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Changes in Older Adults' Oral Health and Disparities: 1999 to 2004 and 2011 to 2016

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Abstract

OBJECTIVES: To examine changes in tooth loss and untreated tooth decay among older low-income and higher-income US adults and whether disparities have persisted.

DESIGN: Sequential cross-sectional study using nationally representative data.

SETTING: The 1999 to 2004 and 2011 to 2016 National Health and Nutrition Examination Survey.

PARTICIPANTS: Noninstitutionalized US adults, aged 65 years and older (N = 3539 for 1999–2004, and N = 3514 for 2011–2016).

MEASUREMENTS: Differences in prevalence of tooth loss (having 19 teeth or fewer, 8 teeth or fewer, and no teeth) and untreated decay and mean number of decayed and missing teeth (DMT) between low- and high-income adults 65 years and older in each survey and changes between surveys. Adjusted prevalence and count outcomes were estimated with logistic and negative binomial regression models, respectively. Models controlled for sociodemographic characteristics and smoking status. Reported findings are significant at $P < .05$.

RESULTS: In 2011 to 2016, unadjusted prevalence of having 19 teeth or fewer, 8 teeth or fewer, no teeth, and untreated decay among low-income adults 65 years and older was 50.6%, 42.0%, 28.6%, and 28.6%, respectively. Multivariate analyses indicated that although most tooth loss

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article.

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measures improved between surveys for both income groups, tooth loss among low-income adults remained at almost twice that among higher-income adults. The disparity in untreated decay prevalence in 2011 to 2016, 15.2 percentage points (26.1% vs 10.9% for low vs high income) was twice that in 1999 to 2004, 8.5 percentage points (22.9% vs 14.4% for low vs high income). DMT decreased for both groups, with lower-income adults having about five more affected teeth in both surveys.

CONCLUSION: Tooth loss is decreasing, but differential access to restorative care by income appears to have increased. *J Am Geriatr Soc* 00:1–6, 2019.

Keywords

oral health; disparities; untreated decay; tooth loss

Oral health is essential to quality of life.¹ Access to preventive and restorative dental care is critical to maintaining oral health. If left untreated, dental disease will not resolve and can result in pain, which, in turn, can affect eating, social interaction, and sleep. The World Bank's Global Burden of Disease recognized untreated tooth decay, extensive tooth loss, and severe periodontitis as having a negative effect on health and quality of life.²

An analysis of data from the National Health and Nutrition Examination Survey (NHANES) in 1999 to 2004 found notable disparities in the prevalence of complete tooth loss and untreated tooth decay by income among older adults, aged 65 years and older.³ The percentage of low-income, older adults with no natural teeth, about 40%, was twice that among higher-income adults. The percentage with untreated decay was also about twice as high among low-income compared to higher-income older adults. An analysis of 2005 to 2008 NHANES data for adults, aged 50 years and older, also found that low-income adults were more likely to report food avoidance, pain, embarrassment, and a less satisfying life due to dental problems than were higher-income adults.⁴ This study also included information from state reports on the oral health of long-term care residents and home-limited elderly individuals not likely to be included in NHANES—long-term care residents and adults unable to leave their home without difficulty (hereon referred to as home limited). Data from state reports suggested that this population could have substantially higher tooth loss and untreated tooth decay than community-dwelling adults (ie, older adults who are not living in long-term care facilities or home limited).

Since the data used in the previous reports were collected, the healthcare system in the United States has undergone substantial reform. Provisions regarding dental care, however, largely addressed services for children. Medicare has not covered routine dental care since its inception in 1965. Many older adults continue to lose dental insurance coverage upon retirement—the percentage of older adults with any type of dental insurance in 2015 (38.0%) was about half that for working-age adults (72.4%) and children or adolescents (87.9%).⁵ Recently published reports suggest that increased dental coverage for children and adolescents may have reaped benefits in terms of notable decreases in untreated decay among young children⁶ and increased sealant prevalence⁷ among school-aged children. In addition, disparities in untreated tooth decay prevalence and sealant prevalence by income decreased between 1999 to 2004 and 2011 to 2016.

