

## Research Article

# Distribution of Treatments by Age of Patients at an Academic Dental Center

Kadhium VS\*, Sharma P, Josan NK, Mhay S, Dault J, Nalliah RP

University of Michigan School of Dentistry, USA

**\*Corresponding Author:** Viyan Sabah Kadhium, University of Michigan School of Dentistry, 1011 N. University, Ann Arbor, MI, 48109, USA

**Received:** 04 May 2022; **Accepted** 12 May 2022; **Published:** 19 May 2022

**Citation:** Kadhium VS, Sharma P, Josan NK, Mhay S, Dault J, Nalliah RP. Distribution of Treatments by Age of Patients at an Academic Dental Center. Dental Research and Oral Health 5 (2022): 011-020.

## Abstract

### Objective

To identify the most common dental treatments in each age group at the University of Michigan School of Dentistry by evaluating electronic health record data at the University of Michigan School of Dentistry clinics.

### Methods

All American Dental Association Code on Dental Procedures and Nomenclature data were extracted from the electronic health record at the University of Michigan School of Dentistry for the period 2014-2020.

### Results

Comprehensive oral examination (D0150) and periodic oral evaluation (D0120) were the most common procedures for age bracket 0-9 years at 1,497 and 1,786 per 10,000 patients respectively. Ages 30-39

experienced a surge in extractions (D7140) (4,680 extractions per 10,000 patients). In age 50-59, adult prophylaxis (D1110) is highest with 9,124 per 10,000 patients

### Conclusions

With proper care and treatment at every stage of life, teeth can stay healthy and strong for a lifetime.

**Keywords:** Lifespan; Epidemiology; Public Health; Access

## 1. Introduction

Most individuals have two sets of teeth in their life: primary (baby) and permanent (adult) teeth. In a baby's first year of life there are many firsts- a first step, first

words and first teeth. A baby's first tooth usually appears around 6 months of age (primary central incisor) [1] and the American Dental Association (ADA) [2] and the American Academy of Pediatric Dentistry (AAPD) [3] currently recommend that all children have their first dental visit after the eruption of their first tooth (6 months) and no later than 12 months. Because cariogenic bacteria (especially mutans streptococci) are transmitted soon after the eruption of the first tooth making primary teeth more susceptible to decay as soon as they appear in the mouth [2,3]. A study showed that the timing of initial detection of mutans streptococci varies between 7 and 36 months [4], and studies have linked mutans streptococci detection to the time period coinciding with the eruption of the primary teeth [5,6]. One of the most common misconceptions about primary teeth is that they are irrelevant to child's future oral health. Primary teeth may be temporary, but they play an important role for the eruption and health of their permanent successors [7,8] and in the function of mastication and phonation<sup>9</sup> and can even instill a sense of confidence. In an 8-year prospective study [10] done in China, the epidemiology of caries in children was observed and they found 94% of the children with carious primary teeth also exhibited carious lesions in their permanent teeth, while 83% of the children with a caries-free primary dentition remained caries-free in the permanent dentition. Early childhood caries (ECC) is a major oral health concern, mainly in socially disadvantaged populations with a prevalence of 85% according to one reported [11]. The main risk factors in the development of ECC can be categorized as microbiological, dietary, and environmental risk factors. The major contributing factors for the high prevalence of ECC are improper feeding practices, familial socioeconomic background, lack of parental education and lack of access to dental care. ECC/dental caries is one of the most prevalent chronic dental diseases in children younger than 6 years old [12,13], in children

