

# The Impact of Improved Oral Health on the Utilization of Dental Services

Stephen A. Eklund, DDS, MHSA, DrPH

*Abstract:* Since the mid-20th century, there has been a remarkable decline in dental caries in the United States. The effects of that caries decline have now been demonstrated well into the adult population. These improvements in oral health are resulting in substantial declines in the reparative and restorative dental services being provided to the affected individuals, who comprise a growing part of the population. Because of fewer compromised teeth, extractions and their sequelae also are declining. Much of the recall and periodontal maintenance care can be provided by allied dental personnel. As the older age cohorts, who were children before the caries decline occurred, become an ever-smaller part of the population, the number of patients an individual dentist can treat in a year is likely to increase. This article was written as part of the project “Advancing Dental Education in the 21<sup>st</sup> Century.”

Dr. Eklund is Professor Emeritus, School of Public Health and Adjunct Professor Emeritus, School of Dentistry, University of Michigan. Direct correspondence to Dr. Stephen Eklund, 1609 Brooklyn Avenue, Ann Arbor, MI 48104; saeklund@umich.edu.

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This article traces the remarkable decline in dental caries in the United States since the mid-20<sup>th</sup> century and its effect on reparative and restorative dental services, currently and into the future. This article was written as part of the project “Advancing Dental Education in the 21<sup>st</sup> Century.”

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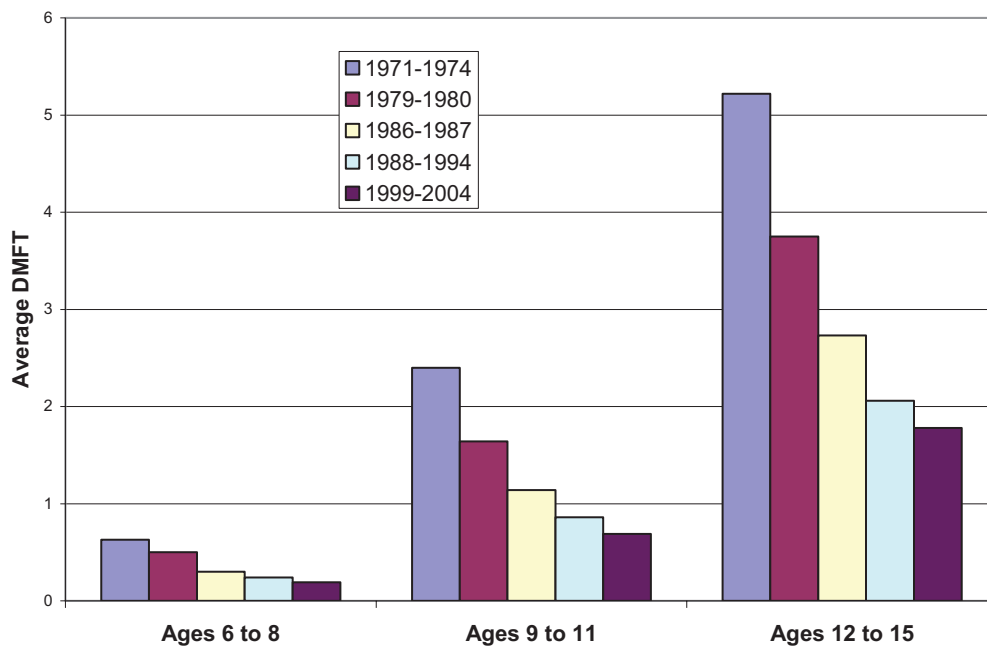
## Decline in Dental Caries and Missing Teeth

In the mid-20<sup>th</sup> century, the accepted wisdom was that dental caries was a disease associated with the most highly developed countries. The highest levels of dental caries were seen in Scandinavia, Australia, and New Zealand, with Western Europe and North America not far behind.<sup>1</sup> Lower levels of caries were associated with poverty and the least developed countries. In the 1960-62 Health Examination Survey conducted by the National Center for Health Statistics (NCHS) among adults in the United States, caries levels were found to be high and largely unchanged from what were assumed to be the historic levels of the previous decades.<sup>2</sup> The same pattern of high levels of caries in children age 12 to 17 was found in an NCHS survey in the late 1960s.<sup>3</sup>

Periodontal disease was also considered to be widespread and a disease that would progress continuously and relentlessly from gingivitis through to inevitable tooth loss unless it was interrupted rigorously and regularly. Loss of all teeth by mid-

adulthood was the norm and was widely expected and accepted. The typical patterns of edentulism in the elderly were described by Ettinger and Beck as being, to a large extent, a product of the life circumstances during which they grew up and became adults.<sup>4</sup> The availability of dental care at the time and the ability of that care to manage patients’ needs undoubtedly played a role. What has since become increasingly clear is that the aggressiveness of dental caries at the time also played a role.

