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Dental Care Utilization among Caregivers Who Care for Older Adults

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Abstract

The goal of this study was to investigate individual and contextual factors associated with dental care utilization by U.S. informal caregivers. The sample included all 2010 Behavioral Risk Factor Surveillance System (BRFSS) respondents who completed the Caregiver Module and reported providing care for one year or more to an individual aged 50 years or older (n=1,196). Multiple logistic regressions were used to examine associations of caregiver and care characteristics and county-level contextual characteristics (from Area Resource File data) with two outcomes: dental visits and dental cleaning during previous year. Caregivers with health insurance coverage and higher education were more likely to use dental care; those who had lost more teeth and who were spouse caregivers were less likely to do so. Community characteristics were not correlated with caregivers' use of dental care. Our findings suggest that better access to dental care could improve dental care utilization by caregivers.

Keywords

dental care utilization; older adults; caregivers

Introduction

Informal caregiving is an important part of America's long-term care system. An informal caregiver is defined as a family member or friend who aids and/or supervises daily care of a weak or disabled person, such as a frail older adult (Dilworth-Anderson, et al., 2002). Most community-living older adults with disability or frailty are cared for at home by family members, primarily spouses and children (Adelman, Timanova, Delgado, Dion, & Lachs, 2014; Feinberg, Reinhard, Houser, & Chula, 2011). Caring for a family member can be rewarding, but providing that care can take a high toll on the caregiver's resources. Financial costs associated with caregiving are extremely high (Moore, Zhu, & Clipp, 2001; Feinberg et al., 2011); furthermore, informal caregivers are less likely to remain employed and retain

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health insurance (Ho, Collins, Davis, & Doty, 2005). Caregiving can also adversely affect caregiver health, particularly if high levels of care are needed for a long period of time (Feinberg et al. 2011; Navaie-Waliser et al., 2002; Pinquart & Sorensen, 2007). Burdens and stresses associated with caregiving can cause physical and psychological distress, exacerbate many chronic illnesses (including arthritis, CVD, and depression), and increase the risk of onset of new comorbidities (Capistrant, Moon, Berkman, & Glymour, 2012; Pinquart & Sorensen, 2007; Pruchno & Meeks, 2004).

Caregivers whose health is significantly impaired may lose the ability to continue providing care unless their own health needs are addressed (Pinquart & Sorensen, 2007). However, caregivers may discount the importance of their health issues in comparison to those of their care recipients (Scharlach, Runkle, Midanik, & Soghikian, 1994). Furthermore, high caregiving demands and stress levels leave some caregivers with insufficient time and energy to attend to their own health (Zarit, 2006). In such circumstances, some caregivers may be unable to sustain health-promoting behaviors such as adequate sleep, exercise, and good nutrition (Acton, 2002; Burton, Newsom, Schulz, Hirsch, & German, 1997; Hoffman, Lee, & Mendez-Luck, 2012); they may also delay or forego preventive healthcare and treatment for their own medical conditions (Acton, 2002; Lu and Wykle, 2007, Zarit, 2006), particularly when financial constraints are severe (Altman, Cooper, & Cunningham, 1999; Ho, Collins, Davis, & Doty, 2005).

In this context, family caregivers' utilization of dental care – an important but often overlooked dimension of health care – is of particular interest. The importance of regular preventive and restorative dental care in maintaining oral health is underscored by findings that incidence of missing teeth and untreated decay is much lower in active-duty members of the U.S. military (which requires annual dental examinations and provides dental care free of charge) than in populations of age-matched civilians, who often lack access to regular dental care (U.S. Department of Health and Human Services [USDHHS], 2000). Neglect of dental care can lead to tooth decay, tooth loss, oral pain and discomfort, inflammation, tooth and periodontal infections conditions which if untreated can impair nutritional status, increase vulnerability to systemic infections, and impair function and quality of life (Boehm and Scannapieco, 2007; Chalmers, Carter, & Spencer, 2003; DeBiase & Austin, 2003; Institute of Medicine & National Research Council, 2011; Li, Kolltveit, Tronstad, & Olsen, 2000; World Health Organization, 2006; Wu, Plassman, Crout, & Liang, 2008). However, the need for dental care is the most common unmet healthcare need among U.S. adults (Chevarley, 2010; Dolan, Atchison, & Huynh, 2005). Furthermore, major barriers that limit access to dental care (low income, lack of dental insurance, limited transportation, inability to take time off from work or family care obligations, and lack of perceived need for dental care [Dolan et al., 2005; USDHHS, 2000] may be particularly salient for family caregivers.

