

*Original Research***The association between dental coverage and self-reported health in older adults**Frances M. Yang, PhD,¹ Solon T. Kao, DDS,² Jordan S. Lundeen¹¹Department of Biostatistics and Epidemiology, Medical College of Georgia, Augusta University, Augusta, GA, ²Dental College of Georgia, Augusta University, Augusta, GACorresponding Author: Solon T. Kao • 1430 John Wesley Gilbert Dr., Augusta, GA 30912-1270 • 706-721-5463 • skao@augusta.edu**ABSTRACT****Background:** For the older population of the United States, lack of dental insurance coverage is a substantial health problem. The purpose of the present study was to examine the longitudinal relationship between dental coverage and self-reported health among older adults.**Methods:** The Health and Retirement Study (HRS), a nationally representative biennial cohort study of community-dwelling individuals, includes 19,595 adults (aged 50 and older) living in the United States. For the 2010, 2012, and 2014 waves, the independent variable of dental coverage and the outcome of self-reported health were examined.**Results:** At each time point, dental coverage for older adults had a positive association with self-reported health (parameter estimate, $\beta=0.340$, standard error (SE)=0.039, $p<0.0001$), controlling for sociodemographic variables of age, sex, race/ethnicity, education, and the status of edentulism. There were no significant longitudinal effects for dental coverage associated with self-reported health.**Conclusions:** At each time point, the results show a positive association between having dental coverage and better self-reported health of older adults. This is relevant, because, in the United States, there is an increasing population of older people.**Key words:** Self-reported health, self-rated health, dental coverage, Health and Retirement Study<https://doi.org/10.21633/jgpha.6.303>**INTRODUCTION**

Dental coverage for the elderly population in the United States is limited, with only 12% of adults aged 65 years and older having such coverage (Willink, Schoen, & Davis, 2016). The elderly have limited options for dental coverage, as the largest health insurance provider for adults 65 and older, Medicare, does not cover dental care unless it coincides with medical needs (US Centers for Medicare and Medicaid Services, 2017). In 28 states, the federal-state partnership that provides health care coverage for low-income Americans, Medicaid, offers dental benefits for preventive services, and 18 states, including Georgia, provide dental services only for emergencies (Medicaid and CHIP Payment and Access Commission, 2015).

A consequence of lacking dental coverage can be the loss of all natural permanent teeth, known as edentulism. Although edentulism has been declining in the United States since the 1950s, it remains a serious problem for the elderly. Data from the 2009-2010 National Health and Nutrition Examination Survey showed that the prevalence of edentulism was 15% for the 65 to 74 year-old population and 22% for the 75 and older population (Emami, de Souza, Kabawat, & Feine, 2013).

Edentulism negatively affects the quality of life, leading to a dissatisfaction in appearance (Santos, Celeste, Hilgert, & Hugo, 2015), reducing social and employment opportunities (Cornejo, Perez, de Lima, Casals-Pedro, & Borrell, 2013; Friedman, Kaufman, & Karpas, 2014; Rodrigues, Oliveira, Vargas, Moreira, & EF, 2012), and increasing the risk of depressive symptoms among older adults (Rouxel, Tsakos, Chandola, & Watt, 2016). The CDC, by analyzing data from 46 states that participated in the oral health module of the 1995-1997 Behavioral Risk Factor Surveillance System (BFRSS), found that edentulism was more prevalent among those without dental insurance (27%) than among those who had insurance (18%) (Centers for Disease & Prevention, 1999).

These results show a negative correlation between edentulism and quality of life in the elderly population; however, most of these studies have the limitation of a cross-sectional study design. Although the analysis accomplished by the CDC indicates a correlation between dental coverage and edentulism, it also has the limitation of a cross-sectional study design.

Due to the lack of dental coverage, older adults suffer from negative oral health consequences that affect their overall health. Studies that have examined dental insurance coverage among adults in the United States have provided

evidence to support the provision of increased dental coverage to improve overall health of older adults (Kreider, Manski, Moeller, & Pepper, 2015; Willink et al., 2016). The aim of the present study was to examine the relationship between dental coverage and self-reported health over time in a national sample of older Americans.

