



The Effect of Functional Limitations on the Demand for Dental Care Among Adults 65 and Older

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ABSTRACT In California, adults living in the community who have two or more of six functional limitations in activities of daily living outnumber adults who live in skilled nursing, intermediate care, and congregate living facilities by almost 2:1. In 2003, approximately 106,000 elderly women living in the community experienced two or more limitations in activities of daily living and were thus 40 percent less likely to access dental care relative to elderly women with fewer limitations.

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As individuals age their need for dental care often increases. The need for dental care, defined as the amount of dental care required to restore an individual to the best possible oral health, is distinct from the demand for dental care, defined as the amount of dental care for which an individual is willing and able to pay. Unfortunately, the two often diverge. The amount of dental care that individuals are willing and able to pay for is often less than the amount required to restore these same individuals to the best possible oral health. Beyond this difference is the distinction between the amount of dental care for which individuals are willing and able to pay and the amount of dental care that they are physically able to access. As individuals move into older adulthood,

they are more likely to experience a growing number of functional limitations that prevent them from accessing dental services, even those dental services for which they are willing and able to pay.

A functional limitation can be defined as needing special equipment or the help of another person to perform activities of daily living, ADLs, which include walking, getting in and out of beds and chairs, bathing, dressing, eating, and using the toilet.¹ In California, limitations in two of six ADLs is one of three ways that qualifies an individual to receive benefits under both tax-qualified and nontax-qualified long-term care plans.² A similar set of limitations may also qualify Medi-Cal recipients to enter intermediate care facilities.³

In California, approximately 92,000 individuals were living in skilled nursing, intermediate care, and congregate living

facilities at the end of 2003.⁴ However, the population of individuals aged 65 or older who live in the community (not in skilled nursing, intermediate care, or congregate living facilities) and who have two or more such limitations included more than 163,000 individuals in 2003, according to the authors' analysis of data from the California Health Interview Survey. What is the impact of these functional limitations on the ability of these individuals to access dental care?

The answer to this question is critical. Relative to younger individuals, the elderly are at increased risk for oral diseases associated with age-related physiologic changes.^{5,6} Poor oral health that causes problems with chewing and eating can be particularly serious as such problems can make good nutritional status much more difficult to achieve. Individuals who are missing teeth or who are edentulous may limit the types of food they eat to soft foods, potentially limiting the nutritional content of their food. This can contribute to both poor nutritional status and to unintended weight loss.⁵ For example, Atchison and Dolan found that among Medicare enrollees in California, 10 percent needed to limit the types of food they ate and 13 percent had trouble biting or chewing.⁷

In addition, many health conditions are associated with infectious diseases. Oral diseases are infectious, and oral health status can affect and be affected by other health problems. Much recent research focuses on how periodontal diseases interact and are associated with other common conditions through various inflammatory processes. Periodontal disease has been shown to be associated with many diseases that affect the elderly including heart disease, stroke, osteoporosis, pneumonia, and diabetes.⁸⁻¹⁸

Moreover, a number of studies also suggest that conditions such as heart disease and stroke, diabetes, and respira-

tory disease can actually be improved by regular periodontal care. This suggests a role for dental care in the medical management of these conditions.

Periodontal treatment interventions have been shown to help diabetic individuals with glycemic control management.¹⁹⁻²² Periodontal treatment interventions have also been shown to be associated with a reduction in risk factors for cardiovascular disease.²³⁻²⁷ There is also good evidence that professional oral health care and improved

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oral hygiene results in a slowing of the progression or even occurrence of respiratory disease in the elderly.²⁸

However, none of the benefits of dental care can be realized unless those who need them are able to access appropriate dental care. While there has been limited research showing the negative effect of functional limitations on access to dental care among the elderly in California, focusing on the city of Santa Monica, there has been no systematic analysis to date on the effect of functional limitations on the demand for dental care among the elderly in California using statewide data.²⁹ In this paper, the authors present their findings on the effect of functional limitations on the demand for dental care using the latest available data from the 2003 California Health Interview Survey.

Methods

Data

This analysis uses data from the California Health Interview Survey (CHIS) for the year 2003.³⁰ The CHIS is a state-level health survey that focuses on public health and access to health care. It is the largest state-level survey conducted in the United States and is designed to produce statistically reliable state-level and county-level estimates. Data were collected from adults aged 18 and older through a random digit dial telephone survey. The 2003 CHIS sample size was 42,044. After the authors restricted their analysis to those 65 years or older, the final sample size became 8,668 (3,294 males and 5,374 females).

