10</sup> For the clinical dental examination, three calibrated dentists and one dental hygienist performed the oral evaluations using guidelines from the Fourth National Health and Nutrition Examination Survey.<sup>11</sup>

## Measures

**Dependent variable**—Dental care utilization was assessed by two questions: last dental visit and frequency of dental check-up. For the time since last dental visit, we asked “When did you last visit a dentist?” and response options were *1= 5 or more years ago, 2= less than 5 years but equal to or more than 3 years ago, 3= less than 3 years but equal to or more than 2 years ago, 4=less than 2 years but equal to or more than 1 year ago, 5= less than 1 year but equal to or more 6 months ago, and 6= less than 6 months ago*. For the frequency of dental check-up, we asked “During the past three years, how often have you gone to the dentist for routine check-ups or cleanings?” and response options were *1=whenever needed, no regular schedule, 2= less than once a year, 3= once a year, and 4=2 or more times a year*. We asked these questions of both the participants and their informants to obtain information about the dental care use of the participants. Informant reported data was used for individuals with dementia; self-reported data was used for individuals with normal cognitive function and cognitive impairment without dementia (CIND).

**Independent variable**—Cognitive function was assigned within three cognitive categories: normal cognitive function, CIND, and dementia (*0= cognitive normal, 1=CIND, and 2= dementia*). The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria were used for diagnosis of dementia.<sup>12</sup> CIND was defined as mild cognitive or functional impairment reported by the participant or informant that did not meet criteria for dementia, or performance on neuropsychological measures that was both below expectation based on reading ability and educational and occupational history, and at least 1.5 SDs below published norms on any test within a cognitive domain (e.g., memory, orientation, language, executive function, praxis). Diagnoses were anchored by these criteria, but final diagnoses were based on clinical judgment. Similar assessment and diagnostic procedures have been used and validated in multiple large epidemiological studies on cognitive impairment in later life.<sup>13</sup>

**Covariates**—Covariates in the categories of socio-demographics, social support, and clinical dental status were included. Socio-demographic variables consisted of age (continuous variable), gender (*0=male, 1=female*), education (*0= high school or less, 1= some college*) and dental insurance (*0=no, 1=yes*). Social support was assessed using the Lubben Social Network Scale-6 (LSNS-6),<sup>14</sup> which is a 6-item questionnaire with 5 response options. The LSNS-6 can be divided into 3 dimensions: active social network (items 1 and 4), perceived social network (items 2 and 5), and perceived confidence in network (items 3 and 6).<sup>15</sup> We used 3 dimensions of social support in order to assess what aspect of social support is particularly related to dental care utilization. Clinical dental status included number of missing teeth and number of decayed coronal and root surfaces as determined by dental examination.

## Analysis

One-way analysis of variance (ANOVA) tests and chi-square tests were completed to establish significant differences in sample characteristics, social support, and dental care utilization by cognitive function. Multivariate ordinal regression analyses using the PLUM

(polytomous logit universal model) procedure were used to examine the association between cognitive function and dental care utilization after controlling for covariates. The sequence of analytical models was as follows: The first step included the cognitive function only; the second step added socio-demographics and social support subscales. The third step added clinical dental status. The Statistical Package for the Social Science 19.0 (SPSS, Chicago, IL) was used for analyses.

## Results

### Sample characteristics

Table 1 shows the sample characteristics by cognitive function. Gender, education, and the presence of dental insurance did not systematically vary by cognitive diagnosis. Individuals with normal cognitive function were younger and more likely to report a higher level of social support than individuals with CIND and dementia. As the level of cognitive function worsened, individuals were less likely to have had recent dental visits and regular dental checkups.

### Multivariate analysis

The results of the ordinal regression models on time since last dental visit and regular dental visit are summarized in Table 2. For the time since the last dental visit, Step 1 revealed that the time since the most recent dental visit was longer for individuals with dementia compared to those with normal cognitive function. This relationship remained significant in the final model (Step 3), with the odds ratio (OR) only slightly reduced at 0.28. Perceived confidence in network and the presence of dental insurance were associated with less time since the last dental visit in Steps 2 and 3. Three clinical dental status variables (i.e., greater number of missing teeth and greater number of decayed coronal and root surfaces) were associated with more time since the last dental visit (OR=0.96, 0.90, and 0.85, respectively) in Step 3.