In this study, we examined prevalence of tooth loss and untreated tooth decay among low- and higher-income, community-dwelling older adults in 2011 to 2016. We also tested for changes in these outcomes from 1999 to 2004 and the presence of disparities by income in both survey periods and persistence over time after controlling for sociodemographic characteristics and smoking status. We focused on income disparities because this is a mutable characteristic (ie, it could be addressed by providing dental care subsidies to low-income older adults). We also examined state reports with information on tooth loss and untreated tooth decay among home-limited older adults and long-term care residents.

METHODS

Community-Dwelling Adults

We used sequential cross-sectional, deidentified data for adults, aged 65 years and older, from NHANES 1999 to 2004 and 2011 to 2016. NHANES is a complex, multistage probability sample of the noninstitutionalized US population. The survey oversampled adults, aged 70 years and older in 1999 to 2004, and adults, aged 80 years and older in 2011 to 2016. Visual oral health assessments were conducted in a mobile examination unit by dentists who were trained prior to and monitored during NHANES data collection to ensure consistent assessment standards. Information on respondent sociodemographic characteristics and smoking status was obtained during the NHANES home interview. NHANES protocols were approved by the National Center for Health Statistics Ethics Review Board. Additional information on NHANES is available at <http://www.cdc.gov/nchs/nhanes.htm>. The total number of adults, aged 65 years and older, who had an oral health examination was 3539 in NHANES 1999 to 2004, and 3514 in NHANES 2011 to 2016.

We focused on outcomes related to tooth loss and untreated decay. The outcome related to tooth loss included having 19 teeth or fewer (definition of functional dentition used by World Health Organization),⁸ having 8 teeth or fewer (case definition used by Global Burden of Disease for tooth loss sufficiently severe to cause great difficulty in eating meat, fruits, and vegetables),² and having no natural teeth (edentate).

Among dentate older adults, we examined prevalence of untreated decay and mean number of affected teeth. Because both tooth loss and untreated disease can affect the ability to eat,² we also examined the mean number of teeth that were either missing or had untreated decay (DMT) and the mean number of missing teeth (MT). Finally, we examined the mean number of teeth that had been affected by caries—filled or currently had untreated decay (DFT).

We present crude estimates of outcomes for all older adults and for select characteristics: (1) age (65–74 or 75 years and older), (2) sex, (3) race/ethnicity (non-Hispanic white, non-Hispanic black, or Mexican American), (4) ratio of family income to federal poverty level (200% or more or less than 200%), (4) education (more than high school, high school or high school equivalency diploma, or less than high school), and (5) smoking status (never, former, or current). We adjusted all outcomes to control for potential differences in the age distribution among the various characteristics. We used the US 2000 population as the standard⁹ and used five-year age group. Although adjusted for age, we refer to these

outcomes as crude to differentiate from findings that controlled for additional sociodemographic characteristics and smoking status. We used *t*-tests to examine disparities (absolute difference in outcome between the reference category and other categories of each characteristic) in 2011 to 2016. The reference category was the group that historically had better oral health outcomes (ie, age 65–74 years, non-Hispanic white, never smoked, family income of 200% or greater federal poverty level, and education more than high school).²

For low- and high-income adults, we used a multivariate regression model to examine changes in outcomes between the NHANES surveys and disparities. We used multivariate logistic regression models to analyze prevalence outcomes. The main explanatory variables were survey period (NHANES 1999–2004 or NHANES 2011–2016), income, and interaction between survey periods. A significant interaction term would indicate changes over time differed by income or equivalently, and disparities by income varied between survey periods. To control for potential confounders, we included the following covariates: age, sex, race/ethnicity, education, and smoking status. To test for differences among count variables, we used negative binomial regression models that included the same independent variables. Our criteria for statistical significance was $P < .05$. There were 3164 and 3119 older adults in NHANES 1999 to 2004 and NHANES 2011 to 2016 with data for all independent variables. Analyses were conducted using statistical software that accounts for the complex sample design of NHANES. Estimates were obtained using the examination sample weights.