Statistical Analysis

The CHIS was collected using a complex survey design. Thus, making accurate inferences about the population the sample was drawn from requires the use of probability weights and replication weights. The authors used Stata 9.2 and the jackknife replication method to incorporate probability weights and replication weights into the calculation of descriptive statistics and the estimation of logistic regression models. The inclusion of variables in the logistic models was based on the economic theory of demand. As a result, they do not contain information on supply factors. Simultaneous equation models of demand and supply could be constructed but are beyond the scope of this analysis. Such models are topics for future research.

The authors' models estimated the association of having a visit to a dental professional at least once during the previous 12 months with age, race/ethnicity, education, family income, marital status, birthplace, general health status,

dental insurance status, family size, and whether a person was experiencing limitations in two or more ADLs. Since the authors' main variable of interest, ADLs, is self-reported, it is important that it be reliable. Studies examining self-reported data on ADLs gathered via telephone have found them to be reliable.^{31,32}

Results

TABLE 1 shows the composition of the authors' sample, appropriately adjusted for the complex survey design of the CHIS. To put the following numbers (reported as proportions) in context, the California Department of Finance estimated that there were 3.8 million people aged 65 and older in 2003. There are slightly more women (0.56) than men (0.44) in this sample consistent with the lower life expectancy of men relative to women. The age distribution of the sample shows that a smaller proportion of the sample is in a given category as the categories move up the age continuum: ages 65-69 (0.28); ages 70-74 (0.24); ages 75-79 (0.21); ages 80-84 (0.17); ages 85 and older (0.10).

The racial/ethnic mix is distributed as follows: white (0.67); black (0.05); Asian/Pacific Islander (0.11); Hispanic (0.15); and other race (0.02). Education is distributed in the following way: less than high school (0.24); high school (0.24); some post-high school training (0.24); college graduate (0.15); and graduate school (0.13). Family income, measured as a percentage of the federal poverty threshold, showed that more than half the population is in a family whose income is less than 300 percent of the federal poverty threshold. The distribution is as follows: 0-99 percent federal poverty threshold (0.12); 100-199 percent federal poverty threshold (0.23); 200-299 percent federal poverty threshold (0.18); 300 percent of federal poverty threshold and above (0.46). More than half of the sample (0.56)

TABLE 1

Descriptive Statistics

Variables	Proportions
GENDER	
Male	0.44
Female	0.56
AGE	
65 - 69	0.28
70 - 74	0.24
75 - 79	0.21
80 - 84	0.17
85 and older	0.10
RACE	
White	0.67
Black	0.05
Asian/Pacific Islander	0.11
Hispanic	0.15
Other	0.02
EDUCATION	
Less than high school	0.24
High School	0.24
Some post-high school	0.24
College graduate	0.15
Graduate school	0.13
FAMILY INCOME (% OF THE FEDERAL POVERTY THRESHOLD [FPT])	
0-99% of FPT	0.12
100% to 199% of FPT	0.23
200% to 299% of FPT	0.18
300% or higher of FPT	

MARITAL STATUS

Married	0.56
Unmarried	0.44

BIRTHPLACE

U.S.-born	0.77
Foreign-born	0.23

GENERAL HEALTH STATUS

Poor	0.11
Fair	0.23
Good	0.29
Very good	0.24
Excellent	0.12

DENTAL INSURANCE

Private	0.33
Denti-Cal	0.21
No insurance	0.45

FAMILY SIZE

1	0.32
2	0.53
3 or 4	0.15
5 or more	0.05

ACTIVITIES OF DAILY LIVING (ADLS)

Less than two limitations in ADLs	0.96
Two or more limitations in ADLs	0.04
Observations	8,668

All proportions are calculated using probability weights to account for the complex survey design of the 2003 California Health Interview Survey.

is married. More than three-quarters of the sample (0.77) was born in the United States.

The general health status of the sample is distributed normally. The sample consists of individuals in poor health (0.11); fair health (0.23); good health (0.29); very good health (0.24); and excellent health (0.12).

Almost half of the sample (0.45) had no dental insurance. Of those with dental insurance, almost one-third had private dental insurance (0.33), while the remainder was covered by Denti-Cal (0.21).

Family size is important when considering the demand for dental care among the elderly as those with larger families may have more individuals available to help them visit a dental professional, should they wish to do so. Almost one-third of individuals lived alone (0.32), while the remaining live with one other person (0.53), two or three other people (0.15), or four or more other people (0.05).