METHODS

Sample

The Health and Retirement Study (HRS) is a nationally representative biennial cohort study of non-institutionalized individuals in the United States. It is funded primarily through the National Institute of Aging and fielded by the University of Michigan. The initial sample of respondents, first surveyed in 1992, was limited to those born between 1931 and 1941. Supplementary samples were added in 1998, 2004, and 2010. In the present effort, data from the 2010, 2012, and 2014 waves, which provided a representative sample of 38,185 individuals aged 50 and older, were examined. Individuals were excluded from the sample if they did not participate in the study for all three years or if there were missing answers for the self-reported health question for all three years. Likewise, individuals were excluded if there were missing answers for the dental coverage question for all three years or for the edentulism question for all three years. After these exclusions, there was a sample size of 19,595.

Measures

For the analysis, responses to three questions from the HRS were examined. The first question was in relation to self-reported health. Participants were asked "Would you say your health is excellent, very good, good, fair or poor?" The variable was initially coded as 1=Excellent, 2=Very Good, 3=Good, 4=Fair, and 5=Poor. We recoded the variable so that 1=Poor, 2=Fair, 3=Good, 4=Very Good, and

5=Excellent, as we felt a higher score should indicate a higher self-reported health. Answers that were listed as Don't Know/Not Ascertained, Refused, or Inapplicable were classified as missing. The second question, in relation to dental coverage, asked "Do you have any insurance that covers dental bills?" Answers were either Yes or No, and answers that were listed as Don't Know/Not Ascertained, Refused, or Inapplicable were classified as missing.

Statistical Analysis

For the 2010, 2012, and 2014 waves, frequencies for dental coverage, self-reported health, and edentulism were calculated by age, gender, ethnicity, and education. Chi-square tests were performed to determine statistical independence between groups and across time points. To use all of the data collected over time, dental coverage and self-reported health were analyzed using a mixed-effects model for repeated measures. A final mixed-effects model added age, gender, ethnicity, and education as covariates along with edentulism as a mediator for dental coverage and self-reported health. All analyses were conducted by use of SAS 9.4 for Windows.

RESULTS

Baseline characteristics for the participants of the 2010, 2012, and 2014 modules of the HRS are shown in Table 1. The study population was 56.87% female and 72.03% white, with more than 50% of the population having a high school diploma or GED. Over the course of the three modules, between 10.42% and 16.33% reported having lost all of their permanent teeth; these values fall below the 2000 national health objective of less than 20% (Centers for Disease & Prevention, 1999). Between 57.64% and 59.15% of the study population reported that they did not have dental coverage, and between 27.98% and 30.50% reported their health to be fair or poor.

Table 1. Characteristics of the National Health and Retirement Study Participants

Characteristic	2010		2012		2014	
	n	%	N	%	n	%
Age, y						
<65	9120	49.43	8053	43.47	6439	39.18
65-69	1633	8.85	1703	9.19	1841	11.20
70-74	2861	15.51	2789	15.06	2254	13.71
>74	4837	26.22	5979	32.25	5901	35.91
Sex						
Male	8448	43.13	--	--	--	--
Female	11139	56.87	--	--	--	--
Race						
White	14114	72.03	--	--	--	--
Black/African American	3809	19.44	--	--	--	--
Other	1617	8.25	--	--	--	--
Unknown	54	0.28	--	--	--	--
Education						
Some or no school	3892	19.86	--	--	--	--
High school graduate	10255	52.34	--	--	--	--
College graduate	5447	27.80	--	--	--	--