Individuals with CIND and dementia were less likely to have regular dental visits than individuals with normal cognitive function in the unadjusted model (Step 1) (odds ratios of 0.54 and 0.12, respectively). However, in Step 3, individuals with dementia were still less likely to visit the dentist regularly than individuals with normal cognitive function (OR=0.22). Greater perceived social network and the presence of dental insurance were associated with more frequent dental visits in Steps 2 and 3. A higher number of missing teeth was associated with less frequent dental visits (OR=0.95) in Step 3.

We did sensitivity analyses to assess whether the use of self-reported dental care utilization information for those with CIND and normal cognition, but proxy-reported information for individuals with dementia influenced our results. We re-ran the analyses using self-reported data for all groups and the main results did not change. In addition, we investigated whether potential inaccuracies in self-reported perceived social network by individuals with moderate to severe dementia may have influenced our results. To assess this issue, we re-ran the analysis examining the relationship between self-reported perceived social network and dental care utilization after excluding individuals with moderate to severe dementia. These

analyses showed that self-reported perceived social network was still significantly related to dental care utilization (result not shown).

## Discussion

We have shown that individuals with dementia and CIND are less likely to have regular dental visits and that it has been a significantly longer time since their most recent dental visit. For dementia, these associations remained after controlling for covariates such as socio-demographics, social support, and clinical dental status. To our knowledge, this is the first study to report the relationship between a well-characterized diagnosis of cognitive impairment and dental care utilization. This study builds on our previous work that assessed dental care utilization and cognitive status using a single cognitive measure, the Digit Symbol Substitution Test, to indicate cognitive function in the NHANES data.<sup>9</sup> The difference between these two studies is that the present study was able to better characterize cognitive status by using a comprehensive evaluation to assign a diagnosis of dementia or CIND. Potential explanations are that caregivers or family members of individuals with dementia may not perceive the importance of dental care and remember dental appointments and individuals with dementia have difficulty to communicate with their caregivers.<sup>6</sup>

Another important finding was the positive relationship between self-reported perceived social network (one of the social support dimensions) and dental care utilization. Several studies have shown that social support is an important determinant of the utilization of overall health services among older adults.<sup>16,17</sup> Our findings suggest that even among individuals with dementia, strong social support may be beneficial in obtaining dental care. This may be attributable to better instrumental support or convenient transportation facilitating access to care.<sup>18</sup>

Dental insurance was significantly associated with both time since last visit and regular dental visits, which is consistent with previous studies.<sup>19</sup> This study also showed the infrequency of dental insurance overall. This may be related to a financial limitation because some federal insurance programs such as Medicare do not cover dental care and Medicaid only offers very limited dental coverage. As illustrated from our study, dental care is strongly related to oral health. In order to improve accessibility of dental care, it is important that the overall medical insurance coverage includes basic dental care.

Some limitations of this study need to be acknowledged. The design of this study is cross-sectional. Further longitudinal studies are required to evaluate the trajectory of dental care utilization over time in individuals with and without cognitive impairment. In addition, generalizability of the findings may be limited because the sample was one of convenience.

In summary, this study found that community-dwelling older adults with cognitive impairment have limited use of dental care, but perceived social network and dental insurance coverage are the factors that may improve their likelihood of receiving dental care. This suggests that adding dental coverage to overall medical insurance may be beneficial to community-dwelling older adults with and without cognitive impairment. Since family members and caregivers are often responsible for arranging health care for

cognitively impaired individuals, it will be key for them to receive education regarding the importance of regular dental care in maintaining the oral health of older adults and ultimately to improve their quality of life.

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**Table 1**

Sample Characteristics by Cognitive Function (N=329)