Finally, with regard to the authors' key variable of interest, the number of limitations a person has in ADLs, 4

percent of the population aged 65 and older suffers from two or more limitations. The remaining 96 percent suffer from one or no such limitations. It is important to remember that 4 percent of this population includes approximately 163,000 individuals (in 2003).

TABLES 2A, 2B AND 3 present the authors' findings for men and women, respectively. The table includes both the odds-ratio and the marginal probability that a person with a given characteristic accessed dental care in the last year relative to the average person in the sample. The authors will refer to the odds-ratio in the text. The marginal probabilities are presented in order to provide a measure of the magnitude associated with each odds-ratio.

One major finding is that women with two or more limitations in ADLs are 40 percent less likely to access dental care relative women with one or fewer such limitations (odds-ratio [OR]=0.601; confidence interval [CI], 0.393-0.918). There is no such finding for men. The reason for this is likely found in the results on general health status and dental visits. Compared to those in poor health, only men who are in excellent health (OR=2.220; CI, 1.263-3.905) or very good health (OR=1.666; CI, 1.112-2.496) are more likely to access dental care than the average man in the population.

This is in strong contrast to the behavior of women. Compared to those in poor health, women with any level of health above poor health are more likely to access dental care whether they have fair health (OR=1.660; CI, 1.216-2.266); good health (OR=1.709; CI, 1.233-2.369); very good health (OR=2.271; CI, 1.608-3.206); or excellent health (OR=2.443; CI=1.664, 3.585).

Aside from health concerns, elderly men and women behave similarly with respect to private dental insurance, but very differently with respect

to Denti-Cal. Elderly men and women who have private dental insurance are about 50 percent more likely to have visited a dental professional in the last year than those without dental insurance (men: OR=1.572; CI, 1.284-1.924; women: OR=1.484; CI, 1.225-1.798).

In contrast, elderly women with Medi-Cal who know they have Denti-Cal are no more likely to have visited a dental professional than women who are uninsured, while men with Medi-Cal who know they have Denti-Cal are about as

ELDERLY MEN AND WOMEN who have private dental insurance are about 50 percent more likely to have visited a dental professional in the last year than those without dental insurance.

likely to have visited a dental professional as men with private insurance (OR=1.712; CI, 1.208-2.426). However, elderly women who have Medi-Cal and do not know they have Denti-Cal are a third less likely to have visited a dental professional in the last year relative to women who have no dental insurance (OR=0.666; CI, 0.494, 0.898). Elderly men who have Medi-Cal and do not know they have Denti-Cal are no more likely to have visited a dental professional in the last year than those who have no dental insurance.

TABLE 3 presents the probabilities of visiting a dental professional for four subgroups of individuals. These are not the only subgroups that could have been chosen, but portray various groups of individuals in California. We purposively do not simply vary only one character-

istic in presenting these subgroups. The change in the probability of accessing care due to a change in any one characteristic can be seen by examining the marginal probabilities in **TABLES 2A, 2B AND 3**.

The characteristics of each subgroup and each subgroup's probability of accessing dental care are as follows: (1) private dental insurance, male, aged 65-69, white, college graduate, family income 300 percent or greater than the federal poverty threshold, very good health, married, U.S.-born, family size of three or four, one or fewer limitations on ADL (probability=0.90; CI 0.83-0.97); (2) Denti-Cal insurance (and knows it) female, aged 65-69, black, high school education, family income less than the federal poverty threshold, poor health, unmarried, U.S.-born, lives alone, two or more limitations on ADL (probability=0.47; CI, 31-65); (3) Denti-Cal insurance (and knows it), male, aged 80-84, Hispanic, less than high school education, family income 100-199 percent of federal poverty threshold, good health, married, foreign-born, family size of two, one or fewer limitations on ADL (probability=0.57; CI, 0.47-0.67); (4) private dental insurance, female, aged 65-69, Asian/Pacific Islander, some college education, family income 300-199 percent of the federal poverty threshold, fair health, married, foreign-born, family size of two, one or fewer limitations on ADL (probability=0.90; CI, 0.81-0.98).

It can be seen that across these subgroups that the difference in the overall probability of having visited a dental professional in the last year varies from 0.47 to 0.90, a 0.43 difference.