Characteristic	2010		2012		2014	
	n	%	N	%	n	%
Edentulism						
Complete	568	10.42	3111	16.33	14	11.20
Partial or None	4881	89.58	15936	83.67	111	88.80
Self-reported health						
Excellent or very good	7564	40.18	7377	38.76	6133	35.97
Good	5992	31.83	6097	32.03	5716	33.53
Fair or poor	5267	27.98	5559	29.21	5198	30.50
Has dental coverage						
Yes	7856	42.36	7729	40.85	7014	41.48
No	10689	57.64	11192	59.15	9894	58.52

Table 2. Tests for independence of characteristics and self-reported health for 2010, 2012, and 2014**Self-Reported Health**

Characteristic	2010				2012				2014			
	Excellent/ Very Good	Good	Fair/ Poor	χ^2	Excellent/ Very Good	Good	Fair/ Poor	χ^2	Excellent/ Very Good	Good	Fair/ Poor	χ^2
Age, y				91.16*				135.18*				95.38*
<65	3764	2683	2672		3316	2493	2237		2447	2090	1897	
65-69	728	528	377		740	540	423		739	598	503	
70-74	1147	988	726		1124	893	767		857	789	608	
>74	1760	1676	1395		1979	1994	1999		1860	2047	1988	
Sex				10.23*				6.17*				4.42
Male	3294	2607	2157		3210	2625	2301		2633	2426	2132	
Female	4270	3385	3109		4167	3472	3258		3498	3288	3063	
Race				527.13*				308.80*				383.86*
White	6048	4279	3260		5823	4342	3648		4911	4031	3345	
Black/African American	1046	1254	1360		1075	1276	1283		847	1233	1230	
Other	458	450	620		468	465	603		366	442	596	
Unknown	12	9	26		11	14	25		9	10	27	
Education				1609.35*				1547.47*				1445.85*
Some or no school	797	1020	1816		805	1051	1874		640	885	1740	
High school graduate	3847	3437	2652		3693	3484	2822		3041	3251	2628	
College graduate	2920	1535	798		2879	1562	863		2452	1580	830	

*Chi-square test had a significant p-value < 0.05

Table 3. Tests for independence of characteristics and dental coverage for 2010, 2012, and 2014

Characteristic	Dental Coverage [†]					
	2010	χ^2	2012	χ^2	2014	χ^2
Age, y		1214.40*		1103.34*		1105.51*
<65	4893 (54.7%)		4274 (53.4%)		3584 (56.1%)	
65-69	617 (38.2%)		707 (41.8%)		792 (43.3%)	
70-74	927 (32.6%)		953 (34.4%)		784 (35%)	
>74	1237 (25.9%)		1545 (26.1%)		1578 (27.1%)	
Sex		2.72		1.70		6.09*
Male	3411 (43.1%)		3345 (41.4%)		3037 (42.6%)	
Female	4445 (41.8%)		4384 (40.4%)		3974 (40.7%)	
Race		37.19*		41.90*		37.20*
White	5529 (41.2%)		5448 (39.6%)		4895 (40.1%)	
Black/African American	1689 (46.8%)		1638 (45.6%)		1499 (45.8%)	
Other	618 (42%)		625 (40.9%)		603 (43.3%)	
Unknown	20 (43.5%)		18 (36.7%)		17 (37%)	
Education		928.11*		827.29*		713.88*
Some or no school	884 (24.8%)		932 (25.2%)		841 (26.1%)	
High school graduate	4006 (40.9%)		3887 (39.1%)		3493 (39.5%)	
College graduate	2966 (57.2%)		2910 (55.1%)		2680 (55.4%)	

[†] Stated they had dental coverage (% of group that had dental coverage)