By the early 1980s, signs from a number of locations around the country began to suggest that something may be changing with respect to dental caries in children.<sup>5-8</sup> These reports all showed caries declines in those locations compared to earlier data. These trends were corroborated on the national level by the report from the 1979-80 National Caries Prevalence Survey of U.S. schoolchildren.<sup>9</sup> This survey found a decline in decayed, missing, and filled teeth (DMFT) scores of 32% compared to similar aged children at the time of the 1971-74 first National Health and Nutrition Examination Survey (NHANES).<sup>10</sup> Further reductions in dental caries were then seen with the results from a survey of dental caries in schoolchildren in 1986-87,<sup>11</sup> the third NHANES of 1988-94,<sup>12</sup> and the NHANES of 1999-2004.<sup>13</sup> Figure 1 shows the drop in DMFT levels between the early 1970s and the early 21<sup>st</sup> century. Subsequent reports from national surveys in 2005-08,<sup>14</sup> 2009-10,<sup>15</sup> and 2011-12<sup>16</sup> generally showed that the pattern of declining levels of dental



**Figure 1. Decayed, missing, and filled teeth (DMFT) levels for three age groups, from five national surveys**

Sources: U.S. Public Health Service, National Center for Health Statistics. Decayed, missing, and filled teeth among persons 1-74 years, United States 1971-74. DHHS publication no. (PHS) 81-1678, series 11, no. 223. Washington, DC: U.S. Government Printing Office, 1981; U.S. Public Health Service, National Institute of Dental Research. The prevalence of dental caries in United States children, 1979-80. NIH publication no. 82-2245. Washington, DC: U.S. Government Printing Office, 1981; U.S. Public Health Service, National Institute of Dental Research. Oral health of United States children. NIH publication no. 89-2247. Washington, DC: U.S. Government Printing Office, 1989; and U.S. Department of Health and Human Services, National Center for Health Statistics. Trends in oral health status: United States, 1988-94 and 1999-2004. DHHS publication no. (PHS) 2007-1698, series 11, no. 248. Hyattsville, MD: National Center for Health Statistics, 2007.

caries in children was continuing. The emphasis of these later reports began to shift to the disparities in dental caries and especially disparities in untreated dental caries becoming increasingly evident in the primary teeth of minority populations, rather than on the low overall levels of dental caries and tooth loss. The overall massive decline in dental caries in children has become an accepted fact and no longer the focus of special attention.

Perhaps of equal long-term importance to the decline in dental caries in children since the 1970s is the more recent and growing realization that this decline, along with the consequences of this decline, is beginning to become clear in adults as the cohorts who were children when the declines were beginning have become adults. As the cohorts born in the late 1960s and 1970s were becoming adults, it was evident that they were carrying the benefit of the lower levels of caries, tooth loss, and restorations in

their childhood into early adulthood. At every age, these adults began to show lower DFMT rates than the cohorts that preceded them.

Evidence from national cross-sectional surveys that included adults documented these declines in edentulism and tooth loss. The decline in edentulism was thoroughly explored by Slade et al. in 2014.<sup>17</sup> The decline has been profound: from about 19% of adults (age 15 years and above) in the mid-1950s to about 5% of adults in the 2009-12 period. Slade et al. projected that, by about 2050, the rate will fall further to be between 2% and 3% of the adult population of the United States, an estimate essentially in agreement with one made previously by Burt and Eklund.<sup>18</sup> All these investigators emphasized the important point that the prevalence of tooth loss and edentulism in the adult population is profoundly affected by tooth loss that occurred in the distant past. Those who became edentulous in their 20s will be edentulous

for the remainder of their lives and thus continue to affect the prevalence calculation for the population for many decades to come.

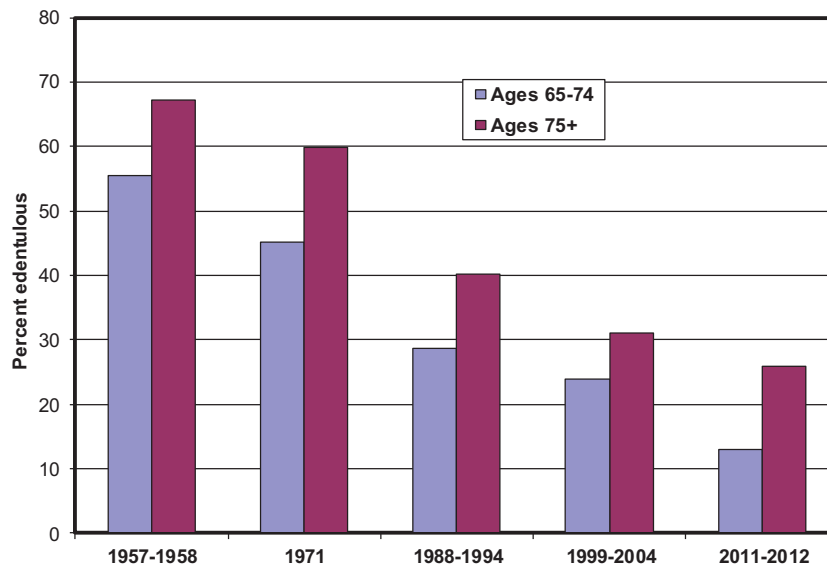
Over the past six decades, even in the oldest age groups, edentulism has rapidly diminished as those who became edentulous in an earlier era are replaced by more recent birth cohorts who have increasingly less tooth loss (Figure 2).<sup>13,19-21</sup> Because the cohorts born in the early part of the 20<sup>th</sup> century were those most likely to have lost teeth, only as they begin to reach an age at which increasing numbers of them have died can the population prevalence reach its lowest levels. Because the cohorts born more recently have been far less likely to lose teeth as they have aged, the net effect has been a reduction in the population values that have now become evident.