Variable	Label	Normal n=205 n (%)	CIND n=50 n (%)	Dementia n=74 n (%)	F/ $\chi^2$	p
Gender	Male Female	74 (36.1) 131 (63.9)	15 (30.0) 35 (70.0)	19 (26.0) 54 (74.0)	2.70	.259
Age, mean $\pm$ SD		77.47 $\pm$ 5.76 <sup>ab</sup>	80.88 $\pm$ 6.00 <sup>ac</sup>	84.67 $\pm$ 7.43 <sup>bc</sup>	37.22	.000
Education	high school or less Some college	95 (46.6) 109 (53.4)	20 (40.0) 30 (60.0)	38 (52.1) 35 (47.9)	1.74	.418
Dental insurance	No Yes	175 (86.6) 27 (13.4)	42 (84.0) 8 (16.0)	57 (89.1) 7 (10.9)	.63	.731
Active social network, mean $\pm$ SD		8.04 $\pm$ 1.84 <sup>ab</sup>	7.20 $\pm$ 1.99 <sup>ac</sup>	5.66 $\pm$ 1.75 <sup>bc</sup>	45.15	.000
Perceived social network, mean $\pm$ SD		5.52 $\pm$ 2.50 <sup>ab</sup>	4.38 $\pm$ 2.52 <sup>a</sup>	3.37 $\pm$ 1.77 <sup>b</sup>	23.54	.000
Perceived confidence in network, mean $\pm$ SD		6.78 $\pm$ 2.33 <sup>ab</sup>	5.84 $\pm$ 2.37 <sup>ac</sup>	3.86 $\pm$ 1.96 <sup>bc</sup>	44.27	.000
Recent dental visit	>5 or more yrs ago < 3 to 5yrs < 2 to 3yrs < 1 to 2 yrs <6 mo to 1yr < 6 mo	10 (5.5) 4 (2.2) 10 (5.5) 9 (4.9) 27 (14.8) 122 (67.0)	2 (5.6) 1 (2.8) 2 (5.6) 2 (5.6) 9 (25.0) 20 (55.6)	2 (3.7) 6 (11.1) 14 (25.9) 6 (11.1) 12 (22.2) 14 (25.9)		
Regular dental visits	Whenever needed, no regular schedule Less than once a year Once a year 2 or more times a year	10 (6.7) 4 (2.7) 18 (12.1) 117 (78.5)	5 (16.7) 2 (6.7) 4 (13.3) 19 (63.3)	11 (36.7) 4 (13.3) 6 (20.0) 9 (30.0)	34.52	.000

Note:

<sup>a-c</sup> Groups with same letter are significantly different according to Bonferroni post hoc test.



Table 2

## Influencing Factors on Dental Care Utilization

	Recent Dental Visit			Regular Dental Visits		
	Step 1 OR (95% CI)	Step 2 OR (95% CI)	Step 3 OR (95% CI)	Step 1 OR (95% CI)	Step 2 OR (95% CI)	Step 3 OR (95% CI)
Cognition (CIND)	0.68 (0.34, 1.38)	0.76 (0.36, 1.60)	0.77 (0.36, 1.65)	0.44 (0.19, 0.99) <sup>*</sup>	0.53 (0.22, 1.28)	0.54 (0.22, 1.32)
Cognition (Dementia)	0.22 (0.12, 0.38) <sup>**</sup>	0.18 (0.08, 0.39) <sup>**</sup>	0.28 (0.13, 0.62) <sup>**</sup>	0.12 (0.05, 0.26) <sup>**</sup>	0.19 (0.06, 0.59) <sup>**</sup>	0.22 (0.07, 0.68) <sup>**</sup>
Active social network		1.06 (0.89, 1.26)	1.10 (0.92, 1.30)		0.99 (0.79, 1.22)	0.96 (0.77, 1.20)
Perceived social network		1.21 (1.07, 1.36) <sup>**</sup>	1.21 (1.07, 1.38) <sup>**</sup>		1.22 (1.04, 1.42) <sup>*</sup>	1.20 (1.03, 1.40) <sup>*</sup>
Perceived confidence in network		0.90 (0.77, 1.04)	0.90 (0.77, 1.04)		1.01 (0.84, 1.21)	1.05 (0.87, 1.26)
Education (Some college)		1.67 (1.00, 2.80) <sup>*</sup>	1.52 (0.89, 2.59)		2.10 (1.06, 4.14) <sup>*</sup>	1.83 (0.90, 3.71)
Gender (female)		0.76 (0.44, 1.34)	0.76 (0.43, 1.34)		0.88 (0.41, 1.88)	0.94 (0.44, 2.03)
Age		1.02 (0.97, 1.06)	1.03 (0.98, 1.07)		1.02 (0.96, 1.08)	1.03 (0.97, 1.09)
Dental insurance (yes)		3.23 (1.25, 8.33) <sup>*</sup>	3.04 (1.17, 7.85) <sup>*</sup>		6.94 (1.45, 33.45) <sup>*</sup>	7.05 (1.46, 34.12) <sup>*</sup>
# of missing teeth			0.96 (0.93, 1.00) <sup>*</sup>			0.95 (0.90, 0.99) <sup>*</sup>
# of decayed coronal surfaces			0.90 (0.83, 0.98) <sup>*</sup>			0.92 (0.79, 1.07)
# of decayed root surfaces			0.85 (0.73, 0.99) <sup>*</sup>			0.78 (0.59, 1.03)

Note. OR = odds ratio; CI = confidence interval;

<sup>\*</sup> <.05,<sup>\*\*</sup> <.01