Family caregivers are the major health care decision makers as well as the primary providers of support for frail older adults in the home setting (Institute of Medicine, 2008). Caregivers who delay or forego needed dental care may experience complications that severely compromise their ability to continue caring for those who depend on them. Thus, although dental care is a relatively small component of overall health care utilization by caregivers, its importance is increasing as the U.S. population continues to age.

Little information is available about dental care use among caregivers. Dental cleaning was included as an outcome in one study of physical and mental health in Connecticut caregivers (Robison, Fortinsky, Kleppinger, Shugrue, & Porter, 2009). Caregivers who were living with care recipients and those with inadequate income were less likely to have regular dental cleaning. However, the study was limited by its lack of measures of oral health, and the use of only individual-level variables. Furthermore, the duration of caregiving was not specified, and thus it was not possible to determine whether a caregiver's most recent dental care visit occurred before or after the initiation of caregiving.

The purpose of this study was to investigate care characteristics and individual and contextual factors associated with dental care utilization in a representative sample of informal caregivers in the home setting from two states within the U.S. The Andersen behavioral model of health service use (Andersen, 1995; Andersen & Newman, 1973; Davidson & Andersen, 1997) was used as a framework for analysis of individual and contextual factors. This model has been widely applied in research on healthcare service utilization, including a number of caregiver studies (Hong, 2012, Toseland, McCallion, Gerber, & Banks, 2002). It has also been used in research on utilization of dental care (Burr & Lee, 2013; Miltiades & Wu, 2010; Wu, Liang, Luo, & Furter, 2013), although not a caregiving context. The Andersen model proposes that health service use is affected by both individual and contextual factors, and further subdivides these factors into three domains: predisposing factors, which influence the likelihood that an individual will seek healthcare services; enabling factors, which affect the individual's ability to obtain healthcare services; and need factors, which determine the individual's level of need for healthcare services. Predisposing factors such as caregiver demographic characteristics and enabling factors such as employment and availability of health insurance have been highlighted as particularly important in caregiving literature, while need factors such as caregiver health have been identified as particularly important in the general literature on health care utilization (Toseland et al., 2002).

We formulated the following hypotheses on the impact of caregiving on dental care utilization: 1) care characteristics such as duration of care, intensity of care, and the relationship of caregiver and care recipient are associated with caregivers' dental care utilization; 2) sociodemographic, economic, and health characteristics of caregivers (predisposing, enabling, and need factors) affect their use of dental care; and 3) contextual characteristics affect dental care utilization by caregivers.

Method

Data Sources

This analysis used the data from the 2010 Behavioral Risk Factor Surveillance System (BRFSS), an annual state-based, random-digit-dialed telephone survey of the non-institutionalized, US civilian population aged 18 years or older. The BRFSS gathers data on preventive health practices and risk behaviors that are linked to chronic diseases, injuries, and preventable infectious diseases. The BRFSS questionnaire consists of three sections: a core survey, optional modules, and state-added questions (Centers for Disease Control and Prevention, 2012). In the 2010 BRFSS, the core questionnaire collected information about

respondents' use of dental care and their dental health. An optional Caregiver Module designed to collect data on caregiver and care recipient characteristics, including relationship with care recipient, duration of care, hours of care provided per week, and care recipient's major illness was administered in two states (Connecticut and New Hampshire) in 2010. Using the county Federal Information Processing Standard (FIPS) code, the 2010 BRFSS data were merged with county-level characteristics from the Health Resources and Services Administration's Area Resource File (ARF), a national county-level health resource information database (Health Resources and Services Administration, 2012). The BRFSS Caregiver Module included data for 12,822 informal caregivers. This analysis was limited to 1,196 respondents who reported providing care for one year or more to care recipients aged 50 years or older.

Outcome Measures

Two dental care variables were used as the study outcomes: *dentist visit* (Yes/No) and *dental cleaning* (Yes/No). In the 2010 BRFSS Core Questionnaires, one of the dental care use questions was, "How long has it been since you last visited a dentist or a dental clinic for any reason? Include visits to dental specialists, such as orthodontists." In this analysis, responses were dichotomized according to the traditional practice of basing dental care utilization statistics on participant reports of at least one dental visit during the past year (American Dental Association 2013; USDHHS, 2000). Respondents were classified as having a *dentist visit* (Yes) if they answered "Within the past year (anytime less than 12 months ago)" to this question. Those who answered "Within the past two years (one year but less than two years ago)", "Within the past five years (two years but less than five years ago)", "five or more years ago", or "Never" were classified as not having a *dentist visit* (No). The second BRFSS question was, "How long has it been since you had your teeth cleaned by a dentist or dental hygienist?" Respondents were classified as having a *dental cleaning* (Yes) if they answered, "Within the past year (anytime less than 12 months ago)", and they were classified as not having a *dental cleaning* (No) if they answered "Within the past two years (one year but less than two years ago)", "Within the past five years (two years but less than five years ago)", "five or more years ago", or "Never".