Discussion

The analysis shows that women and men behave quite differently with respect to their demand for dental care. Elderly women appear to be far

CONTINUES ON PAGE 556

TABLE 2A

Demand for Dental Care: Men Aged 65 and Older

Variables	Odds Ratio	95% Confidence Interval	Marginal Probability	95% Confidence Interval
DENTAL INSURANCE				
No insurance	reference		reference	
Private	1.572	[1.284, 1.924]	0.092***	[0.052, 0.133]
Medi-Cal, know about Denti-Cal	1.712	[1.208, 2.426]	0.098**	[0.039, 0.157]
Medi-Cal, don't know about Denti-Cal	0.782	[0.538, 1.135]	-0.052	[-0.133, 0.028]
AGE				
65 - 69	reference		reference	
70 - 74	1.047	[0.808, 1.357]	0.009	[-0.042, 0.061]
75 - 79	0.923	[0.681, 1.251]	-0.017	[-0.079, 0.045]
80 - 84	1.137	[0.838, 1.543]	0.025	[-0.033, 0.084]
85 and older	1.088	[0.747, 1.586]	0.017	[-0.056, 0.090]
Race				
White	reference		reference	
Black	0.866	[0.540, 1.390]	-0.030	[-0.130, 0.070]
Asian/Pacific Islander	2.173	[1.391, 3.395]	0.137***	[0.067, 0.206]
Hispanic	2.009	[1.362, 2.964]	0.133***	[0.064, 0.202]
Other	0.723	[0.442, 1.183]	-0.070	[-0.182, 0.041]
EDUCATION				
Less than high school	reference		reference	
High school	1.888	[1.390, 2.565]	0.120***	[0.063, 0.176]
Some post-high school	2.142	[1.505, 3.048]	0.142***	[0.082, 0.201]
College graduate	4.132	[3.036, 5.625]	0.230***	[0.181, 0.279]
Graduate school	4.025	[2.816, 5.754]	0.215***	[0.164, 0.266]
FAMILY INCOME (% OF THE FEDERAL POVERTY THRESHOLD [FPT])				
0-99% of FPT	reference		reference	
100% to 199% of FPT	1.254	[0.801, 1.962]	0.045	[-0.041, 0.130]
200% to 299% of FPT	1.832	[1.137, 2.951]	0.111**	[0.032, 0.190]
300% or higher of FPT	2.735	[1.777, 4.210]	0.204***	[0.113, 0.295]
GENERAL HEALTH STATUS				
Poor	reference		reference	
Excellent	2.220	[1.263, 3.905]	0.145**	[0.057, 0.233]
Very good	1.666	[1.112, 2.496]	0.099**	[0.028, 0.170]
Good	1.455	[0.965, 2.196]	0.074	[-0.002, 0.150]
Fair	1.220	[0.796, 1.870]	0.039	[-0.041, 0.119]
MARITAL STATUS				
Married	reference		reference	
Unmarried	0.976	[0.670, 1.421]	-0.005	[-0.080, 0.070]

TABLE 2A CONTINUES ON 554

TABLE 2A CONTINUED FROM 553

BIRTHPLACE				
U.S.-born	reference		reference	
Foreign-born	0.538	[0.398, 0.728]	-0.126***	[-0.189, -0.063]
FAMILY SIZE				
1	reference		reference	
2	1.597	[1.126, 2.265]	0.091**	[0.029, 0.153]
3 or 4	1.103	[0.705, 1.726]	0.020	[-0.067, 0.107]
5 or more	1.204	[0.673, 2.154]	0.037	[-0.072, 0.146]
ACTIVITIES OF DAILY LIVING (ADLs)				
Less than two limitations in ADLs	reference		reference	
Two or more limitations in ADLs	1.306	[0.676, 2.522]	0.054	[-0.078, 0.187]