In the early part of the 20<sup>th</sup> century, dental care was primitive by today's standards, modern local anesthetics were not available, the theory of "focal infection" was widely accepted, and tooth loss was assumed by both dentists and the public to be an inevitable part of normal aging. Thus, tooth loss was a routine response to many dental complaints, and this

response eventually led to the removal of all teeth and the fabrication of dentures for many. As these underlying factors have changed, acceptance of the routine removal of teeth has also changed. As members of those generations who routinely lost teeth have passed on and been replaced by cohorts who have not routinely lost teeth, the population picture has changed and will continue to do so for decades to come. The well-designed and continuing national surveys have made clear that, in the aggregate in the U.S. population, teeth are being retained and showing far fewer restorations.

## Decline in Utilization of Dental Services

Given the massive changes in the effects of dental caries and tooth loss that are under way, it seems that there should be a corresponding change occurring in the patterns and types of care provided by dentists to their patients. While there is nowhere near the body of evidence for this as is the case for



**Figure 2. Percent of people who were edentulous in two age ranges, from five national surveys**

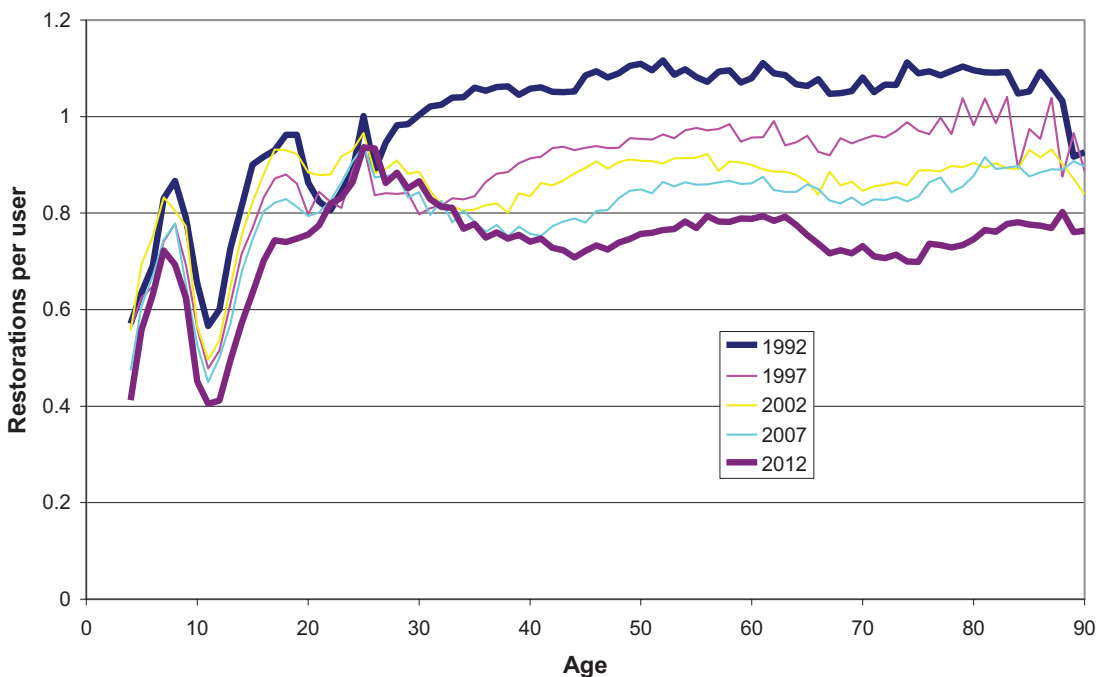
Sources: U.S. Department of Health and Human Services, National Center for Health Statistics. Trends in oral health status: United States, 1988-94 and 1999-2004. DHHS publication no. (PHS) 2007-1698, series 11, no. 248. Hyattsville, MD: National Center for Health Statistics, 2007; U.S. Public Health Service. Loss of teeth, United States, June 1957-June 1958. PHS publication no. 584-b22. Washington, DC: U.S. Government Printing Office, 1960; U.S. Public Health Service, National Center for Health Statistics. Edentulous persons, United States 1971. DHEW publication no. (HRA) 74-1516, series 10, no. 89. Washington, DC: U.S. Government Printing Office, 1974; and Dye BA, Thornton-Evans G, Li X, Iafolla TJ. Dental caries and tooth loss in adults in the United States, 2011-12. NCHS data brief no. 197. Hyattsville, MD: National Center for Health Statistics, 2015.

the underlying conditions, the evidence that does exist is quite consistent.