Measures of Care Characteristics

Three characteristics of the caregiving relationship were assessed in this study: duration of care (in years), average hours of care per week, and relationship between caregiver and care recipient. The relationship variable was recoded into three categories: child, spouse, and "other" (a category that included sibling, parent-in-law, grandparent, grandchild, other relative, and non-relative).

Measures of Individual Caregiver Characteristics

Individual caregiver characteristics assessed in this study included predisposing factors, enabling factors, and need factors.

- 1) *Predisposing* factors are characteristics of the individual caregiver that increase the likelihood of health service utilization. A number of sociodemographic characteristics are predisposing factors for dental care utilization in U.S. adults;

individuals who are younger, female, White, married, and have higher levels of education and income are more likely to use dental services (Akingube & Lucas-Perry, 2013; Cunha-Cruz, Hujuel, & Nadanovsky, 2007; Dolan, Atchison, & Huynh, 2005; Doty & Weech-Maldonado, 2003; Galobardes, Shaw, Lawlor, Lynch, & Smith, 2006; Manski, Moeller, & Maas, 2001; Wu, Plassman, Liang, & Wei, 2007). Predisposing factors represented in this analysis included age in years (continuous variable) and dichotomous measures of gender, race/ethnicity (White vs. other), marital status (married vs. other), and education (college degree or higher vs. fewer years of education). An income variable was not used, because data were missing for 12.5% of the sample and preliminary analyses showed that income was significantly correlated with individual characteristics such as education, current employment, and health insurance. These individual-level variables and a measure of mean income at community level may to some extent serve as proxies for income in this analysis.

- 2) *Enabling factors* are characteristics which make it possible for an individual to obtain health care when needed. Because cost significantly limits access to dental care, dental insurance, which enables individuals afford that care, is a powerful driver of dental care utilization (Wall, Vujcik, & Nasseh, 2012; Wu et al., 2007). The BRFSS survey did not include a dental insurance item, but did include items assessing employment, which enables dental care utilization because employers are the primary source of private dental insurance (USDHSS, 2000) and health insurance coverage. These factors are represented in this analysis by dichotomous variables (employment status: currently employed vs. other; having health insurance: yes/no).
- 3) *Need factors* are characteristics of an individual's health status that affect the level of need for healthcare services (in this case, dental care services). Most edentulous adults perceive little need for dental care (Dolan et al., 2005), while individuals who retain larger numbers of permanent teeth are more likely to have dental visits (Wu, Liang, Plassman, Remle, & Luo, 2012). This need factor is represented in our analysis by a variable measuring the number of permanent teeth lost by the caregiver (none, 1 to 5, 6 or more, and all).

Other factors pertaining to caregiver health were treated as control variables in our analysis. Smoking status (coded as current smoker, former smoker, or never smoked) was included in the models because smoking affects oral health (Bloom, Adams, Cohen, & Simile, 2012) and is associated with lower utilization of dental care (Akinsugbe & Lucas-Perry, 2012). Dichotomous (Yes/No) measures of self-reported diabetes and cardiovascular disease (defined as heart attack, coronary heart disease, or stroke) were also included in the models because these chronic conditions are associated with oral health (Boehm and Scannapieco, 2007; Hung et al., 2003; Skamagas, Breen, & LeRoith, 2008).

Measures of Contextual Characteristics

Contextual factors are community characteristics that shape the resources and opportunities available to individuals in that community. Some studies have reported associations of

community characteristics such as overall educational or socioeconomic status and racial/ethnic composition with oral health or dental care utilization (Borrell, Taylor, Borgnakke, Woolfolk, & Nyquist, 2004; Locker & Ford, 1996; Quinn, Catalano, & Felber, 2009; Turrell, Sanders, Slade, Spencer, & Marcenes, 2007), while others (Borrell & Baquero, 2011; Reijneveld, 1998; Sanders & Spencer, 2004; Schulz et al., 2000) have not found such associations. This analysis included two contextual characteristics of the county population categorized as predisposing factors: racial/ethnic community composition (operationalized as the percentage of Whites) and overall educational status (operationalized as the percentage of adults aged 25 years with less than a high school education), and two county-level contextual characteristics categorized as enabling factors (mean per capita income and the number of dentists/dental hygienists per 1,000 population). These county-level contextual characteristics were extracted from ARF data. Contextual need factors were not included in our analysis because dental information about need factors at the county level is not readily available.