*Chi-square test had a significant p-value < 0.05

Results of chi-square tests for independence between baseline characteristics and each of the variables of interest—self-reported health and dental coverage—for the three time points are presented in Tables 2-3. Self-reported health and dental coverage showed statistically significant independence with age, sex, race, and education in at least one time point. For example, there were significant differences among age groups for each category of self-reported health for 2010 ($\chi^2=91.16$, $p<0.05$); 2012 ($\chi^2=135.18$, $p<0.05$); and 2014 ($\chi^2=95.38$, $p<0.05$), with the largest values for those who were younger than 65 years and those having very good to excellent self-reported health (Table 2). There were also significant differences between dental coverage and age groups (Table 3), with the largest values for those who were in the youngest group, which had more than 53% with dental coverage at each time point ($p<0.05$: 2010, $\chi^2=1214.40$; 2012, $\chi^2=1103.34$; 2014, $\chi^2=1105.51$). There were racial/ethnic differences in the proportions of those who had dental coverage. At each time point, the highest proportions of dental coverage were among Black/African Americans ($p<0.05$: 2010, 46.8%, $\chi^2=37.19$; 2012, 45.6%, $\chi^2=41.90$; 2014, 45.8%, $\chi^2=37.20$).

Table 4 shows the results from the mixed-effects modeling for self-reported health by dental coverage over time. The longitudinal relationship between dental coverage and self-reported health was not significant ($p=0.12$). However, there was a statistically significant, cross-sectional relationship between each of the variables discussed below with self-reported health ($p<0.001$). Dental coverage was statistically significant ($p<0.0001$), with self-reported health being higher for those with dental coverage than for those without coverage. Sex was statistically significant ($\beta=-0.13$, $p<0.0001$), with self-reported health being higher for males than for females. Race was also statistically significant ($\beta=-0.029$, $p<0.0001$), with African Americans having lower self-reported health. The magnitude of the effect of having dental coverage was a 0.34-point increase in self-reported health ($p<0.0001$), compared to those who did not have dental coverage. With each increase in one year of education, there was a 0.38-point increase in self-reported health ($p<0.0001$). Those who had complete edentulism had a self-reported health score 0.33 points below that for those who had partial or no edentulism ($p<0.0001$). However, age, time, and the interaction between dental coverage and time were not statistically significant.

Table 4. Mixed-effects modeling for self-reported health by dental coverage over time (N=19,595)

Effect	Estimate	Standard Error	t	p-value
Intercept	2.810	0.055	51.33	<0.0001
Dental Coverage	0.340	0.039	8.81	<0.0001
Time	-0.009	0.010	-0.87	0.3852
Dental Coverage x Time	-0.0216	0.014	-1.57	0.1171
Age	0.041	0.038	1.06	0.2893
Sex	-0.133	0.026	-5.16	<0.0001
Race	-0.029	0.006	-4.59	<0.0001
Education	0.385	0.020	19.64	<0.0001
Edentulism	-0.327	0.042	-7.72	<0.0001

DISCUSSION

The findings from the Health and Retirement Study for each time point between 2010 and 2014 show that, for the older population, having dental coverage was associated with better self-reported health than for those who did not have dental coverage. In this sample, the lack of dental coverage and the low self-reported health scores were high, with more than 57% at each time point lacking dental coverage and more than 27% having fair to poor self-rated health. Another study, using the 2008 module of the HRS found similar results, showing that low income and a lack of dental coverage have a negative impact on self-reported health in the elderly (Manski, Hyde, Chen, & Moeller, 2016). The magnitude and the direction of the relationship between dental coverage and self-reported health are similar to the relationship between education and self-reported health within each time point; edentulism also has a negative relationship with self-reported health.

Since the current statistical analysis did not include sampling weights for population inference, which is a limitation, there is limited generalizability of the study findings to the general population. Due to the large number of questions asked of participants, survey fatigue and recall bias are potential limitations. Missing responses led to a smaller sample size in some of the 2014 variables; however, by also considering the 2010 and 2012 modules, the overall sample size of the three waves of data is adequate. Furthermore, the direction of the relationship between dental coverage and self-rated health should be interpreted with caution, as the longitudinal relationship was not significant. Whether those who have high self-rated health are more likely to obtain dental coverage or vice-versa needs to be explored.

This is the first study to examine the relationship between dental coverage and self-reported health in the elderly over time. The results show that dental coverage has a statistically significant association with self-reported health. Although previous studies have assessed the relationship between dental insurance and quality of life, they have had the limitation of cross-sectional designs; the present study was longitudinal.