aged 6 to 11 years old and adolescents aged 12 to 19 years old [14]. Research has stated and proven the same notion, that poor oral health and dental disease often continue into adulthood [15,16]. According to the Centers for Disease Control (CDC), 26% of adults in the United States (U.S.) have untreated tooth decay, and 46% of all adults aged 30 years or older show signs of gum disease; severe gum disease affects about 9% of adults [17]. Just as oral health conditions change with age, so do the risk factors- social and physical. Dental benefits coverage varies by age. Medicaid and the Children's Health Insurance Program (CHIP) play a vital role in providing American children with health insurance and enrollment varies state to state. In 2017, 46.3 million children were either enrolled in Medicaid or CHIP and as of July 2020, 36.6 million children were enrolled in Medicaid or CHIP [18]. Despite coverage by Medicaid and the Affordable Care Act (ACA) expansion, which covers children's dental care but not adults, access to dental care still poses an issue for children from low-income, minority, and rural communities. In 2014, More than 18 million low-income children went without dental care [19]. In Adults, dental benefits are optional under Medicaid. According to the Health Policy Institute, 59.0% have private dental benefits, 7.4% have dental benefits through Medicaid, and 33.6% do not have dental benefits [20]. Low-income or uninsured adults are twice as likely to have one to three untreated cavities and three times as likely to have four or more untreated cavities as adults with higher incomes or private insurance [21]. Access to care is also an issue across all age groups. As of 2019, only about 43% of dentists in the U.S. accept Medicaid or CHIP [22]. More people are unable to afford dental care than any other types of health care [23]. Older Americans with poorest oral health tend to be those who are economically disadvantaged, lack insurance and are members of ethnic and racial minorities. Being disabled, homebound

or institutionalized (e.g., seniors who live in nursing homes) also increase the risk of poor health. Finally, adults 50 years or more who smoke are less likely to get dental care than people who do not smoke [24]. Another risk factor is underlying chronic conditions that occur with age. About 80% of older adults have at least one chronic condition and 77% have at least two [25]. Diabetes is one of the most common chronic conditions found in adults. In 2018, 34.2 million Americans had diabetes and of those 7.3 million were undiagnosed [26]. There is a bi-directional relationship between diabetes and periodontitis. Diabetes is a major risk factor for periodontal disease and severe periodontal disease also can increase the risk of developing diabetes [27]. Other oral manifestations include- xerostomia; burning sensation in the mouth; impaired/delayed wound healing; and increased incidence and severity of infections [28]. There is evidence that demonstrates a relationship between general health and oral health of patients with diabetes [28,29]. Emerging evidence suggests that poor oral health influences the initiation and/or progression of diseases such as atherosclerosis (with sequelae including myocardial infarction and stroke), neurodegenerative disease (such as Alzheimer's disease, rheumatoid arthritis, and others) [30]. Aspiration of oropharyngeal (including periodontal) bacteria can cause pneumonia, especially in hospitalized patients and the elderly [31]. In 2000, the first Surgeon General's Report on oral health (the second is in progress) made clear that oral health is part of overall health and well- being [30]. Good oral health is critical for effective eating, speaking, smiling, and quality of life. Oral and general health go hand in hand and it's important for patients with chronic conditions to get regular dental visits to prevent negative oral health outcomes. The primary goal of this study is to highlight the most common treatments among different age groups at the University of Michigan School of Dentistry (UOMSOD). By identifying the most

common treatments in each age range, our goal is to determine focused early interventions in earlier age ranges in order to prevent poor oral health outcomes in later age ranges.

## 2. Materials and Methods

This is, primarily, a quasi-experimental evaluation and the overarching goal was to determine the most common treatments in each area and consider opportunities and synergies for optimizing the care of patients in each age group in the U.S. University of Michigan School of Dentistry uses Axium electronic health records which is an Exan product [32]. We extracted all de-identified data of procedures (as documented by ADA CDT treatment codes) delivered between January 2014 to July 2020 in the University of Michigan School of Dentistry clinics. We identified the seven most common treatments in each age bracket 0-9; 10-19; 20-29; 30-39; 40-49; 50-59; 60-69; 70-79; 80-89; 90-99. We did not use any patient identifying data. Our goal is to identify the most common treatments delivered to each age group. The Committee on Human Subjects research evaluated the research proposal and deemed this study as IRB exempt (HUM00188624).