In analyses of dental insurance claims from Michigan, it is evident that in the past several decades the per capita annual receipt of restorations, endodontic procedures, crowns, extractions, and most prosthetic procedures has declined in a way that is consistent with the patterns of the caries decline.<sup>22,23</sup> Those birth cohorts affected by the caries decline in their childhood years, that is 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 who were children in earlier times. Among adults over age 25 in Michigan, the annual use of restorations of all types, including crowns, declined about 30% in the 21-year period shown in Figure 3, which includes five years of additional data, available since the 2010 publication. The use of crowns in that state declined most, centering between about age 30 and 45, with those born after about 1960 receiving half as many crowns per capita per year at that age than those born just after World War II did at the same age (Figure 4).

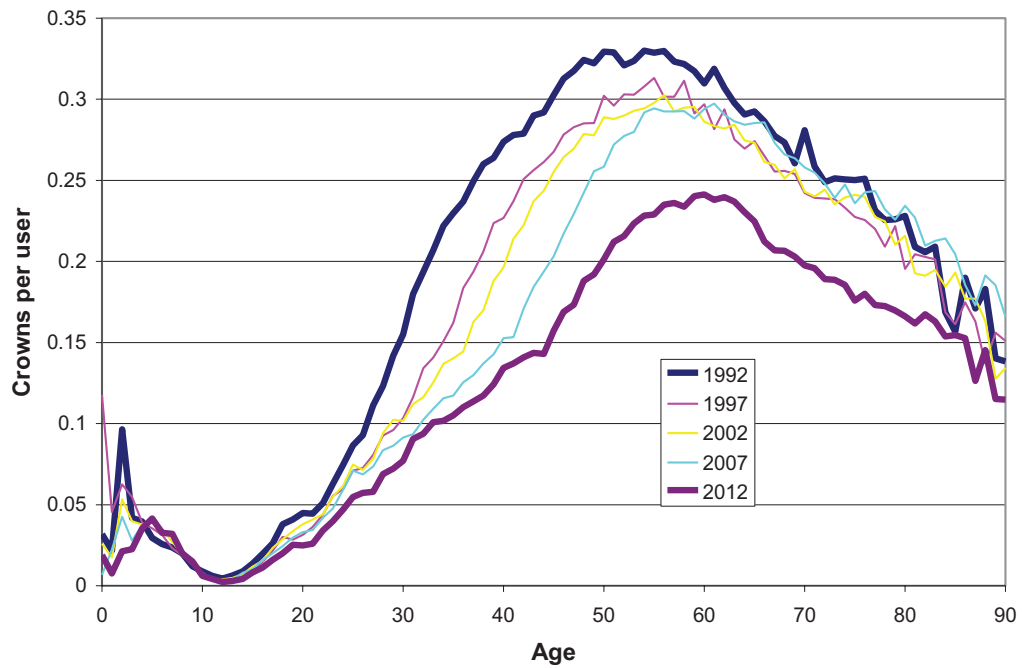
Extractions and endodontic treatments declined per capita in Michigan about 20% and 30%, respectively, in people in their 30s and above between 1992 and 2012, indicating fewer teeth per capita at any given age that were so compromised as to require one or the other of these remedial treatments (Figure 5 and Figure 6). In fact, the most commonly extracted teeth are the third molars in 17- to 20-year-olds, followed by removal of primary teeth around the age of usual exfoliation.

Prosthetics care was affected even more profoundly. Across the 21-year span, per capita use of both fixed bridges and removable partial dentures in Michigan declined about 50% across virtually all ages. Figure 7 shows changes in the count of pontics placed in fixed bridges, and Figure 8 shows the number of removable partial dentures placed, both in that state. While implants did increase, their total number accounted for a very small part of this decline, again demonstrating the tooth loss that would precede one or the other of these services is declining considerably. The drop in the use of full dentures also rapidly declined, and those still placed are being done in ever older individuals, most likely as replacement dentures