Home-Limited or Long-Term Care Residents

To examine the oral health status of older adults who were home-limited or long-term care residents, we used information from nine states that had conducted a Basic Screening Survey (BSS)¹⁰ for this population between 2011 and 2016. The BSS was designed to assess population oral health. The two oral health outcomes common to both the BSS and NHANES examination component were prevalence of having no teeth and untreated decay. The criteria for assessing these outcomes were similar for NHANES and BSS, but NHANES assessments in 1999 to 2004 and 2011 to 2016 were conducted solely by dentists, whereas the BSS could have been conducted by dentists, dental hygienists, or other appropriate healthcare workers.

The website of the Association of State and Territorial Dental Directors (ASTDD) provided a list of states that have conducted a BSS for older adults and the year it was conducted. Reports for these states were obtained by directly downloading them from the ASTDD website (<https://www.astdd.org/healthy-aging-committee/>) or for states without downloadable reports, with a Google search using the search term “[state name] basic screening survey older adults.” The authors extracted these reports for the following information: population sampled (home-limited or long-term care resident, number sampled, whether findings were representative of state), population characteristics (age, income), percentage edentate, and percentage with untreated decay (Supplementary Appendix S1).

RESULTS

Crude Findings (Only Adjusted for Age) for NHANES

Among all older adults in 2011 to 2016, the prevalence of having 19 teeth or fewer, 8 teeth or fewer, and no teeth was 31.6%, 25.8%, and 17.3%, respectively (Table 1). Prevalences among low-income adults were at least double those among higher-income adults—50.6% vs 22.4% for 19 teeth or fewer, 42.0% vs 16.2% for 8 teeth or fewer, and 28.6% vs 10.7% for no teeth. Disparities of similar magnitude existed by race/ethnicity, education level, and smoking status.

Prevalence of untreated tooth decay was 15.9% overall, and the mean number of affected teeth was 0.3 teeth (Table 1). There were again notable disparities in prevalence and mean number of teeth with untreated decay by income, race/ethnicity, education level, and smoking status. Prevalence of untreated decay among low-income older adults (28.6%) was about three times as high as prevalence among higher-income adults (9.9%), as was mean untreated decay (0.7 vs 0.2 teeth). Mean MT, DMT, and DFT among all older adults was 6.7, 7.0, and 10.1 teeth, respectively (Table 1). Among low-income adults, mean DMT (10.0) and mean MT (9.4) were almost twice that among higher-income adults (5.5 and 5.3 teeth, respectively). Similar disparities were present by race/ethnicity, education, and smoking status.

Findings for NHANES After Controlling for Sociodemographic and Smoking Status

After controlling for covariates, we found notable improvements between surveys in having 8 or fewer teeth and no teeth for all older adults—declines equaled 6.1 and 5.8 percentage points, respectively, among low-income adults and 9.7 and 5.3 percentage points, respectively, among higher-income adults (Table 2). For having 19 teeth or fewer, we could only detect an improvement among higher-income adults—an 11.9–percentage point decrease. Lower-income, older adults had significantly higher prevalence of tooth loss in 2011 to 2016—19.1 percentage points higher for having 19 teeth or fewer, 17.8 percentage points higher for 8 teeth or fewer, and 11.9 percentage points higher for no teeth (Table 2). The increase in the disparity in having 19 teeth or fewer by income between surveys approached statistical significance ($P = .064$).

There were no detectable changes in untreated tooth decay prevalence for either low- or higher-income adults. The disparity by income, however, increased from 8.5 percentage points (22.9%–14.4%) in 1999 to 2004 to 15.2 points (26.1%–10.9%) in 2011 to 2016 (Table 2). Similarly, the disparity in the mean number of decayed teeth increased from 0.12 to 0.27 teeth between surveys. Both mean MT and mean DMT decreased by about 2.5 and 3.5 teeth, respectively, for low- and higher-income adults between surveys. In both surveys, low-income adults had about five more MT and DMT compared to higher-income adults. In contrast to findings for MT and DMT, DFT increased by about one tooth for both income groups, with higher-income adults having about three more affected teeth than did lower-income adults.

