How Many Dentists Are Needed in 2040: Executive Summary

Howard L. Bailit, DMD, PhD

Abstract: Five background articles in Section 2 of the "Advancing Dental Education in the 21st Century" project examined some of the factors likely to impact the number of dentists needed in 2040: 1) the oral health of the population, 2) changes in the utilization of dental services, 3) new technologies, 4) the growth of large capitated dental group practices, and 5) the demand for dental care. With this information, a sixth background article estimated the number of dentists needed in 2040 compared to the number expected if current trends continue. This executive summary provides an overview of findings from these six articles. The data indicate major improvements in oral health, especially in upper income groups that account for 65% of practice revenues. At the same time, per capita utilization of restorative and prosthetic services has declined dramatically. No major new technologies are likely to impact the need for dentists by 2040. In a large capitated group practice, full-time general dentists treated an average of 2,100 patients per year; solo general dentists averaged 1,350. Based on the examined factors, growth in demand for traditional forms of care may slow substantially, raising the potential for a surplus of dentists in 2040. If these trends continue, the key national policy issue then would be: should schools reduce the number of graduates before market forces require them to downsize or close, or are other alternatives available?

Dr. Bailit is Professor Emeritus, Department of Community Medicine, School of Medicine, University of Connecticut. Direct correspondence to Dr. Howard L. Bailit, Department of Community Medicine, School of Medicine, University of Connecticut, 263 Farmington Ave., Farmington, CT 06030-6325; 860-679-5487; bailit@uchc.edu.

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The question of how many dentists will be needed in 2040 is an important issue because it will determine the size and capacity of the dental education system. In 2013, there were approximately 195,202 clinically active licensed dentists in the U.S. providing care to patients.[1] The annual number of dental school graduates increased from 4,300 in 2002 to 6,000 in 2016 (1.9% increase per year), growing twice as fast as the U.S. population (0.9% per year). The number of dentists per 100,000 population is expected to increase from 61.7 in 2013 to 63.3 or higher in 2033. With the increase in dentists and decrease in demand for care, dentists' incomes began to decline in 2000, well before the 2007-09 economic recession.[2] This decline continues in inflation-adjusted dollars, and the number of solo practice owner dentists who claim that they are not busy enough is now 35% to 40%. These data suggest that the supply of dental services from a national perspective may in time exceed the demand as defined by current users.

To estimate the number of dentists needed in 2040, we examined six basic issues in Section 2 of the "Advancing Dental Education in the 21st Century" project. The background articles in this section and their authors are listed in Table 1. This executive summary is based on those articles. More detailed information on each topic may be found in them.

Five major trends were examined in this section, beginning with trends in the oral health of the U.S. population.[3] We were particularly interested in oral health status trends by family income group. Dentists currently generate about 65% of their revenues from the 154 million people (48% of population) who are 300% or more of the Federal Poverty Level (FPL). Also of interest were disparities in oral health and access to care among family income groups. Second are trends in the utilization of dental services.[4] As the oral health status of the population changes, so will the number and mix of services patients receive. Thus, we wanted to estimate service mix utilization trends over the past 20 years and to make projections for 2040. In large part, this will determine the knowledge and skills needed by dentists in 2040. Third are trends in new technologies.[5] Both the public and private sectors spend substantial resources developing new technologies to prevent, diagnose, and treat oral diseases. These technologies could have a major impact on improving oral health and increasing the productivity of dentists. For this reason, we wanted to know if there were any new technologies now in development that would impact the need

Table 1. Titles and authors of background articles in Section 2 of this project

Title	Author/s
Trends in Oral Diseases in the U.S. Population	R. Gary Rozier, B. Alexander White, and Gary D. Slade
The Impact of Improved Oral Health on the Utilization of Dental Services	Stephen A. Eklund
Dental Group Practice and the Need for Dentists	David S. Gesko and Howard L. Bailit
The Effect of New Oral Care Technologies on the Need for Dentists in 2040	Peter M. Milgrom and Jeremy A. Horst
Projecting the Demand for Dental Care in 2040	Richard J. Manski and Chad D. Meyerhoefer
Estimating the Number of Dentists Needed in 2040	Stephen A. Eklund and Howard L. Bailit

Note: See references for full citations of these articles and links to them in the online supplement.