Statistical Analysis

Descriptive statistics were calculated for care characteristics, individual factors, and contextual factors, and the distribution of these variables with respect to dental care utilization was examined. Then, for each of the two outcomes examined in this study (having a *dentist visit* within the past year and having a *dental cleaning* within the past year), we ran three sequential multiple logistic regression models. Model I assessed the association between care characteristics and the outcome variable. In Model II, individual caregiver characteristics were added to Model I. In Model III, community characteristics (contextual factors) were added to Model II, and multilevel modeling was used.

Because the BRFSS is a complex survey that involves unequal sampling probabilities and stratification, a multilevel model was used to account for correlations between counties and the complex design. Standard statistical software packages for analyzing survey data (e.g. SUDAAN, SAS, and STATA) do not include this type of model. Therefore, we used the likelihood based approach (Rabe-Hesketh & Skrondal, 2006) implemented in the STATA 11 (College Park, TX) program GLLAMM (Rabe-Hesketh, Skrondal, & Pickles, 2004). The multilevel model analyses were implemented in three steps. In Step 1, the sampling weights were standardized to sum to the effective sample size. In Step 2, a multilevel model that accounted for these weights and included random intercepts by county was fitted. All the individual-level covariates and county-level covariates were included as fixed effects in this model. In Step 3, a sandwich estimator was used to correct the standard errors accounting for the sample stratification. Results were considered significant if $p < 0.05$.

Results

Dental Care Utilization

All sample members ($n = 1,196$) provided information dentist visits. Of these, 79.3% responded that they had visited a dentist “within the last year” and were scored “Yes” on the dentist visit outcome measure. This measure was scored “No” for all others (6.2% who responded “within the past two years”, 6.7% who responded “within the past five years”,

7.4% who responded “five or more years ago”, and 0.3% who responded “never”). Responses to the dental cleaning outcome measure were provided by 94.5% of the sample (n = 1,130) and followed a very similar pattern: 80.0% scored “Yes” on dental cleaning by responding “within the past year”, and the dental cleaning measure was scored “No” for remaining 20% (6.3% “within the past two years”, 6.4% “within the past five years”, 6.2% “five or more years ago”, and 1.1% “never”). (Data not shown in Tables.)

Sample Characteristics

Table 1 presents care characteristics, individual caregiver characteristics, and contextual characteristics for study sample and for the sample subgroups who scored “Yes” and “No” on each of the two dental utilization outcome measures. In our sample, 44% of caregivers were children of the care recipients, 16% were spouses, and 40% were “other”. Mean duration of care was 6 years, and with a mean of 20 hours of care provided per week. Mean age of caregivers was 53 years. The majority of the caregivers were female (59%), White (95%), and married (66%) and had at least a college degree (72%). In addition, most were employed (61%) and had health insurance (90%). More than half of the caregivers (54%) had retained all of their natural teeth. Seventeen per cent were current smokers, 29% were former smokers, and 54% had never smoked. Ten per cent of the caregivers reported having diabetes and 7% reported having cardiovascular disease.

Bivariate Analysis

Care characteristics, individual caregiver characteristics, and contextual characteristics are also shown in Table 1 for the sample subgroups who scored “Yes” and “No” on each of the two dental utilization outcome measures. Caregivers who had a dentist visit reported providing fewer weekly hours of care than those who did not have a dentist visit (18.2 vs. 26.2 hours). Caregivers who had a dentist visit were more likely to be married (69.6% vs. 59.8%), currently employed (63.4 % vs. 48.8%), and college-educated (78.4% vs. 50.8%), and to have health insurance (94.3% vs. 72.0%). They were also more likely to have never smoked (56.7% vs. 40.4%), and to have retained all of their permanent teeth (58.5% vs. 35.1%). Caregivers who had a dental cleaning during the previous year also reported providing fewer hours of care than those who did not have a dental cleaning (17.4 vs. 25.7 hours). Caregivers who had a dental cleaning were more likely to be married (70.6% vs. 56.7%) and college-educated (79.4% vs.53.7%), and to have health insurance (94.4% vs. 69.7%). They were also more likely to have never smoked (57.7% vs. 40.3%), and to have retained all of their permanent teeth (60.8% vs.35.5%).