State BSS Reports: Home-Limited or Long-Term Care Residents

Almost all of the BSS reports (Supplementary Appendix S1) included in our analysis were intended to be representative of adults living in long-term care or assisted living facilities or who were home limited. The percentage of vulnerable adults who were edentate ranged from 25.0% to 42.9% (median = 32.5%; Table 3). By comparison, among the NHANES sample, 17.3% of all older adults were edentate (Table 1). Older adults, aged 75 years and older, had higher edentulism than adults aged 65 to 74 years (22.5% and 13.0%, respectively; Table 1). The percentage of older adults with untreated decay in the state reports ranged from 25.3% to 53.0% (median = 40.0%; Table 3). Among the NHANES sample, untreated decay prevalence was 15.9% for adults aged 65 years and older, 15.4% for adults aged 65 to 74 years, and 16.5% for adults aged 75 years and older (Table 1).

DISCUSSION

Older adults are retaining more of their natural teeth. After controlling for covariates, the prevalence of edentulism decreased by over five percentage points between surveys for both low- and higher-income adults. Decreases in severe tooth loss (having fewer than 8 teeth) were even greater—6.1 and 9.7 percentage points for low- and higher-income adults, respectively. The decrease in tooth loss between 1999 to 2004 and 2011 to 2016, especially among adults aged 65 to 74 years (born between 1925 and 1939 and between 1937 and 1951 in NHANES 1999–2004 and 2011–2016, respectively) likely reflects lower rates of dental disease and tooth extraction that began in the 1950s and 1960s. Over 35% of the US population received fluoridated water by 1965, and about 50% by 1975.¹¹ Fluoride toothpaste was introduced in the United States in the mid-1950s and widely marketed over the following decades.¹² Based on the availability of fluoride, more persons in the 2011 to 2016 survey would have received the benefits of fluoride as adolescents or young adults when compared to the 1999 to 2004 sample. Other factors that could have contributed to decreases in tooth loss include: more positive patient and practitioner attitudes toward prevention measures, advances in dental technology leading to more treatment options (eg, introduction of high-speed handpiece/drill),¹³ regular use of dental services as affluence, employer-based dental insurance, reduced smoking rates since 1965¹⁴ (a major risk factor for periodontal disease¹⁵), and an increase in educational levels¹⁶ (which occurred after World War II¹⁷).

The trend in decreased tooth loss among older adults can result in improved quality of life. Typically, a minimum of 20 teeth with 9 to 10 pairs of contacting units is necessary for chewing efficiency.¹⁸ Reduced chewing efficiency can limit food choices, which, in turn, can result in poorer dietary choices and weight loss or obesity.³ Extensive tooth loss without suitable replacements may also detract from physical appearance and impede speech—factors that can lead to restricted social contact, inhibited intimacy, and lower self-esteem.¹ Many low-income adults, however, still experience profound tooth loss—50.6% do not meet the World Health Organization definition for functional dentition and 42% have tooth loss sufficiently severe to be classified by the Global Burden of Disease as having major difficulty in eating meats, fruits, and vegetables. Large numbers of racial/ethnic minorities

(non-Hispanic black and Mexican American adults), less educated, and current smokers also lack functional dentition and experience severe tooth loss.

Decreased tooth loss presents different challenges as older adults with teeth remain at risk for the two most common dental diseases (caries and periodontitis). Though not statistically significant, our analysis found a slight decrease in the prevalence of untreated decay among higher-income adults and a slight increase among low-income adults. The difference in the trends by income, 6.7 percentage points, however, was statistically significant. Left untreated, caries can progress, resulting in infection, pain, and loss of function. At present, there is a limited safety net to provide dental care to low-income, older adults. Medicare does not cover routine dental services, and in only 16 states and the District of Columbia does Medicaid offer comprehensive dental services to adults.¹⁹ The difference in the direction of the change of untreated decay between surveys by income that we found corresponds to trends in the percentage of older adults with private and public dental insurance coverage in 1999, 2004, 2011, and 2015—21.1%, 23.8%, 26.1%, and 28.0%, respectively, with private insurance and 10.1%, 10.4%, 9.7%, and 10.5%, respectively, with public insurance.⁵