for dentists in 2040. Fourth, we examined trends in practice organization.[6] More dentists are now delivering care in various types of group practices. As this trend continues, will it impact the efficiency of the delivery system? That is, are there significant differences between solo and group practices in the number of patients treated annually per dentist? Fifth are trends in the demand for dental care.[7] A critical factor in determining the need for dentists in 2040 is the likely demand for dental services. In large part, this demand will depend on the size of the population, the availability of public and private dental insurance, and the economy. Because of family income disparities in oral health and utilization, changes in social policy that promote greater access to care by lower income populations is particularly important. Finally, based on the information in the previous five articles, we estimated the number of dentists needed in 2040 and compared it to the estimated number of dentists in practice if the trends we examined continue.[8] We also considered the policy implications of these two estimates.

Results

Oral Health Trends

Dental caries. Over the past 40 years, as reported in the article by Rozier et al., the prevalence and severity of caries declined for all age and income groups: for example, a Decayed, Missing, and Filled Teeth (DMFT) decline of 188% for ages 12-15 years (1971-74 to 1999-2004).[3] Equally dramatic, untreated carious permanent teeth declined in children and adolescents: an average of 1.43/person to 0.33/person for the same time period. While the prevalence and severity of caries improved, disparities among income groups actually increased. This is because the mean number of DMFT declined much faster in children and adults from upper income families (300% or more of the FPL).

In terms of 2040 projections, the decline in the prevalence of dental caries in children and adolescents has stabilized at a very low level over the past ten years and is unlikely to decline much further.[3] This is especially true for those from higher income families (92% of those ages 12 to 18 have no untreated decayed teeth). Furthermore, caries prevalence will continue to decline in adults as cohorts born after 1970 with fewer caries and filled teeth grow older, and reductions in disparities will require improved public dental insurance coverage and reduced social inequalities.

Periodontal disease. In 2009-12, the prevalence of periodontitis in adults was 45.9% with 8.9% having severe disease.[3] The latter condition is mainly seen in adults over the age of 50 years who have not completed high school, have family incomes below 200% of the FPL, and are smokers. The methods used to measure periodontal disease in the NHANES surveys changed over time, so the only comparable data come from the 1988-94 and 1999-2004 surveys. The prevalence of periodontal disease (including severe periodontitis) declined for all major subgroups except for persons living at 100-199% of the FPL. In terms of 2040 projections, the prevalence of periodontal disease is expected to decline, but the number of people with periodontal disease will likely increase.

Complete tooth loss in adults. Complete tooth loss (edentulism) affected 4.9% of U.S. adults aged ≥15 years in 2009-12 (12.2 million people), about one-fourth the prevalence seen half a century earlier.[3] The prevalence of adult edentulism is projected to decline slowly to reach 2.6% in 2050. The decline will be offset only partially by population growth and aging. In 2050, only 8.6 million adults will be edentulous, a 30% reduction from the current number.

Disparities remain a major problem. In 2009-12, the prevalence was 0.6% in high-income households and 12.3% in low-income families.

Partial tooth loss in adults. The mean number of missing teeth plummeted over a four-decade period, with reductions seen in all age and income groups.[3] In 2009-12, people aged 15-54 years in the highest income quartile averaged less than one missing tooth per person, and only 8% had one or more missing teeth. In the lowest income quartile, corresponding figures were 1.5 teeth per person and 27%.

In sum, caries severity in children has declined to historically low levels. This downward trend is carrying over into adulthood for cohorts born since the beginning of the fluoride era in the middle of the 20th century. The prevalence of periodontal disease is slowly declining, and tooth loss has declined dramatically and been virtually eliminated in higher income groups. The social gradient in dental caries, periodontal disease, and tooth loss is widening. The oral health of the upper income population is excellent and will be difficult to improve further without scientific innovations. Oral diseases at the lower end of the income spectrum are substantial and are primarily driven by social determinants such as poverty, education, and personal behaviors. Improvements will require changes in these social determinants as well as greater access to dental care.

Trends in Utilization of Dental Services

Based on studies of dental insurance claims, dentist practices, and national dental expenditures, Eklund reported that the per capita annual receipt of restorations, root canals, crowns, extractions, and most prostheses has declined.[4] Those born since the 1960s received fewer annual restorations and extractions per capita as children and are requiring fewer major dental interventions as adults compared to those born earlier. For adults over age 25, the annual use of restorations of all types, including crowns, declined about 30-35% in the last 21 years. Total extractions and endodontic treatments declined per capita about 20-30% in people in their 30s and above.