Multivariate Analysis

Table 2 summarizes the results of multiple logistic regressions with “having a dentist visit” as the outcome. Results from Model I show that caregivers who provided more hours of care were less likely to have a dentist visit (AOR [adjusted odds ratio]=0.80, 95% CI [confidence interval]: 0.67-0.96). Model II results show that duration of care was no longer significant after controlling for individual caregiver characteristics. College education, health insurance, never smoked, and the loss of one or more teeth were the significant factors. After community characteristics were added to the analysis, results from Model III show that caregivers who were the spouse of the care recipient (AOR=0.51, 95% CI: 0.27-0.99) and

those who had lost six or more teeth (AOR=0.36, 95% CI: 0.16-0.81) or all permanent teeth (AOR=0.12, 95% CI: 0.04-0.34) were less likely to have a dentist visit, while caregivers with a college education (AOR=2.32, 95% CI: 1.38-3.93) and those with health insurance (AOR=6.54, 95% CI: 2.59-16.51) were more likely to have a dentist visit.

Table 3 presents results of the multiple logistic regression model results with “having a dental cleaning” as the outcome. Results for this outcome were somewhat similar to those presented in Table 2. Model I results show that caregivers who provided more hours of care were less likely to have a dental cleaning (AOR=0.82, 95% CI: 0.68-0.99). Model II results show that having a college education, having formerly smoked and never smoked, having health insurance, and loss of one or more teeth were significantly associated with having dental cleaning. Finally, Model III results show that caregivers being married (AOR=2.37, 95% CI: 1.00-5.61), with a college education (AOR=2.53, 95% CI: 1.59-4.01) and health insurance (AOR=10.23, 95% CI: 4.67-22.43) were more likely to have a dental cleaning. Caregivers who had lost six or more teeth (AOR=0.29, 95% CI: 0.14-0.58) were less likely to have a dental cleaning.

Discussion

Our study is one of the first to examine factors related to dental care use among long-term caregivers for older adults in the U.S. The present study extends prior observations in several respects: 1) a clearly defined conceptual framework was used (we applied the well-established Andersen health services utilization model to assess caregivers’ dental care utilization); 2) both individual-level and contextual level characteristics were included in the analyses; and 3) information about caregivers’ oral health was incorporated into the model (we included tooth retention information, an oral health indicator).

The study results partially support the first hypothesis that care characteristics are related to dental care. Model I showed that caregivers providing a higher number of hours of care per week were significantly less likely to report having either a dental visit or a dental cleaning within the past year, but these associations lost their significance in Models II and III. One plausible explanation is that patterns of dental care utilization are firmly established within an individual’s routines before the initiation of caregiving and may not be easily modified by factors such as the number of hours per week spent providing care (Kolanowski et al., 2004).

In models controlling for individual and contextual factors, the only significant association of a care characteristic with use of dental care was that spouse caregivers were less likely than adult child caregivers to report having visited a dentist within the past year. For spouse caregivers, who can be much more involved in caregiving than adult children, dental care may become less of a priority. Of note, this relationship should not be over-interpreted, because it was significant only in the full model after individual characteristics and contextual factors were controlled.

The findings of this study provide more support for the second hypothesis (individual caregiver characteristics are associated with dental care utilization). Two predisposing

factors were significantly associated with use of dental care in models adjusted for individual and contextual factors. Caregivers who were married were more likely to have had a dental cleaning in the previous year than those who were not married ($p < .05$ in Models II and III). College-educated caregivers were more likely to have visited the dentist and to have had their teeth cleaned during the previous year than caregivers with less education ($p < .001$ in Models II and III for both outcomes). These findings are consistent with previous reports that dental care utilization by adult Americans increases with the level of education (Doty & Weech-Maldonado, 2003; Ho, Collins, Davis, & Doty, 2005). Caregivers with a higher educational level are more likely to have financial resources to afford dental care. They may have better access to information on oral health and more knowledge about oral health conditions and diseases. Given the strength of the relationship with dental care utilization, it is possible that providing health education to less educated caregivers might promote dental utilization.

One enabling factor (having health insurance) was also very strongly associated with higher utilization of dental care for each outcome (dental visits and dental cleaning) in both Model II (adjusted for other individual factors) and Model III (adjusted for both individual and contextual factors). Having health insurance is likely to be correlated with having dental insurance, and presumably individuals with health insurance are better able to afford dental expenses. As expected, the need factor in this analysis (number of permanent teeth lost) was strongly associated with use of dental care; individuals with fewer teeth were less likely to have either dental visits or dental cleaning.