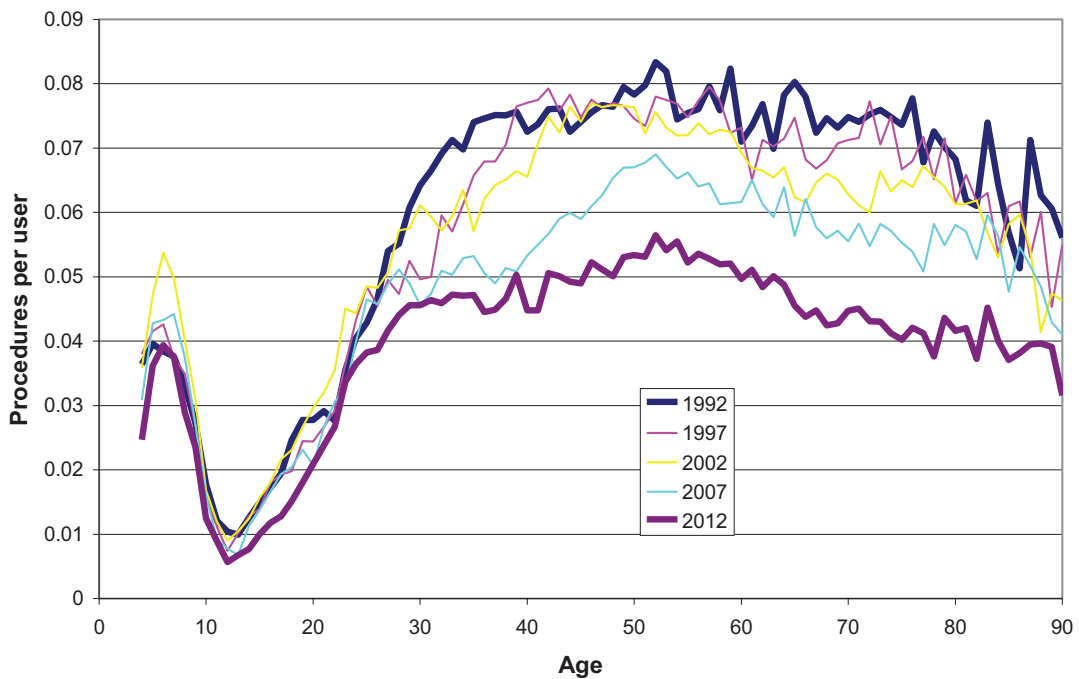
**Figure 3. All restorations per user, various years, in Michigan**

Source: Delta Dental Plan of Michigan claim files analyzed by the author.



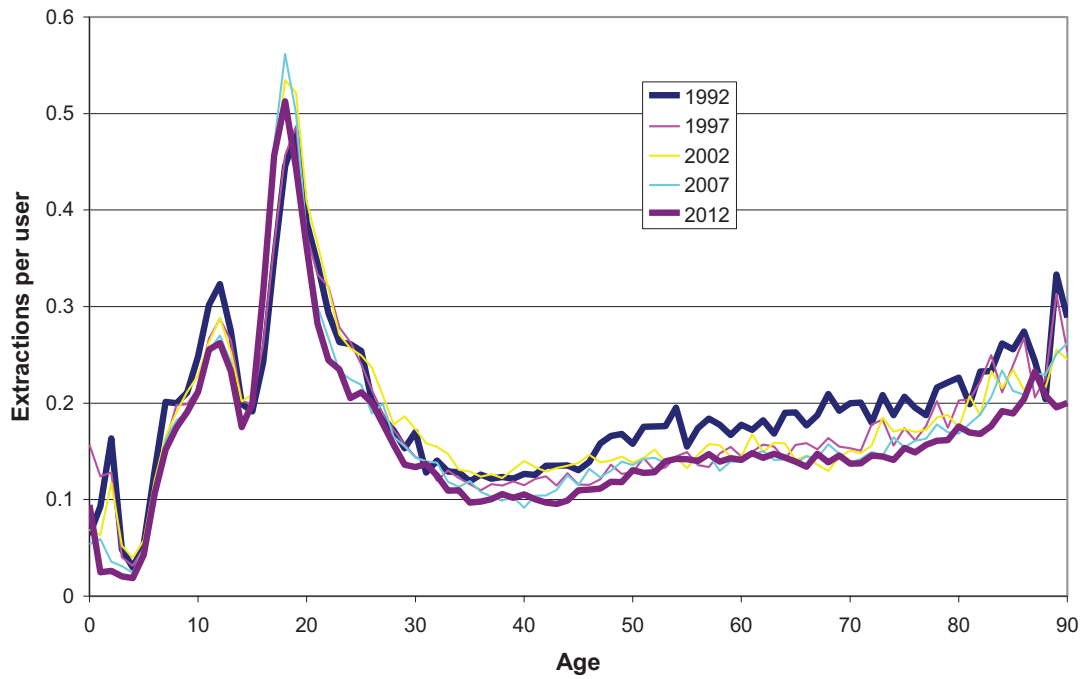
**Figure 4. Crowns per user, various years, in Michigan**

Source: Delta Dental Plan of Michigan claim files analyzed by the author.