Prosthetics care was affected even more profoundly. Across a 21-year span, both fixed bridges and removable partial dentures declined about 50% across virtually all ages.[4] While implants did increase, they accounted for relatively few services. The use of full dentures also declined, and most are replacement dentures for people who became edentulous many decades ago. The effect of these trends on dental practices will be more strongly felt as people from the more recent decades become an ever-increasing part of the patient mix.

In the early 1980s, dentists reported a "busyness problem" caused by a large influx of dental graduates that resulted from federal programs in the 1970s to expand the number and size of dental schools.[4] This problem began to diminish as the Baby Boom group, born between 1946 and the early 1960s, began to make up an increasing part of the adult patient population. These people had historically high levels of dental caries as children, but generally maintained their teeth rather than having them extracted. Also contributing to the high level of demand is the fact that they had relatively high incomes and dental insurance and constituted the largest number per birth year of any group in the U.S. Stated simply, the people with the greatest need for expensive care per capita also had the greatest means to pay for that care, and they were at the time the largest group in the U.S. This large group insulated dentists from the financial effects of the underlying changes that were beginning to affect the need for dental care in the younger population. The Baby Boomers are now declining in numbers and are being replaced by much healthier patients who require less restorative dental care.

It is impossible to know the scope of dental practice in the future. Some dentists are now advertising for patients to treat sleep apnea, provide botox injections, and whiten teeth. There are also calls for dentists to provide more medical and other health-related services. It is questionable if these new services will substitute for traditional dental services. However, at least in terms of restorative services that have been the mainstay of dental education and practice, the caries decline and its continuing and growing effect on the U.S. population suggests that future dentists will be able to manage the needs of more patients than in the past.

Trends in New Technologies

The article by Milgrom and Horst addresses how changes in technology could increase or decrease the demand for dentists by 2040.[5] There are two key areas to explore: what is known about recent or soon-to-be-available technologies, and how long does it take before new technologies become well established in the practice community. By definition, oral care technology is the practical application of

scientific knowledge for the diagnosis, prevention, or treatment of oral diseases. The article focuses on dental caries, periodontitis, and temporomandibular joint disorders (TMD). The first two drive current dental practice, and TMD is a relatively new growth area.

The scientific literature and government registries were examined by Milgrom and Horst to identify recent or soon-to-be-available technologies in these three areas.[5] This search strategy was based on the assumption that any regulated medical device or drug that is close enough to market to have an impact on the demand for dentists in 2040 will be registered in Clinical Trials.gov irrespective of funding source (public or private). Dissemination times were estimated based on a combination of two factors. First is the time it takes to bring a device or drug to market. Thus, only technologies that have reached the Phase II stage are likely to affect the need for dentists in 2040. The second assumption is that the half-life for adoption by dentists of new devices and drugs takes about 20 years.

The review of available databases found that the majority of interventional trials on dental caries were focused on fluorides or filling materials, including sealants.[5] There were also records on xylitol, probiotics, antimicrobials such as chlorhexidine, and two Phase II studies for a specifically targeted antimicrobial peptide caries prevention agent. There were 12 listings for studies involving silver diamine fluoride, including multiple Phase II trials, and 22 studies targeted remineralization of existing cavities. Nearly all of the remineralization studies were in situ or limited clinical studies. The periodontitis trials largely reported on the use of antibiotics as adjunctive therapy in treatment and showed modest, if any differences, in the antibiotic group. The search on TMD produced no reports.

Within the horizon of the next 25 years, emerging technologies will continue to slowly reduce the need for more dentists.[5] There is little reason to expect a new technology that will have a significant impact on the demand for services. In the longer term, two new approaches to managing enamel caries (remineralization and the use of silver diamine fluoride or other antibacterial agents to stop the decay process) are likely to have a profound impact on increasing dentist productivity and, therefore, the supply of dental services. However, these new technologies are expected to have a limited impact within the next 25 years since they are not part of the curricula of all dental schools.