## 3. Results

We summed the total number of visits, ages, and treatments from 2014-2020 to identify the most common treatments in each age range at the University of Michigan School of Dentistry. From 0-9 years of age comprehensive oral examination (D0150) (Figure 1) and periodic oral evaluation (D0120) (Figure 1) were the top procedures at 1,497 and 1,786 per 10,000 patients respectively. For ages 10-19, periodic orthodontic treatment visits (D8670) (figure 2) were the highest with 6,936 visits per 10,000 patients followed by the 20-29 years age group at 631per 10,000 patients. For 20-29 years of age, a comprehensive oral exam (D0150)) was the most common treatment (1,134 per 10,000 patients)

(Figure 1). Ages 30-39 experienced a surge in extractions (D7140) (Figure 2), there were 4,680 extractions per 10,000 patients which all seemed unrelated to orthodontics or wisdom tooth removal. The following age group 40-49 years had 2,530 extractions per 10,000 patients also unrelated to orthodontics or wisdom tooth removal (Figure 2). In ages 50-59, adult prophylaxis (D1110) (Figure 2) was the highest with

9,124 per 10,000 patients. Periodontal maintenance (D4910) (Figure 2) was the most common for ages 60-69 with 525 per 10,000 patients, 70-79 years at 616 per 10,000 patients and 80-89 years at 627 per 10,000 patients. For ages 90-99, extractions (Figure 2) were the most common treatment at a rate of 2,139 extractions per 10,000 patients.