CONCLUSION

This is the first longitudinal study looking at dental coverage and self-reported health among a sample of older Americans. The results support a positive and significant association between dental coverage and self-reported health for older adults. This is relevant, because, in the United States, there is an increasing population of older people.

Acknowledgements

We thank the blind reviewer for comments that have been incorporated in this manuscript and Dr. Daniel Linder for his advice regarding the data analysis.

References

- Centers for Disease, C., & Prevention. (1999). Total tooth loss among persons aged > or =65 years--selected states, 1995-1997. *MMWR Morb Mortal Wkly Rep*, 48(10), 206-210.
- Cornejo, M., Perez, G., de Lima, K. C., Casals-Pedro, E., & Borrell, C. (2013). Oral Health-Related Quality of Life in institutionalized elderly in Barcelona (Spain). *Med Oral Patol Oral Cir Bucal*, 18(2), e285-292.
- Emami, E., de Souza, R. F., Kabawat, M., & Feine, J. S. (2013). The impact of edentulism on oral and general health. *Int J Dent*, 2013, 498305. doi:10.1155/2013/498305
- Friedman, P. K., Kaufman, L. B., & Karpas, S. L. (2014). Oral health disparity in older adults: dental decay and tooth loss. *Dent Clin North Am*, 58(4), 757-770. doi:10.1016/j.cden.2014.06.004
- Kreider, B., Manski, R. J., Moeller, J., & Pepper, J. (2015). The effect of dental insurance on the use of dental care for older adults: a partial identification analysis. *Health Econ*, 24(7), 840-858. doi:10.1002/hecl.3064
- Manski, R. J., Hyde, J. S., Chen, H., & Moeller, J. F. (2016). Differences Among Older Adults in the Types of Dental Services Used in the United States. *Inquiry*, 53. doi:10.1177/0046958016652523
- Medicaid and CHIP Payment and Access Commission. (2015). *Medicaid Coverage of Dental Benefits for Adults*. Retrieved from <https://www.macpac.gov/wp-content/uploads/2015/06/Medicaid-Coverage-of-Dental-Benefits-for-Adults.pdf>
- Rodrigues, S. M., Oliveira, A. C., Vargas, A. M., Moreira, A. N., & EF, E. F. (2012). Implications of edentulism on quality of life among elderly. *Int J Environ Res Public Health*, 9(1), 100-109. doi:10.3390/ijerph9010100
- Rouxel, P., Tsakos, G., Chandola, T., & Watt, R. G. (2016). Oral Health-A Neglected Aspect of Subjective Well-Being in Later Life. *J Gerontol B Psychol Sci Soc Sci*. doi:10.1093/geronb/gbw024

Santos, C. M., Celeste, R. K., Hilgert, J. B., & Hugo, F. N. (2015). Testing the applicability of a model of oral health-related quality of life. *Cad Saude Publica*, 31(9), 1871-1880. doi:10.1590/0102-311X00119914

US Centers for Medicare and Medicaid Services. (2017). Dental services. *Your Medicare Coverage*. Retrieved from <https://www.medicare.gov/coverage/dental-services.html>

Willink, A., Schoen, C., & Davis, K. (2016). Dental Care And Medicare Beneficiaries: Access Gaps, Cost Burdens, And Policy Options. *Health Aff (Millwood)*, 35(12), 2241-2248. doi:10.1377/hlthaff.2016.0829

© Frances M. Yang, Solon T. Kao, Jordan S. Lundeen. Originally published in jGPHA (<http://www.gapha.org/jgpha/>) May 15, 2017. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial No-Derivatives License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work ("first published in the Journal of the Georgia Public Health Association...") is properly cited with original URL and bibliographic citation information. The complete bibliographic information, a link to the original publication on <http://www.gapha.jgpha.org/>, as well as this copyright and license information must be included.