TABLE 2B

Demand for Dental Care: Women Aged 65 and Older

Variables	Odds Ratio	95% Confidence Interval	Marginal Probability	95% Confidence Interval
DENTAL INSURANCE				
No insurance	reference		reference	
Private	1.484	[1.225, 1.798]	0.070***	[0.038, 0.103]
Medi-Cal, know about Denti-Cal	1.276	[0.971, 1.676]	0.041	[-0.001, 0.082]
Medi-Cal, don't know about Denti-Cal	0.666	[0.494, 0.898]	-0.079*	[-0.142, -0.016]
AGE				
65 - 69	reference		reference	
70 - 74	0.827	[0.667, 1.025]	-0.035	[-0.074, 0.003]
75 - 79	0.999	[0.768, 1.300]	0.000	[-0.046, 0.046]
80 - 84	1.101	[0.873, 1.389]	0.017	[-0.022, 0.056]
85 and older	1.062	[0.799, 1.411]	0.010	[-0.038, 0.059]
RACE				
White	reference		reference	
Black	0.541	[0.396, 0.740]	-0.124***	[-0.191, -0.056]
Asian/Pacific Islander	1.649	[1.133, 2.399]	0.079**	[0.026, 0.133]
Hispanic	1.161	[0.858, 1.571]	0.026	[-0.025, 0.077]
Other	0.766	[0.524, 1.119]	-0.050	[-0.125, 0.024]
EDUCATION				
Less than high school	reference		reference	
High School	1.230	[0.968, 1.561]	0.036	[-0.003, 0.074]
Some post-high school	1.694	[1.342, 2.139]	0.087***	[0.052, 0.122]
College graduate	1.951	[1.436, 2.650]	0.105***	[0.065, 0.145]
Graduate school	3.239	[2.331, 4.502]	0.160***	[0.124, 0.195]

TABLE 2B CONTINUES ON 555

TABLE 2B CONTINUED FROM 554

FAMILY INCOME (% OF THE FEDERAL POVERTY THRESHOLD [FPT])				
0-99% of FPT	reference		reference	
100% to 199% of FPT	0.842	[0.644, 1.102]	-0.031	[-0.081, 0.018]
200% to 299% of FPT	1.192	[0.919, 1.545]	0.030	[-0.012, 0.072]
300% or higher of FPT	1.790	[1.373, 2.332]	0.103***	[0.058, 0.148]
GENERAL HEALTH STATUS				
Poor	reference		reference	
Excellent	2.443	[1.664, 3.585]	0.136***	[0.087, 0.184]
Very good	2.271	[1.608, 3.206]	0.133***	[0.080, 0.185]
Good	1.709	[1.233, 2.369]	0.089**	[0.038, 0.140]
Fair	1.660	[1.216, 2.266]	0.081***	[0.037, 0.126]
MARITAL STATUS				
Married	reference		reference	
Unmarried	1.475	[1.146, 1.899]	0.070**	[0.026, 0.113]
BIRTHPLACE				
U.S.-born	reference		reference	
Foreign-born	1.149	[0.892, 1.478]	0.025	[-0.019, 0.068]
FAMILY SIZE				
1	reference		reference	
2	0.836	[0.658, 1.063]	-0.032	[-0.075, 0.010]
3 or 4	0.750	[0.568, 0.990]	-0.052	[-0.103, 0.000]
5 or more	0.421	[0.258, 0.687]	-0.172**	[-0.286, -0.059]
ACTIVITIES OF DAILY LIVING (ADLS)				
Less than two limitations in ADLs	reference		reference	
Two or more limitations in ADLs	0.601	[0.393, 0.918]	-0.090*	[-0.165, -0.015]

TABLE 3

Probability of Accessing Dental Care: Selected Subgroups

Subgroups	Probability	95% CI (lower)	95% CI (upper)
Subgroup (1): Male, aged 65-69, white, college graduate, three- to four-family size, private insurance, family income 300% or greater than the federal poverty line, very good health, married, U.S.-born, two or more limitations in activities of daily living	0.90	0.83	0.97
Subgroup (2): Female, aged 65-69, black, high school education, lives alone, Denti-Cal (and knows it) family income below of the federal poverty line, poor health, unmarried, U.S.-born, two or more limitations in activities of daily living	0.47	0.31	0.65
Subgroup (3): Male, aged 80-84, Hispanic, less than high school education, two-person family size, Denti-Cal (and knows it), family income 100-199% of federal poverty line, good health, married, foreign-born, one or fewer limitations in activities of daily living	0.57	0.47	0.67
Subgroup (4): Female, aged 65-69, Asian/Pacific Islander, some college education, two-person family size, private insurance, family income 300% or greater than the federal poverty line, good health, married, foreign-born, one or fewer limitations in activities of daily living	0.90	0.81	0.98

Petris Center analysis of data from the 2003 California Health Interview Survey.