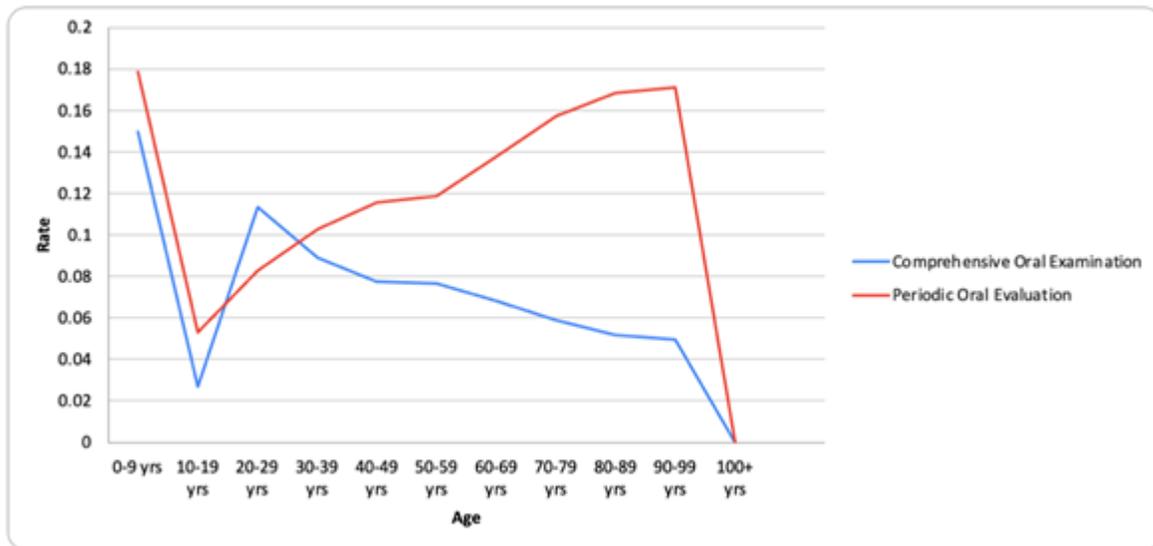


Figure 1: Oral examination

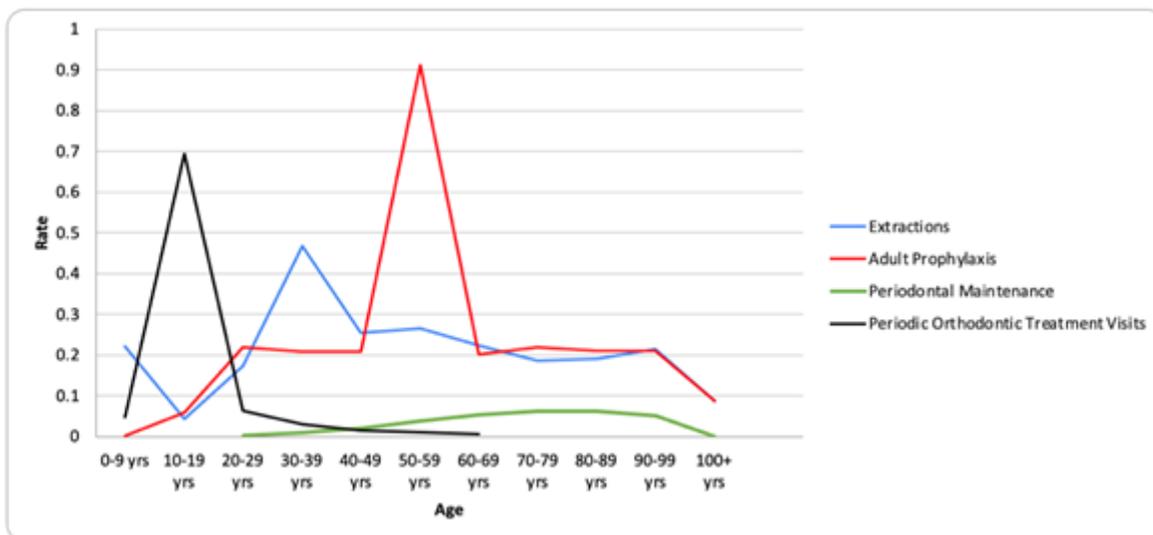


Figure 2: Treatments

#### 4. Discussion

Dental school clinics play a very important role in patient care. According to a 2020-21 ADA report [33], dental students in the US provided 2,349,841 patient visits, 330,656 of which were extramural clinics. The UOMSOD provided the second-highest number of patient visits (100,968) among all U.S. universities. Furthermore, UOMSOD serves 82 of the 83 counties in Michigan [34] and accepts most major dental insurances. Lastly, UOMSOD provides every specialty and has a special care clinic as well as a community health center [35]. UOMSOD, therefore, plays a vital role in the oral health of Michigan. For this reason, our goal was to understand whether we could identify common issues in certain age groups and address them before they arise. Parents play a big role in oral healthcare among children [36]. Furthermore, regular dental visits are important not only to help children create good oral health habits but also to help detect oral health problems early [37,38]. Our study found that for age group 0-9 years of age, comprehensive oral examination and periodic oral evaluation were the top procedures at 1,497 and 1,786 per 10,000 patients, respectively. A 2021 study [39], that looked at patient attendance, failure, and cancellation at the UOMSOD found that children aged under 12 had significantly better attendance compared to other age groups. One reason for this could be linked to the current generation of parents-millennials [40]. Millennial parents are more likely to invest in their children's oral healthcare compared to their boomer parents [41]. According to a survey done by the AAPD, 29% of millennial parents are more likely to take their child to the dentist by age 1 than any other generation [42]. Another reason could be because of insurance. Under the ACA, all children under the age of 19 must be covered by dental insurance, it one of the ten essential health benefits [43]. Lastly, Michigan and a few other states are now

requiring parents to provide some form of certification of a dental screening, examination, or assessment prior to elementary and/or high school [44,45]. Our study found that the most common treatment for 20-29 years of age was a comprehensive oral exam at a rate of 1,134 per 10,000 patients. One possible reason for this low rate could be due to insurance and income. According to the Michigan Household Survey on Health Insurance [46], adults aged 20-29 have the highest rate of lack of insurance (26%), and more than a quarter of the uninsured live below the poverty line. While the UOMSOD does provide dental services at a lower cost compared to market prices [47], like most dental schools [48], and has a check-up clinic that offers basic cleaning and x-rays for \$102 [49], the minimum wage in the state of Michigan is \$9.87 [50]. Even these prices, therefore, can be expensive for low-income individuals. According to one study, two of the top three reasons for not visiting a dentist for adults ages 18-34, were cost and lack of time to get a dentist; 35.7%, and 28.4%, respectively [51]. Furthermore, in Michigan's Medicaid plan, adult dental benefits are limited [52], which could explain why the most common treatment was a comprehensive oral exam, which is included in the plan. This can be a problem because untreated oral health problems, such as caries and periodontitis, may lead to tooth loss [53]. Interestingly, we found that adults aged 30-39 and 40-49 experienced a surge in routine extractions that were unrelated to orthodontics or wisdom tooth removal: 4,680 extractions per 10,000 patients and 2,530 extractions per 10,000 patients, respectively. According to one study done in 1997 and most likely still hold true to today, most patients receiving care at dental schools are low-income [54]. In 2020, 13% of Michigan residents lived below the poverty line [55]. The high rate of extractions among this age group could thus