Trends in Practice Organization

Over the past 25-plus years, as reported in the article by Gesko and Bailit, the dominant organizational form for the private practice of medicine has gone from solo to group practice.[6] Indeed, only 18% of U.S. physicians are now in solo practice. The obvious question is: will the private practice of dentistry follow the same trend? While it is premature to make a conclusive assessment of this issue, there is substantial evidence that the percentage of dentists in solo practice is declining. Especially among younger dentists, many are now employed by group practices. In general, large dental group practice companies employ more than 500 full-or part-time employees, have multiple practices, and often operate in more than one state. Many are also licensed insurers and assume the financial risk for providing care, and some are part of medical organizations.

Gesko and Bailit examined the number of patients treated annually per general dentist in large groups versus solo general dental practices.[6] Information on the annual number of patients treated in solo general dental practices came from the 2013 American Dental Association (ADA) Dental Practice Survey. The data on large group practices came from Health Partners (HP) of Minneapolis, Minnesota. HP is a not-for-profit Health Maintenance Organization that provides medical and dental care in the large metropolitan community as well as out-state/rural locations. HP focuses on employer-based private insurance and Medicaid groups and provides care for a fixed amount of money (global budget). It pays employed health professionals based on their productivity (relative value/time units) and adherence to evidence-based clinical guidelines. HP employs 43.5 full-time equivalent general dentists and 69 dental hygienists. The general dentists treat 89,264 patients per year.

The average number of patients per dentist seen annually in solo general dental practices is about 1,350 versus 2,100 in HP.[6] Working approximately the same number of weeks and days annually, HP dentists' average about 700 more patients. The possible reasons for this large difference are the following. First, there is excess capacity in some solo practices because of lower patient demand. In 2014, 40% of solo owner general dentists said they were not busy enough. In large groups, the practices are staffed based on the demand for care. If demand declines, so does the number of employed dentists and dental hygienists. Second, HP employs more dental

hygienists per general dentist than do solo practices. For the latter, 74.6% of solo general dentists employ a dental hygienist. However, most average 22.5 hours per week for 46 weeks per year. In contrast, HP averages about one full-time dental hygienist per general dentist. Third, HP requires employed dentists to follow evidence-based treatment guidelines based on patient risk. For example, caries in the enamel are remineralized rather than restored, and low-risk patients are seen less than every six months. The extent to which solo general dentists follow evidence-based guidelines is unknown, but it is reasonable to assume that HP general dentists provide fewer services to low-risk patients.

A major limitation of the analysis carried out in this article is that the data on large group practices came from one company in one state and was probably not representative of most large group practices.[6] Further, large groups still account for a very small percentage of the dental care provided to patients nationally. However, if current trends continue, it is reasonable to expect that, by 2040, HP-type dental group practices may provide care to 25% or more of privately and publicly insured patients. If, as predicted, CMS moves all Medicaid services to large group practices that work under global budgets (as in the Oregon Medicaid system), the percent of patients could be much higher, which would significantly reduce the need for dentists.

Trends in Demand for Dental Care

As Manski and Meyerhoefer report in their article, the U.S. population is projected to grow to 380 million in 2040 with a significant increase in the elderly and minorities.[7] The percentage of households with income between $35,000 and $74,999 has steadily decreased during the last 50 plus years, suggesting a trend that is likely to continue. In contrast, the percentage of households with income $100,000 and over has increased, resulting in a growing gap between the rich and poor. The overall economy (GDP) is growing about 2.5% per year, much slower than in past years.

Total visits and visits per person have experienced a multiyear decline, but the percentage of the population with at least one visit has remained relatively stable.[7] Controlling for population growth, the per person national dental spending increased with the exception of a decline (1978-81 and 2010-12) and slowing (2003-06 and 2007-10) in several periods. Of the $85 billion spent on personal dental care during 2012, $35 billion was paid by private dental insurance, $4.7 billion was paid by Medicaid, $789 million was paid by Medicare, and $41 billion was paid directly out-of-pocket by patients. The impact of dental care coverage on dental visits is profound. Persons with public dental coverage are more likely to report a dental visit than persons with no coverage, but fall far behind persons with private coverage.