CONTINUED FROM PAGE 552

more vigilant about visiting a dental professional than elderly men, and will seek care even when they do not have dental insurance, whereas elderly men are less likely to visit a dental professional if they do not have some type of dental insurance. This is consistent with studies of gender differences with respect to health insurance.³³

It is noted that it is possible that the odds-ratios that describe the relationship between accessing dental care and various types of dental insurance are biased due to potential reverse causation (individuals who are more likely to need to visit a dental professional may be more likely to obtain dental insurance). Although this problem can often be corrected statistically (e.g., using the instrumental variable technique), the authors have been unable to do so due to data limitations.

However, other researchers who have implemented this correction uniformly find that the corrected parameter estimates are higher than the uncorrected parameters estimates.³⁴⁻³⁶ The authors therefore consider their estimates to approximate a lower bound of the association of dental insurance and visits to a dental professional.

In contrast, functional limitations limit access to dental care for women much more than men. Women with two or more functional limitations are 40 percent less likely to have visited a dental professional in the last 12 months relative to those who have one or no functional limitations. In other words, women who need special equipment or the assistance of another person in two or more of the following areas are less likely to visit a dental professional than the average women in the sample: walking, getting in and out of beds and chairs, bathing, dressing, eating, and using the toilet. Approximate-

ly 106,000 women aged 65 or older were in this category in California according to the authors' analysis of the 2003 CHIS.

This finding is independent of family income, dental insurance, education, age, race, marital status, family size, nation of birth, and general health status. This finding suggests that a key barrier that prevents these individuals from obtaining dental care is physical access or the availability of dental offices that will accept such patients. This problem could be alleviated in a number of ways.

**IT IS ALREADY THE CASE
that virtually all dentists
treat such individuals with
dignity, but communicating
this to potential patients is
critical to reassure those with
functional limitations.**

One way is to bring dental services to those who need it via a mobile dental clinic. Such clinics are permissible in California and are regulated by the Business and Professions Code and the Health and Safety Code.³⁷ Mobile dental clinics have been used in California for more than 20 years. The University of Southern California's Mobile Dental Clinic has a long history of successful use with children from low-income families and rural populations.³⁸⁻⁴⁰

Mobile clinics can also be used for reaching out to elderly with limitations in ADLs. Units can be set up like a dental office so that a patient can sit down and be treated inside, or it can be used to transport portable equipment that can then be set up at a patient's bedside.⁴¹ Another strategy that has been successful with improving access in rural popula-

tions that could be applied to the population of elderly with limitations in ADLs would be to coordinate their transportation to and from a local dental office.

A third approach is for a subgroup of dental professionals to make their practices senior friendly by reaching out to the elderly who may suffer from limitations in ADLs. This can be done both by making their practices more accessible to such individuals as well as by reaching out via advertising to individuals who primarily will not come to visit a dental professional due to embarrassment about their condition. Many individuals who suffer from functional limitations may be more than willing to visit a dental professional if they know that the facility is able to accommodate their functional limitation and that they will be seen and treated with dignity. To be sure, it is already the case that virtually all dentists treat such individuals with dignity, but communicating this to potential patients is critical to reassure those with functional limitations.

Given the current computer technology available and trends of more seniors accessing the Internet for information, dental practices can use this technology to better track the health and ADL status of patients as they age and alert elderly patients of their ability to provide ADL accommodations (like portable lifts or other types of needed equipment) through Web sites or newsletter announcements.⁴¹

Federal- and state-level policy solutions to improving access to dental care for this subgroup should be considered as well. A growing number of the elderly may begin to experience one or more limitations in ADLs with advancing age. California's population is aging, with every county reporting increases in numbers of elderly between 1990 and 2004, especially among those age 85 and older.⁴²

The elderly have Medicare to cover most of their health care needs, yet Medi-

care does not cover routine dental care or dental treatments, unless a dental procedure is a critical component for treating a different condition.^{43,44} An individual can purchase a separate Medigap plan. In 2002, 17 percent of Medicare enrollees in California also had Medigap.⁴² However, Medigap plans vary, most standard plans do not include dental benefits, and they are often prohibitively expensive for many elderly. This population would likely enjoy improved access to dental care if Medicare included dental coverage.

State-level policy strategies should include building California's dental infrastructure and developing a plan to address the elderly population's dental needs, with extra attention paid to those elderly with limitations in ADLs. Oral Health America gave California a "D+" overall infrastructure grade on its report card in 2003, with "Fs" specifically for lacking a state dental director and an oral health plan.⁴⁵ A permanent state dental director would help provide leadership and establish and monitor progress on California-specific oral health goals and priorities.