Maintaining oral health is a high public health priority because of its relationship with systemic health, the disproportionate burden of oral diseases in adults with low education and income, and marked disparities in access to dental care for adults (Lamster, 2004; Petersen & Yamamoto, 2005). The use of preventive dental care is known to be highly correlated with oral health (Kressin, Boehmer, Nunn, & Spiro, 2003; Philip, Rogers, Kruger, & Tennant, 2012; Sharma et al., 2004; Sniehotta, Araujo Soares, & Dombrowski, 2007; Wu et al., 2007). There is evidence that failure to prevent or control oral disease (e.g., periodontal disease) may increase the risk of adverse health outcomes including diabetes and heart disease (Griffin, Jones, Brunson, Griffin, & Bailey, 2012). With reference to oral health policy, our findings suggest that reducing disparities in access to dental care and making dental care more affordable would contribute to better oral health, and possibly overall health, in informal caregivers.

Our third hypothesis (that contextual factors would be significantly associated with dental care utilization) was not supported by the findings of this study. No significant association was found between community characteristics (education, income level, and racial/ethnic composition of the community and number of dental professionals in the area) and utilization of dental care by informal caregivers. Results of previous research on the effects of community characteristics on oral health have been mixed. Several earlier studies reported a lack of significant association between neighborhood socioeconomic conditions and self-rated general health (Borrell & Baquero, 2011; Reijneveld, 1998; Sanders & Spencer, 2004; Schulz et al., 2000), but other studies found that community health norms may actually influence the oral or general health behaviors of individuals (Burr & Lee,

2013; Borrell et al., 2004; Locker & Ford, 1996; Turrell et al., 2007). We need to be aware that our study sample was drawn from two states in the Northeast (Connecticut and New Hampshire). The lack of strong association between community characteristics and dental care utilization in this sample may partially due to the limited variation in community characteristics within these two states. Future research is warranted to further examine the impact of community characteristics on dental care use in more diverse regions in the country.

This study has several limitations. The data used were cross-sectional, so no causal relationships can be inferred. All BRFSS data were self-reported and are subject to recall and other biases. Furthermore, the data available for this sample did not include information about factors such as caregiving stress and depression, which can influence the utilization of preventive health behaviors such as dental visits and dental cleaning. The sample used in this analysis represents only the states in which the BRFSS Caregiver Module was administered (New Hampshire and Connecticut), and sample members were overwhelmingly White (95%) with a high level of education (72%), which may limit the generalizability of our findings to caregivers in other states. Further studies are needed to examine dental care utilization among caregivers using a national sample.

Conclusions

Our study suggests that caregiving characteristics such as the duration of caregiving may have an impact on dental care utilization by caregivers, but the association is not strong. Individual characteristics, rather than care characteristics, explain caregivers' dental care utilization patterns. Higher levels of education and having health insurance are positively related to the use of preventive dental services. As the U.S. population ages, informal caregivers will play an increasingly important role in caring for frail older adults. Thus, special attention needs to be paid to behaviors (including dental care utilization) that promote caregiver well-being. Given increasing evidence linking oral health and systemic diseases, improving access to dental care for caregivers would not only improve caregivers' oral health, but would also have positive impact on the quality of care that they provide for frail older adults.

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Table 1

Characteristics of caregivers for full sample and by dental utilization subgroup.