Manski and Meyerhoefer report that two studies have addressed the future demand for dental care.[7] Both used national Medical Expenditure Panel Survey data, but one used visits and the other used expenditures as the dependent variable. Both studies projected that visits and expenditures will increase over the next 25 years, but at a much slower rate than in the past. Several demographic and economic trends are consistent with future increases in dental care utilization and expenditures. The most significant is the projected 19% growth in the U.S. population between 2015 and 2040. Another potential driver of increased utilization is changes in access to dental insurance resulting from the Affordable Care Act (ACA). This includes the Medicaid expansion and mandated pediatric dental coverage in private insurance plans.

A linear predictor was used to estimate total dental visits, dental visits per person, and the population of individuals with at least one dental visit in 2040.[7] Total dental visits were projected to rise very slowly (0.37%/year) from 294 million in 2017 to 319 million in 2040. This is because dental visits per person are projected to continue to drop from 0.92 in 2017 to 0.84 in 2040. The percentage of the population with a dental visit would increase from 42% in 2015 to 44% in 2040. The results from a study of per capita expenditures were similar.[9] Under the least conservative model that takes into account changes in the age and size of the population, the percent increases expected would be 1.25% (2010-20), 0.42% (2020-30), and 0.23% (2030-40). Improved oral health, a decline in private dental insurance coverage, and income inequalities are all possible reasons for the decline. In sum, per capita dental visits and expenditures are expected to continue to grow, but to do so more slowly than in the past (e.g., 3.85% for 1996-2002).

Estimating Dentists Needed in 2040

Eklund and Bailit's consideration of these factors in their article led them to conclude that fewer

dentists may be needed per 1,000 population in 2040 compared to the projected number of about 240,000.[8] Improvements in oral health have already led to substantial declines in restorative and prosthetic services, the traditional mainstay of general dental practice, and this decline is projected to continue as cohorts born after 1970 become the dominant adult patients. At the same time, dentists are expected to slowly become more efficient at treating enamel and dentinal caries, using chemicals to stop the decay process and to remineralize (rather than restore) lesions. Finally, it is likely that more patients will receive care in large group practices that have the capacity to increase the annual number of patients treated per general dentist.

To estimate the number of dentists needed in 2040, we examined the average number of patients treated per year per dentist. Currently, the average full-time solo practitioner treats about 1,350 patients per year, and by 2040 the conservative estimate is 2,000 patients/year.[8] In 2040, the U.S. population will be 380 million. Estimates of the percentage of people with one or more dental visits per year range from 42% to 67%; we consider the former percentage the best estimate. If 42% (160 million people) had at least one dental visit per year, and if dentists averaged 2,000 patients per year in 2040, 80,000 Full-Time Equivalent (FTE) dentists (114,000 full- and part-time dentists) would be needed to provide care to this population. If 67% (255 million people) had at least one dental visit per year, 127,000 FTE dentists would be required. Based on ADA estimates, there would be about 240,000 dentists in 2040, if current trends continue. Some 70% (168,000 dentists) would be in full-time practice. These estimates suggest that a surplus of dentists could vary from 32% to 110%; we find the higher percentage more likely.

Our estimate conflicts with a 2015 report from the Health Resources and Services Administration (HRSA) that there will be a shortage of 15,600 dentists in 2025.[10] Appendix 1 presents the reasons we and others believe the HRSA report is flawed.[11,12] Finally, for several reasons, we find it unlikely that better Medicaid coverage will substantially change the demand for dentists and the surplus problem in the near future. This issue is discussed in Appendix 2.

The primarily limitations of this section are the amount and quality of the available data and the possibility that unforeseen developments could alter predictions of the number of dentists needed in 2040. The six background papers used the best data available at the time, and the articles were prepared by nationally recognized experts. Nevertheless, the likelihood of unforeseen developments is a problem, so this strategic analysis should be updated every few years as new data become available. These limitations are inherent in all strategic analyses.

Policy Implications

If one accepts this analysis, the key policy question would be what to do about the growing national surplus of dentists. One option is to let the marketplace solve whatever problems arise, as it did in the 1980s. That is, market competition would likely result in declining dentist incomes, which, in turn, could reduce the number of dental school applicants. With fewer qualified applicants, some schools may close, and many may downsize. With the average debt of dental school graduates approaching $300,000 and with static or declining dentist incomes, this could be a realistic scenario in my opinion.[13] While the market would clear the excess capacity, it would have an adverse impact on dental graduates and dental school faculty and support staff. Unlike in the 1990s, schools today have little room to further reduce their operating expenses as they downsize, and they are increasingly dependent on student tuition and fees for operating revenues.