Additional opportunities such as residencies/graduate programs and continuing dental education sessions that provide geriatric training could be offered as part of a statewide effort to prepare the dental workforce for caring for the needs of elderly, particularly the frail elderly and those with limitations in ADLs.⁴⁴ There are training and cost implications for each of these potential solutions that are not addressed here that will need to be assessed when deciding to implement any of these strategies to improve access for this population.

Conclusion

Among elderly females, having two or more functional limitations is associated with being approximately 40 percent

less likely to visit a dental professional relative to the average elderly female. Approximately 106,000 individuals in California are in this category as of 2003, larger than the entire population of individuals in skilled nursing, intermediate care, and congregate living facilities. Policymakers, both public and private, should consider how to aid such individuals in obtaining dental care.

Individual practitioners should also consider implementing simple practice changes to help increase access to care for elderly patients with functional limitations, such as purchasing equipment that will make their offices more accessible and comfortable places to visit, and perhaps providing some services through mobile dental clinics. ■■■■

REFERENCES

1. Katz S, Ford AB, et al, Studies of illness in the aged. the index of ADL: a standardized measure of biological and psychosocial function. *JAMA* 185:914-9, 1963.
2. California Department of Insurance, Consumers: long-term care insurance, 2005. insurance.ca.gov/0100-consumers/0060-information-guides/0050-health/ltc-rate-history-guide/long-term-care-insurance.cfm. Accessed June 4, 2009.
3. California Department of Health Care Services, Medi-Cal: manual of criteria: intermediate care facility services, 2007. dhcs.ca.gov/services/medi-cal/Documents/ManCriteria_27_InterCare.htm. Accessed June 4, 2009.
4. Office of Statewide Health Planning and Development, Long-term care facility annual utilization data, 2003. oshpd.ca.gov/HID/Products/Hospitals/Utilization/LTC_Utilization.html. Accessed June 4, 2009.
5. U.S. Department of Health and Human Services. Oral health in America: a report of the surgeon general- executive summary. Rockville, Md., U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000.
6. Miller CS, Epstein JB, et al, Changing oral care needs in the United States: the continuing need for oral medicine. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 91(1):34-44, 2001.
7. Atchison KA, Dolan TA, Development of the geriatric oral health assessment index. *J Dent Educ* 54(11):680-7, 1990.
8. Offenbacher S, Katz V, et al, Periodontal infection as a possible risk factor for preterm low birth weight. *J Periodontol* 67(10):1103-13, 1996.
9. Beck JD, Offenbacher S, Oral health and systemic disease: periodontitis and cardiovascular disease. *J Dent Educ* 62(10):859-70, 1998.
10. Mattila KJ, Valtonen VV, et al, Role of infection as a risk factor for atherosclerosis, myocardial infarction, and stroke.