This analysis of NHANES data had several strengths. It used a nationally representative survey with dentists whose assessments using a standard protocol were determined to be reliable. The oversampling of older adults in both surveys also increased the reliability and precision of estimated outcomes in this analysis. One limitation is that although the data from state reports used a standardized protocol to assess the oral health of vulnerable adults, examiners were not calibrated across all states and in a few states turned into a convenience sample because of high nonresponse rates. The intended sample of vulnerable adults also differed by state (eg, residents of long-term care facilities vs assisted living). Nevertheless, we found that vulnerable adults had consistently higher levels of tooth loss and untreated decay than community-dwelling adults. Better integration of oral health into medical care could help improve the oral health of vulnerable older adults. A 2011 Institute of Medicine report²⁰ recommended that nondental healthcare professionals take a more active role in the dental care of older adults living in long-term care facilities. The report found that with proper training, nurses, nursing assistants, and other healthcare workers could assess risk and screen for common oral conditions, educate residents about how to prevent oral diseases (eg, daily brushing with fluoride toothpaste), and deliver preventive services (eg, fluoride varnish). Curricula on oral health that include a geriatric component designed for medical providers are now available on the Association of American Medical Colleges' MedEdPortal curricular repository²¹ and on the Smiles for Life (an oral health curriculum for medical professionals²²) website.

In conclusion, we found that although tooth loss largely decreased in all groups of older adults, disparities between low- and higher-income adults persisted. The improvement in tooth retention offers new challenges as untreated decay among all older adults has not decreased and indeed among low-income older adults has increased relative to their higher-income counterparts. Vulnerable older adults who are home limited or residing in long-term care facilities also continue to experience high rates of edentulism and untreated decay. These findings support the need to increase older adult's access to dental services. Possible

approaches include examining the feasibility of providing a safety net that covers routine dental services, implementing community programs to increase access to preventive dental care, better integrating dental and medical care, and developing a comprehensive strategy to provide routine dental care to home-limited and long-term care residents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1. Estimates (SEs) of Dental Health Status and Disparities Among Adults Aged 65 Years and Older, by Select Characteristics: United States, National Health and Nutrition Examination Survey 2011 to 2016¹