Another alternative could be to reduce enrollment before a potential market-based solution occurred, but that strategy would have its own set of challenges. First, what specific changes in dental education could lead to major reductions in students but still keep the basic integrity of dental education in research universities? In Phase 2 of this project, a draft set of recommendations on the future of dental education will be developed and sent to key stakeholder organizations and individuals for review. These reviews will be incorporated into the final project recommendations. Second, it would be difficult to convince dental schools to move in a fundamentally new direction on a voluntary basis. This is because there is no central planning body with control over the decisions of U.S. dental schools. Each school will make decisions that make sense in its own local environment and not on the basis of a potential national problem. To have a meaningful impact, this project will need to produce a compelling report that examines these and other alternatives and makes recommendations that gain the support of major stakeholders.

Editor's Disclosure

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APPENDIX 1

Limitations in HRSA Report on Need for Dentists

The HRSA report[1] is flawed, in my assessment, for two basic reasons. First, it assumed that there is a current balance between the supply and demand for dental care. The HRSA report did not discuss the drop in utilization rates for working adults and the decline in dentists' incomes starting before the 2007-08 recession. Over 30% of dentists now report not being busy enough. This surplus problem is likely to grow as adult utilization rates continue to decline (associated with fewer privately insured and improving oral health).

Second, the report claims that 7,014 additional dentists are needed to provide care to underserved populations in Dental Health Professional Shortage Areas. While there is a large underserved population in the shortage areas, HRSA did not recognize that need will not be turned into demand unless more public funds are available to reduce financial and other access barriers. Simply stated, I would argue that the HRSA report confused the need and the demand for care and, as a result, overestimated the additional dentists needed in 2025 to meet expected demand. Other investigators have come to the same conclusion.[2,3]

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APPENDIX 2

Potential Impact of Expanded Medicaid Coverage on the Need for Dentists

For four basic reasons, my assessment is that better Medicaid coverage may not substantially change the demand for dentists and the surplus problem. First, most low-income children (<250% of the Federal Poverty Level, FPL) are already covered by Medicaid, the Children's Health Insurance Program (CHIP), or private dental insurance, and their utilization has increased substantially in the last ten years. Some of the 11% of low-income children who do not have public dental insurance are eligible for it.[1] The major access problem is uninsured low-income adults. Some 28 states provide reasonably comprehensive adult dental Medicaid benefits, but state enrollment eligibility varies between <100% and 150% of the FPL. Therefore, large numbers of low-income adults (<250% of the FPL) are not enrolled in Medicaid even in states with relatively good dental benefits. If the 22 states with no or limited adult Medicaid benefits offered the average adult benefits of the 28 states, the increase in Medicaid expenditures would be less than $3 billion dollars/year (1.2% increase in 2015 national dental expenditures).[2] The primary reasons for this modest increase are that average adult Medicaid reimbursement rates are low (37.2% of private insurance fees), expensive elective services are not covered, and utilization rates are much less than those seen in privately insured patients.

Second, in the future, the Medicaid population will almost certainly be covered by capitation plans provided by large group practices for medical and dental services. Thus, premiums will be substantially less than those seen in fee-for-service commercial insurance plans. To remain profitable while assuming the financial risk, capitated practice will delegate as many services to allied dental health personnel as possible. They will also seek to change dental practice acts to meet the needs of their delivery model, expand the delivery of community-based care using allied staff, and manage patients based on their level of risk. These changes are already taking place in some states.[3] As a result, even if Medicaid were expanded to cover more adults, this would not translate into a proportional increase in the need for dentists.

Third, it is important to remember that the oral health of low-income Americans continues to improve. Oral health disparities for underserved children are much less than for adults. If these trends continue, the poor will require many fewer services in 2040 than is currently the case. Fourth, the political likelihood of the Trump administration greatly expanding dental Medicaid or Medicare enrollment, benefits, and fees is limited. Current proposals by the majority leadership in Congress (as of June 2017) are to give states a Medicaid block grant, putting great financial pressure on states to cut back Medicaid expenditures for all services and especially dental. The impact of future presidential administrations and congressional actions on health policy is impossible to predict. For the reasons explained here, I believe it is unlikely that increasing enrollment in the dental Medicaid program will have a major impact on the demand for dentists in the next 25 years.

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