be due to the relationship between income and tooth loss, which many studies have shown [56,57]. Another reason could be untreated tooth decay, given that, as previously stated, the rate of comprehensive oral exams was low among those aged 20-29, and untreated tooth decay can lead to tooth loss [58]. Gingivitis is the most basic form of gum disease and is treatable through periodontal maintenance which includes personal and professional care. But, if left untreated can advance to periodontitis, the more severe form of gum disease [59]. Regular dental check-ups help to prevent or control the disease. Our study showed that adult prophylaxis (D1110) was the highest in ages 50–59, with 9,124 per 10,000 patients. Periodontal maintenance (D4910) was most common among those aged 60–69, 70–79, and 80–89, with 525 per 10,000 patients, 616 per 10,000 patients, and 627 per 10,000 patients, respectively. This high rate of adult prophylaxis for ages 50–59 may be a result of the fact that this age group is still covered by Medicaid, which provides prophylaxis twice a year in Michigan. The low rates of periodontal maintenance from ages 60 to 89 could be due to the lack of dental insurance for those aged 65 or older. Medicare only covers medically necessary dental procedures [60] and according to a report done by the National Poll on Healthy Aging, just 53% of people over the age of 65 have dental coverage, while the other half have no dental coverage [61]. A possible reason for periodontal maintenance being the top procedure among those aged 55–64 could be that periodontal disease tends to relate to age. According to the CDC, 70.1% of adults aged 65 or older have periodontal disease [62]. One study that estimated the prevalence, severity, and extent of periodontitis in the USA found that 47.2% of residents have mild, moderate, or severe periodontitis and that the prevalence rates increase to 70.1% for adults aged 65 or older [63]. Furthermore, older

patients are more likely to develop chronic conditions [64] that can affect their periodontal health, like diabetes, a weakened immune system, neurodegenerative disease, and heredity increases the risk of developing periodontal disease as they age [65]. Lastly, another reason could be lack of regular dental visits. Rosén et al. [66] found that patients who didn't visit a dentist at least once annually were more susceptible to periodontal progression. In severe cases, periodontitis can lead to tooth loss [67]. In our study, we found that extractions were the most common treatment for ages 90-99, at a rate of 2,139 extractions per 10,000 patients. A contributing factor for tooth loss in this age group is medication, which commonly causes xerostomia [68]. About 89% adults 65 and older report they are currently taking prescription medicine [69] and more than 400 commonly used drugs have xerostomia as one of their side effects [70]. Findings of a 2013 screening done on senior citizens living in Michigan showed that 17% of seniors suffered from severe dry mouth (xerostomia), 17% had untreated tooth decay, and 13% had root fragments. Lastly, a decline in cognitive function (e.g., Alzheimer's) may be another reason. According to the Alzheimer's association, Alzheimer's is a growing public health crisis in Michigan - 190,000 people aged 65 and older have Alzheimer's disease in Michigan. There are many studies showing the link between dementia and tooth loss.

## 5. Conclusion

Poor oral health is largely preventable through regular annual dental visits to help maintain teeth. Interventions that enhance access to prevention in the 20-29 age group could improve oral health outcomes and tooth preservation. Similarly, enhanced access to periodontal specific preventive care in ages 50-59 may reduce or delay the onset of periodontal disease

which also has implications for systemic health. With proper care and treatment at every stage of life, teeth can stay healthy and strong for a lifetime. Proper maintenance of oral health is very important and should be started young because it influences future oral health conditions.

### Conflict of interest

All authors agree to no conflict of interest.

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