Characteristic	Prevalence of Tooth Loss				Mean No. of Affected Teeth ⁴			
	19 Teeth ²	8 Teeth ³	Edentate	Prevalence Untreated Tooth Decay ⁴	Untreated Decayed Teeth	Missing Teeth	Untreated Decayed and Missing Teeth	Untreated Decayed and Filled Teeth
Total	31.6 (1.2)	25.8 (1.4)	17.3 (1.3)	15.9 (1.2)	0.3 (0.0)	6.7 (0.2)	7.0 (0.2)	10.1 (0.2)
Age, y								
75	38.6 (2.1) ⁵	33.2 (2.1) ⁵	22.5 (1.6) ⁵	16.5 (1.4)	0.3 (0.0)	7.9 (0.3) ⁵	8.2 (0.3) ⁵	9.9 (0.3)
65–74 (reference)	25.8 (1.3)	19.8 (1.3)	13.0 (1.3)	15.4 (1.6)	0.3 (0.0)	5.6 (0.2)	5.9 (0.2)	10.3 (0.2)
Sex								
Female	32.9 (1.5)	25.9 (1.6)	16.9 (1.3)	14.2 (1.3)	0.3 (0.0)	6.8 (0.3)	7.1 (0.3)	10.0 (0.2)
Male (reference)	30.2 (1.7)	25.7 (1.7)	17.7 (1.5)	18.0 (1.6) ⁵	0.4 (0.0) ⁵	6.5 (0.3)	6.9 (0.3)	10.1 (0.3)
Race/ethnicity								
NH black	60.3 (3.1) ⁵	45.7 (2.2) ⁵	30.7 (2.1) ⁵	29.1 (2.5) ⁵	0.7 (0.1) ⁵	11.2 (0.4) ⁵	11.9 (0.5) ⁵	5.1 (0.2) ⁵
M-A	49.2 (2.7) ⁵	28.0 (2.2) ⁵	16.7 (1.9)	35.9 (3.2) ⁵	1.0 (0.2) ⁵	8.9 (0.5) ⁵	9.8 (0.5) ⁵	5.8 (0.5) ⁵
NH white (reference)	25.9 (1.4)	22.2 (1.8)	15.2 (1.7)	13.4 (1.3)	0.3 (0.0)	5.8 (0.2)	6.0 (0.2)	11.1 (0.2)
Ratio income to federal poverty level								
<200%	50.6 (2.2) ⁵	42.0 (2.0) ⁵	28.6 (1.9) ⁵	28.6 (2.3) ⁵	0.7 (0.1) ⁵	9.4 (0.3) ⁵	10.0 (0.5) ⁵	7.5 (0.3) ⁵
200% (reference)	22.4 (1.2)	16.2 (1.4)	10.7 (1.3)	9.9 (1.3)	0.2 (0.0)	5.3 (0.2)	5.5 (0.2)	11.5 (0.2)
Education								
Less than high school	54.7 (2.5) ⁵	47.3 (2.2) ⁵	34.8 (2.1) ⁵	30.8 (2.8) ⁵	0.7 (0.1) ⁵	10.3 (0.4) ⁵	11.1 (0.4) ⁵	6.1 (0.3) ⁵
High school	38.7 (2.6) ⁵	31.7 (2.3) ⁵	21.3 (2.2) ⁵	18.8 (2.2) ⁵	0.4 (0.1) ⁵	8.1 (0.3) ⁵	8.5 (0.3) ⁵	8.9 (0.4) ⁵
More than high school (reference)	23.4 (1.2)	15.8 (1.4)	9.3 (1.1)	11.7 (1.4)	0.2 (0.0) ⁵	5.3 (0.2)	5.5 (0.2)	11.4 (0.2)
Smoking status								
Current	59.9 (5.2) ⁵	56.3 (3.5) ⁵	42.8 (3.1) ⁵	33.9 (5.1) ⁵	0.8 (0.2) ⁵	10.8 (0.8) ⁵	11.6 (0.8) ⁵	7.2 (0.7) ⁵

Characteristic	Prevalence of Tooth Loss			Prevalence of Untreated Tooth Decay ⁴			Mean No. of Affected Teeth ⁴		
	19 Teeth ²	8 Teeth ³	Edentate	Untreated Tooth Decay ⁴	Untreated Decayed Teeth	Missing Teeth	Untreated Decayed and Missing Teeth	Untreated Decayed and Filled Teeth	Untreated Decayed and Filled Teeth
Former	33.1 (1.9) ⁵	28.0 (1.4) ⁵	18.5 (1.3) ⁵	15.3 (1.7)	0.3 (0.0)	7.2 (0.3) ⁵	7.5 (0.3) ⁵	10.0 (0.3)	10.0 (0.3)
Never (reference)	27.0 (1.6)	18.8 (1.5)	12.1 (1.1)	14.2 (1.4)	0.29 (0.03)	5.7 (0.3)	6.0 (0.3)	10.4 (0.3)	10.4 (0.3)

Abbreviations: M-A, Mexican American; NH, non-Hispanic.

¹ All estimates adjusted by age (5-year groups, the maximum age group set to 80 years or older) to the 2000 standard US population.

² World Health Organization criteria for functional dentition is having 20 teeth or more, so having 19 teeth or fewer is equivalent to not having functional dentition.

³ Global Burden of Disease case definition for severe tooth loss.

⁴ Population only included dentate adults.

⁵ Significantly different from reference group as $P < .05$.