Variables	Dentist visit within past year (n = 1,196 responses)		Dental cleaning within past year (n = 1,130 responses)		Full sample (n = 1,196)	
	Yes (n = 949; 79.3%)	No (n = 247; 20.7%)	Yes (n = 904; 80.0%)	No (n = 226; 20.0%)		
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)		% (95% CI)
Care characteristics						
Relation to care recipient						
Child	45.4 (40.5-50.3)	37.4 (28.8-46.1)	45.9 (40.9-50.8)	39.5 (30.6-48.4)		43.9 (39.6-48.2)
Spouse	14.7 (11.8-17.7)	21.1 (14.9-27.4)	13.7 (10.8-16.6)	20.2 (13.7-26.7)		15.9 (13.2-18.6)
Other	39.9 (35.1-44.7)	41.4 (32.7-50.1)	40.4 (35.5-45.4)	40.3 (31.3-49.4)		40.2 (35.9-44.4)
Hours of care per week (mean)	18.2 (15.1-21.2) *	26.2 (19.2-32.2)	17.4 (14.4-20.4) *	25.7 (18.8-32.7)		19.6 (16.8-22.4)
Duration of care (years of care; mean)	5.7 (5.1-6.3)	6.5 (5.4-7.7)	5.6 (5.0-6.2)	6.5 (5.3-7.6)		5.9 (5.3-6.4)
Caregiver characteristics						
Age in years (mean)						
Female	52.6 (50.7-54.4)	53.3 (50.2-56.4)	52.3 (50.5-54.2)	52.1 (48.9-55.4)		52.7 (51.1-54.3)
White	58.9 (53.7-63.8)	56.3 (49.5-67.1)	61.2 (56.4-66.0)	56.6 (48.0-65.2)		58.7 (54.3-63.1)
Married	95.7 (93.2-98.2)	94.0 (88.9-98.5)	95.4 (92.6-98.1)	95.2 (91.6-98.8)		95.4 (93.1-97.6)
College education	69.6(64.7-74.4) *	59.8 (51.3-68.3)	70.6 (65.6-75.6) **	56.7 (47.7-65.7)		66.2 (62.0-70.3)
Currently employed	78.4 (74.2-82.7) ***	50.8 (42.1-59.6)	79.4 (75.0-83.8) ***	53.7 (44.6-62.8)		72.3 (69.4-77.2)
Has health insurance	63.4 (59.0-67.8) **	48.8 (40.5-57.5)	64.7 (60.3-69.1) **	50.7 (41.7-59.8)		60.7 (56.7-64.6)
Number of lost permanent teeth	94.3 (92.0-96.6) ***	72.0 (63.8-80.1)	94.4 (92.2-96.6) ***	69.7 (66.5-80.9)		90.1 (87.6-92.7)
Number of lost permanent teeth						
None	58.5 (53.9-63.1) ***	35.1 (26.1-44.2)	60.8 (56.1-65.4) ***	35.5 (26.3-44.8)		54.2 (50.0-58.4)
1 to 5	32.3 (28.1-36.5)	35.2 (26.8-43.6)	32.3 (27.9-36.6)	43.3 (34.2-52.3)		32.8 (29.0-36.6)
6 or more	7.2 (5.3-9.2)	18.3 (12.2-24.5)	7.0 (5.0-9.0)	21.2 (14.4-28.0)		9.3 (7.3-11.3)
All	2.0 (0.7-3.3)	11.3 (6.8-15.9)	NA	NA		3.7 (2.4-5.0)
Smoking						
Current smoker	14.3 (10.0-18.6) ***	29.9 (21.7-38.1)	13.3 (9.0-17.7) ***	34.3 (25.2-43.3)		17.3 (13.4-21.1)
Former smoker	28.9 (24.9-32.9)	29.6 (22.2-37.0)	29.0 (24.9-33.1)	25.5 (18.1-32.8)		29.1 (25.5-32.6)
Never smoked	56.7 (51.9-61.6)	40.4 (31.8-49.2)	57.7 (52.7-62.6)	40.3 (31.5-49.1)		53.7 (49.4-58.0)

Variables	Dentist visit within past year (n = 1,196 responses)		Dental cleaning within past year (n = 1,130 responses)		Full sample (n = 1,196)	
	Yes (n = 949; 79.3%)	No (n = 247; 20.7%)	Yes (n = 904; 80.0%)	No (n = 226; 20.0%)	% (95% CI)	% (95% CI)
Chronic conditions						
Diabetes	9.2 (6.4-11.9)	13.8 (8.5-19.1)	9.0 (6.2-11.8)	12.4 (7.0-17.8)	10.0 (7.6-12.5)	
CVD	6.6 (4.4-8.8)	8.7 (4.8-12.6)	5.8 (3.7-8.0)	7.9 (4.2-11.7)	7.0 (5.1-9.0)	
Community characteristics (means)						
Whites as % of county population	86.6 (85.81-87.3)	87.3 (85.8-88.7)	86.5 (85.7-87.3)	87.3 (85.8-88.8)	86.7 (86.0-87.4)	
% of adults with < high school education	5.2 (5.0-5.3)	5.2 (5.0-5.4)	5.2 (5.0-5.3)	5.1 (4.9-5.4)	5.2 (5.1-5.3)	
Per capita income (× \$1,000)	50.5 (48.8-52.2)	47.9 (45.4-50.4)	50.4 (48.7-52.2)	48.4 (45.8-51.0)	50.2(48.5-51.5)	
# dentists/hygienists/10,000 population	13.0 (12.7-13.2)	12.4 (11.9-13.0)	13.0 (12.7-13.3)	12.4 (11.8-13.0)	12.9 (12.6-13.1)	

* p<0.05
 ** p<0.01
 *** p<0.001

Table 2

Factors associated with having a dentist visit.