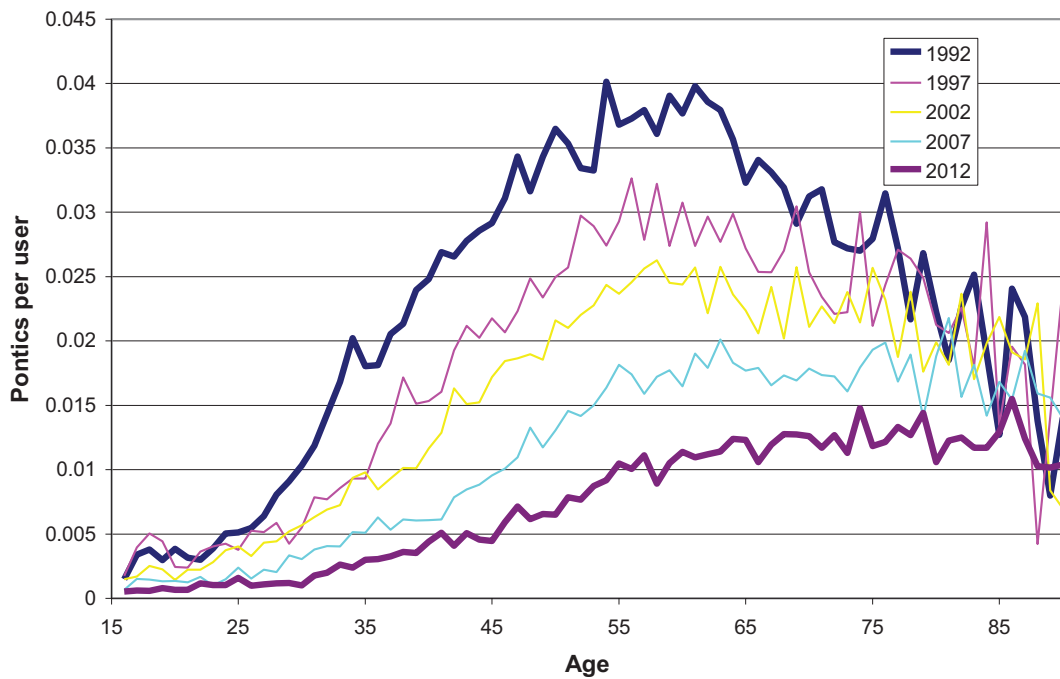
**Figure 5. Endodontic procedures per user, various years, Michigan**

Source: Delta Dental Plan of Michigan claim files analyzed by the author.



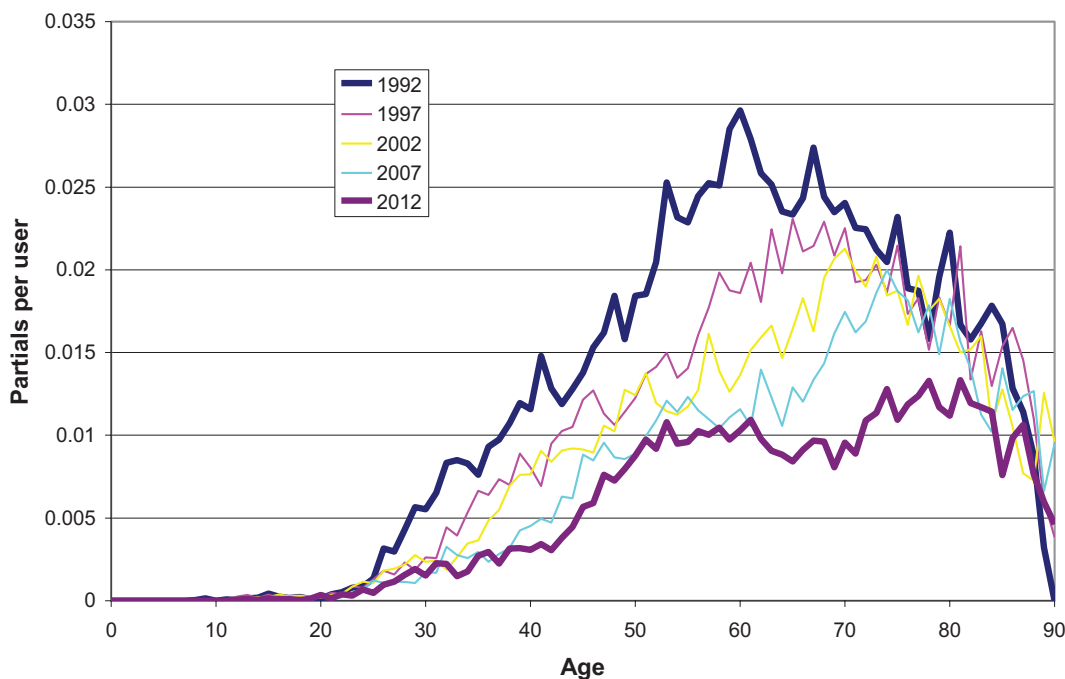
**Figure 6. Extractions per user, various years, in Michigan**

Source: Delta Dental Plan of Michigan claim files analyzed by the author.