11. Slavkin HC, Baum BJ, Relationship of dental and oral pathology to systemic illness. *JAMA* 284(10):1215-17, 2000.
12. Iacopino AM, Periodontitis and diabetes interrelationships: role of inflammation. *Ann Periodontol* 6(1):125-37, 2001.
13. Teng YT, Taylor GW, et al, Periodontal health and systemic disorders. *J Can Dent Assoc* 68(3):188-92, 2002.
14. Taylor GW, Manz MC, Borgnakke WS, Diabetes, periodontal diseases, dental caries, and tooth loss: a review of the literature. *Compend Contin Educ Dent Suppl* 25(3):179-90, 2004.
15. Glick MA, Exploring our role as health care providers: the oral-medical connection. *J Am Dent Assoc* 136(6):716-8, 2005.
16. Barnett ML, The oral-systemic disease connection: an update for the practicing dentist. *J Am Dent Assoc* 137(S2):55-65, 2006.
17. Kim J, Amar S, Periodontal disease and systemic conditions: a bidirectional relationship. *Odontology* 94(1):10-21, 2006.
18. Mealey BL, Oates TW, Diabetes mellitus and periodontal diseases. *J Periodontol* 77(8):1289-1303, 2006.
19. Soell M, Hassan M, et al, The oral cavity of elderly patients in diabetes. *Diabetes Metab* 33(S1):S10-8, 2007.
20. Jones JA, Miller DR, et al, Does periodontal care improve glycemic control? The Department of Veterans Affairs Dental Diabetes Study. *J Clin Periodontol* 34(1):46-52, 2007.
21. Yun F, Firkova EI, et al, Effect of nonsurgical periodontal therapy on patients with type 2 diabetes mellitus. *Folia Med (Plovdiv)* 49(1-2):32-6, 2007.
22. Kiran M, Arpak N, et al, The effect of improved periodontal health on metabolic control in type 2 diabetes mellitus. *J Clin Periodontol* 32(3):266-72, 2005.
23. Ellis JS, Averley PA, et al, Change in cardiovascular risk status after dental clearance. *Br Dent J* 202(9):543-4, 2007.
24. Söder B, Yakob M, Risk for the development of atherosclerosis in women with a high level of dental plaque and severe gingival inflammation. *Int J Dent Hyg* 5(3):133-8, 2007.
25. Tonetti MS, D'Áiuto F, et al, Treatment of periodontitis and endothelial function. *N Engl J Med* 356(9):911-20, 2007.
26. D'Áiuto F, Parkar M, et al, Periodontal infections cause changes in traditional and novel cardiovascular risk factors: results from a randomized controlled clinical trial. *Am Heart J* 151(5):977-84, 2006.
27. Elter JR, Hinderliter AL, et al, The effects of periodontal therapy on vascular endothelial function: a pilot trial. *Am Heart J* 151(1):47, 2006.
28. Azarpazhooh A, Leake JL, Systematic review of the association between respiratory diseases and oral health. *J Periodontol* 77(9):1465-82, 2006.
29. Dolan TA, Peek CW, et al, Functional health and dental service use among older adults. *J Gerontol A Biol Sci Med Sci* 53(6):M413-8, 1998.
30. California Health Interview Survey, 2003. chis.ucla.edu/main/default.asp?page=dac. Accessed June 4, 2009.
31. Ciesla JR, Shi L, et al, Reliability of Katz's activities of daily living scale when used in telephone interviews. *Eval Health Prof* 16(2):190-203, 1993.
32. Shinar D, Gross CR, et al, Reliability of the activities of daily living scale and its use in telephone interview. *Arch Phys Med Rehabil* 68(10):723-8, 1987.
33. Owens GM, Gender differences in health care expenditures, resource utilization, and quality of care. *J Manag Care Pharm* 14(3 Suppl):2-6, 2008.

34. Wang H, Norton EC, Rozier RG, Effects of the state children's health insurance program on access to dental care and use of dental services. *Health Services Res* 42(4):1544-63, 2007.
35. Munkin MK, Trivedi PK, Dental insurance and dental care: the role of insurance and income. Health, econometrics, and data group (HEDG), The University of York, Working Paper 07/16, 2007. http://www.york.ac.uk/res/herc/documents/wp/07_16.pdf. Accessed June 4, 2009.
36. Selden TM, Hudson JL, Access to care and utilization among children: estimating the effects of public and private coverage. *Medical Care* 44(5 Suppl):119-26, 2006.
37. Dental Bureau of California, Mobile Dental Clinic Permits, 2008. dbc.ca.gov/licensees/permits_mdc.shtml. Accessed June 4, 2009.
38. Mulligan R, Goldstein CM, Niederkohr RE, Rural dentistry: opportunities for the next millennium in fixed and mobile practices. *J Calif Dent Assoc* 28(2):133-40, 2000.
39. Stewart RE, Dental care for the underserved children of Monterey county: meeting the challenge. *J Calif Dent Assoc* 26(5):394-6, 1998.
40. Goldstein CM, Schoenberg DN, The University of Southern California mobile dental clinic program: Twenty years of continuous operation. *J Int Assoc Dent Child* 19(2):19-24, 1988.
41. Fiske J, The delivery of oral care services to elderly people living in a noninstitutionalized setting. *J Pub Health Dent* 60(4):321-5, 2000.
42. California HealthCare foundation and RAND corporation, Medicare facts and figures: a California Perspective, 2006. chcf.org/documents/insurance/MedicareFactsFigures06.pdf. Accessed June 4, 2009.
43. Oral Health America, an oral health America special grading project, September 2003, a state of decay: the oral health of older Americans, 2003. oralhealthamerica.org/pdf/StateofDecayFinal.pdf. Accessed June 4, 2009.
44. Bonito AJ, Executive summary: dental care considerations for vulnerable populations. *Spec Care Dentist* 22(3 Suppl):5S-10S, 2002.
45. Oral Health America, the oral health America national grading project 2003. keep America smiling: oral health in America, 2003. oralhealthamerica.org/pdf/2003ReportCard.pdf. Accessed June 4, 2009.

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