Variables	Model I AOR (95% CI)	Model II AOR (95% CI)	Model III AOR (95% CI)
Care characteristics			
Relation to care recipient (vs. child)			
Spouse	0.91 (0.51-1.63)	0.57 (0.27-1.24)	0.51 (0.27-0.99) *
Others	1.24 (0.76-2.04)	1.29 (0.69-2.39)	0.91 (0.37-2.25)
Hours of care per week (log)	0.80 (0.67-0.96) *	1.00 (0.80-1.25)	1.03 (0.81-1.32)
Duration of care in years (log)	0.90 (0.74-1.10)	0.85 (0.67-1.07)	0.82 (0.62-1.09)
Caregiver characteristics			
Age		1.01 (0.99-1.04)	1.02 (1.00-1.04)
Female		1.01 (0.58-1.75)	0.92 (0.50-1.72)
White		0.86 (0.30-2.47)	1.23 (0.41-3.66)
Married		1.68 (0.98-2.89)	1.84 (0.89-3.84)
College education		2.56 (1.51-4.32) ***	2.32 (1.38-3.93) **
Currently employed		1.35 (0.73-2.50)	1.11 (0.71-1.74)
Health insurance		8.27 (3.97-17.24) ***	6.54 (2.59-16.51) ***
Number of lost permanent teeth (vs. none)			
1 to 5		0.60 (0.34-1.05)	0.75 (0.49-1.15)
6 or more		0.38 (0.19-0.76) **	0.36 (0.16-0.81) *
All		0.14 (0.05-0.36) ***	0.12 (0.04-0.34) ***
Smoking (vs. current smoker)			
Former smoker		1.46 (0.68-3.13)	1.13 (0.58-2.21)
Never smoke		1.96 (0.94-4.08)	1.36 (0.67-2.75)
Chronic conditions			
Diabetes		1.00 (0.49-2.04)	0.67 (0.34-1.35)
CVD		0.90 (0.44-1.86)	1.01 (0.72-1.42)
Community characteristics			
Whites as % of county population			1.01 (0.98-1.04)
% of adults with < high school education			1.07 (0.94-1.23)
Per capita income (log)			2.30 (0.60-8.84)
# Dentists/hygienists per 10,000 population			1.01 (0.95-1.08)

AOR: adjusted odds ratio; CI: confidence interval; CVD: cardiovascular diseases

* p<0.05

** p<0.01

*** p<0.001

Table 3

Factors associated with having a dental cleaning.

Variables	Model I AOR (95% CI)	Model II AOR (95% CI)	Model III AOR (95% CI)
Care characteristics			
Relation to care recipient (vs. child)			
Spouse	0.86 (0.46-1.58)	0.45 (0.20-1.03)	0.45 (0.17-1.23)
Others	1.10 (0.67-1.83)	1.16 (0.61-2.21)	1.08 (0.52-2.22)
Hours of care per week(log)	0.82 (0.68-0.99)*	1.01 (0.81-1.26)	1.02 (0.82-1.26)
Years of care (log)	0.89 (0.72-1.10)	0.81 (0.63-1.04)	0.83 (0.64-1.08)
Caregiver characteristics			
Age		1.01 (0.99-1.04)	1.02 (0.99-1.05)
Female		1.11 (0.64-1.94)	1.07 (0.60-1.91)
White		0.46 (0.13-1.56)	0.56 (0.18-1.72)
Married		1.84 (1.04-3.25)*	2.37 (1.00-5.61)*
College education		2.43 (1.40-4.20)**	2.53 (1.59-4.01)**
Currently employed		1.35 (0.70-2.63)	1.13 (0.62-2.07)
Health insurance		12.37 (6.16-24.85)**	10.23 (4.67-22.43)**
# of lost permanent teeth (vs. none)			
1 to 5		0.44 (0.25-0.78)**	0.51 (0.28-0.92)*
6 or more		0.27 (0.13-0.55)**	0.29 (0.14-0.58)**
All		NA	NA
Smoking (vs. current smoker)			
Former smoker		2.13 (0.97-4.68)	1.57 (0.77-3.21)
Never smoked		2.18 (1.05-4.53)*	1.47 (0.66-3.27)
Chronic conditions			
Diabetes		0.89 (0.38-2.04)	0.68 (0.32-1.46)
CVD		0.85 (0.38-1.91)	0.75 (0.44-1.28)
Community characteristics			
Whites as % of county population			0.99 (0.96-1.03)
% of adults with < high school education			1.03 (0.90-1.17)
Per capita income (log)			1.56 (0.37-6.51)
# Dentists/hygienists/10,000 population			1.02 (0.95-1.10)

AOR: adjusted odds ratio; CI: confidence interval; CVD: cardiovascular diseases

*
p<0.05**
p<0.01**
p<0.001