Table 2. Estimates (SEs) of Dental Health Status by Family Income Among Adults Aged 65 Years, Controlling for Sociodemographic Characteristics and Smoking Status: United States, National Health and Nutrition Examination Survey 1999 to 2004 and 2011 to 2016

Characteristic	Prevalence of Tooth Loss			Mean No. of Affected Teeth ³				
	19 Teeth ¹	8 Teeth ²	Edentate	Prevalence Untreated Tooth Decay ³	Untreated Decayed Teeth	Missing Teeth	Untreated Decayed and Missing Teeth	Untreated Decayed and Filled Teeth
Family income <200% federal poverty level								
2011–2016	44.0 (2.3) ⁴	37.0 (1.8) ⁴	25.0 (1.7) ⁴	26.1 (2.2) ⁴	0.45 (0.04) ⁴	13.2 (0.4) ⁴	13.6 (0.4) ⁴	6.1 (0.2) ⁴
1999–2004	49.4 (2.6) ⁴	43.1 (2.3) ⁴	30.8 (1.7) ⁴	22.9 (1.7) ⁴	0.37 (0.04) ⁴	15.6 (0.5) ⁴	16.0 (0.4) ⁴	5.1 (0.3) ⁴
Change	-5.4 (3.3) ⁵	-6.1 (2.5) ^{5,6}	-5.8 (2.1) ^{5,6}	3.3 (2.4) ⁵	0.08 (0.06) ⁵	-2.5 (0.6) ⁶	-2.4 (0.6) ⁶	1.0 (0.4) ⁶
Family income 200% federal poverty level								
2011–2016	24.9 (1.3)	19.2 (1.6)	13.1 (1.5)	10.9 (1.4)	0.18 (0.03)	8.1 (0.4)	8.3 (0.3)	9.3 (0.2)
1999–2004	36.8 (1.4)	28.9 (1.6)	18.4 (1.3)	14.4 (1.2)	0.25 (0.03)	11.6 (0.4)	11.8 (0.4)	8.2 (0.2)
Change	-11.9 (1.8) ⁶	-9.7 (2.1) ⁶	-5.3 (1.9) ^{5,6}	-3.4 (1.9) ⁵	-0.07 (0.04) ^{5,6}	-3.5 (0.6) ⁶	-3.5 (0.6) ⁶	1.1 (0.3) ⁶
Disparities in change	6.5 (3.4) ⁵	3.7 (3.0) ⁵	-0.5 (2.5) ⁵	6.7 (2.8) ^{5,6}	15.0 (0.08) ^{5,6}	1.1 (0.7) ⁵	1.1 (0.7) ⁵	-0.1 (0.4) ⁵

¹ World Health Organization criteria for functional dentition is having 20 teeth or more, so having 19 teeth or fewer is equivalent to not having functional dentition.

² Global Burden of Disease case definition for severe tooth loss.

³ Population limited to dentate adults.

⁴ Disparity by income significant at $P < .05$.

⁵ Estimate is unstable because relative SE/estimate is greater than 0.3.

⁶ Estimate significantly different from 0 at $P < .05$.

Table 3.

Prevalence of Edentulism and Untreated Tooth Decay Among Home-Limited and Long-Term Care Residents:
Nine State Reports With Results From Basic Screening Survey¹

State, Year Conducted	% Edentate	% With Untreated Decay Among Dentate
Arkansas, 2012	42.9	48.6
Connecticut, 2013 ²	36.0	53.0
Georgia, 2013	28.8	25.3
Kansas, 2012	33.0	34.0
Maryland, 2013–2014 ³	Not reported	31.8
Minnesota, 2016 ²	25.0	40.0
North Carolina, 2015 ²	29.0	50.0
North Dakota, 2016 ²	32.0	27.0
Vermont, 2013–2014	38.5	48.0
Mean	33.2	39.7
Range	25.0–42.9	25.3–53.0
Median	32.5	40.0

¹Values not necessarily representative of state. See Supplementary Appendix S1.

²Did not report percentages to 1 decimal point.

³Did not report data for home-limited or long-term care residents.