**Figure 7. Pontics per user, various years, in Michigan**

Source: Delta Dental Plan of Michigan claim files analyzed by the author.



**Figure 8. Partial dentures per user, various years, in Michigan**

Source: Delta Dental Plan of Michigan claim files analyzed by the author.

for people who had become edentulous many decades ago. The per patient use of full dentures has declined by about 80% across all ages in Michigan (Figure 9). It is unlikely that anywhere near the number of people are becoming newly edentulous today compared to numbers in previous decades. The effect of these trends on dental practices will be most strongly felt as people from more recent decades become an ever-increasing part of the patient mix.

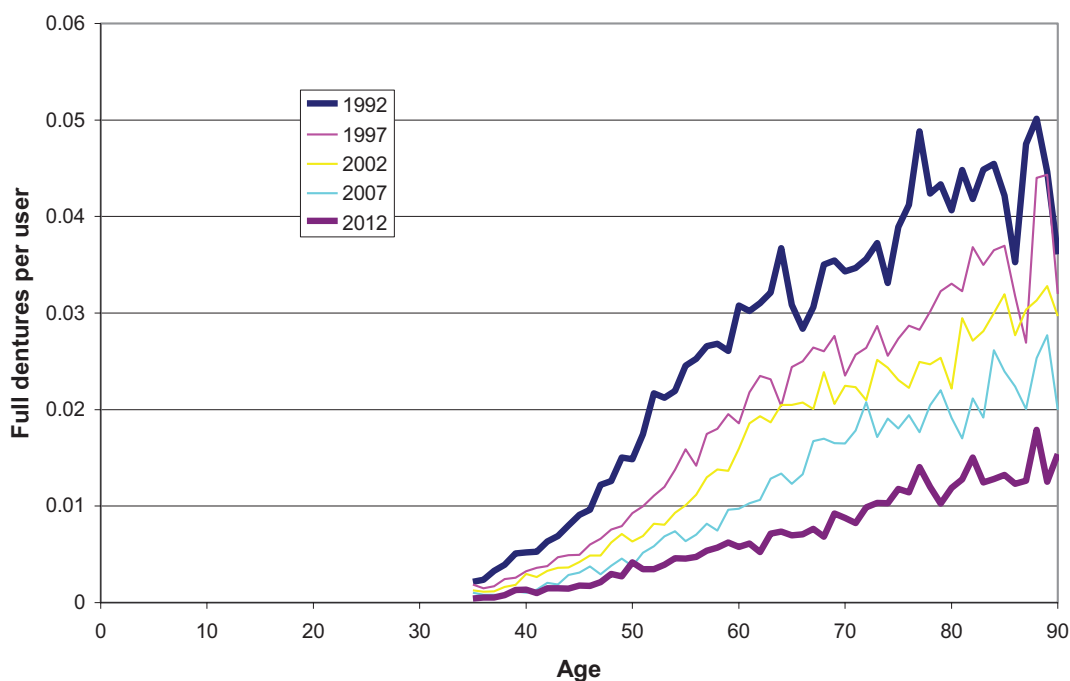
This pattern of a shift in dental treatment subsequent to the earlier-reported decline in dental caries is also evident from a comparison of the 1999 and the 2009 Medical Expenditure Panel Survey.<sup>24,25</sup> These comparisons showed, in both the working age and the 65 and above population, a pattern of decline in number of restorations, endodontic procedures, and most other types of reparative dental procedures between the two surveys. These data from national surveys are especially important because they suggest that the patterns evident in the more detailed insurance data from a single state apply more widely across the country, and they include data from people with and without dental insurance. In effect, the epidemiologic data showing the improvements in oral health are robust, and the more limited measures

of fewer treatments by dentists point in the same direction.

## Effects on Dental Practices

The impact of these changes in dental caries and tooth loss on dental practices has been dependent on their different effects on the various birth cohorts and the age of these cohorts at different times. There was a period in the early 1980s when dentists were reporting what was then termed a “busyness problem.”<sup>26</sup> This was a time when a large influx of newly trained dentists was being produced by new and expanded dental schools that had begun to occur about a decade earlier.<sup>27</sup> The large group of the Baby Boom generation was still in early adulthood, a period of life when individuals are least likely to be visiting dentists. The parents of this Baby Boom generation, on average, were less demanding consumers of dental care, and many had already lost considerable numbers of teeth.

This preoccupation with a busyness problem diminished as the Baby Boom group, born before the mid-1960s, began to make up an increasing part of



**Figure 9. Full dentures per user, various years, in Michigan**

Source: Delta Dental Plan of Michigan claim files analyzed by the author.

the adult patient population. These were the people who had historically high levels of dental caries as children, but generally maintained their teeth rather than having them extracted. Many of them began to have relatively high incomes and insurance over the next decades (later 1980s through the 2010s) and thus were inclined to maintain their dentitions at a high level and had the financial ability to do so. Also contributing to the high level of demand for dental care during that period is that this group born between 1946 and the mid-1960s had the largest number per birth year of any group in the U.S. population.<sup>28</sup> Stated simply, the people with the greatest need for expensive care per capita were also the ones with the greatest means to pay for it, and they were at the time the largest group in the United States. This large group made it likely that many individual dentists were largely insulated from the financial effects of underlying changes that were beginning to affect the need for dental care in the younger population.

Dentists began to report a decline in demand for dental care around the time of or a bit before the economic shock of 2008.<sup>29,30</sup> This trend was widespread across much of the United States. However,

as much of the U.S. economy has recovered, albeit slowly, dentists are still reporting less demand for care. The reasons for this continuing lower level of demand for care is important for the future economic situation for dentists. If any substantial part of the recent reduced demand for dental care is the shift of need levels of the population from the high need group born before about 1970 to the increasingly lower need in adults born since then, the implications could be profound. It may well be that, into the future, each dentist will be able to maintain the desired level of oral health in many more patients per dentist than has been the case in the past decades. The pattern of the caries decline since the early 1970s and the resulting effect of lower treatment needs per capita strongly suggest that the aggregate clinical needs are a matter of needs in each birth cohort, in addition to the more widely understood age effects. These data suggest that, for example, the average 50-year-old patient in a dental practice today has a very different level of restorative need compared to the 50-year-old of 20 years ago. Further, the average 50-year-old of 20 years from now will have even less need for these types of treatment.



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## Conclusion

Cohorts born in the 1930s, 1940s, 1950s, and early 1960s before fluoride use was widespread had high levels of caries as children, but were more likely to avoid extractions compared to earlier cohorts. These heavily restored teeth have required much maintenance care in the past several decades. Demographically, those born after World War II are the largest group in the U.S. population. Dentists in the 1980s through the early 2000s experienced high levels of demand for expensive care from these cohorts. However, under conditions as they currently exist, factors likely to have a substantial effect point in the direction of allowing, indeed perhaps requiring, each dentist to have a larger pool of patients than has been the case for at least the past 50 years.

Among these conditions is the continuing effect of the profound decline in prevalence of dental caries. Much, indeed most, of what dentists have done through virtually all of their existence has to do with the treatment of dental caries and its sequelae. Even though existence of this caries decline has now been known for nearly 40 years, its long-term effect on the adult population has yet to be fully felt. Throughout this 40-year period, the generation who were born before it had begun carried with them the damage done by high levels of dental caries suffered in their childhood. Dentists have spent much time and effort dealing with the maintenance of this group. However, this generation and its related need for regular, extensive, and expensive care will soon be moving out of the picture. That group is already entering its retirement years, and its size will inevitably diminish as each year goes by. The group that has consumed a large part of the attention of the existing population of dentists will largely disappear in the next 30 to 40 years. The cohorts that follow will have a markedly reduced need for extensive dental care. Also, much of their routine recall and preventive periodontal care will likely be handled by allied dental personnel.

It is impossible to know what will be defined as within the scope of dental practice in the future. There is evidence in advertising for such things as sleep apnea treatments, botox injections, and bleaching treatments, among others, provided by dentists. How much scope for these and other kinds of procedures exists within dentistry and whether dentists will be the best source for them will be decided elsewhere. There is no question that there always will be a need for dental care and thus for dentists. Virtually

all people will benefit from some regular care, and some will periodically need substantial care. Even if the barriers that limit access for the underserved can somehow be reduced, the available data suggest that, for both the well-served and the underserved, the average per patient levels of need in the future will be lower than the levels in the past decades. Therefore, on average, at least in terms of the types of oral health care that has been traditionally the mainstay of dental education and practice, the caries decline and its sequelae since the early 1970s and its continuing and growing effect on the U.S. population suggest that the average future dentist will be able to fully manage the needs of many more patients than has been possible in the past.

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## Editor's Disclosure

This article is published in an online-only supplement to the *Journal of Dental Education* as part of a special project that was conducted independently of the American Dental Education Association (ADEA). Manuscripts for this supplement were reviewed by the project's directors and the coordinators of the project's sections and were assessed for general content and formatting by the editorial staff. Any opinions expressed are those of the authors and do not necessarily represent the *Journal of Dental Education* or ADEA.

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