

# An Analysis of Utah's Emergency Department Non-traumatic Dental Visits 2007-2017

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# Acknowledgements

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# Executive Summary

The Utah Department of Health (UDOH) Oral Health Program (OHP) conducted an analysis of data from oral health care visits made to Utah emergency rooms between 2007 and 2017. Nearly 52 million dollars was spent in emergency departments (ED) for dental care related to non-traumatic and preventable diagnoses during this time period. In 2002, Dr. David Satcher, former U.S. Surgeon General stated, “. . . we have come to recognize that the mouth is a mirror of the body, it is a sentinel of disease, and it is critical to overall health and well-being.”

The primary objective of this analysis was to assess the charges and visits for dental-related ED visits to all Utah hospitals. Additionally, charges and visits were assessed following stratification by hospital geographic location (i.e., urban and rural), primary diagnosis, patient age, primary payers, and race/ethnicity. This data can be used to inform discussions concerning solutions to target the problem of patients visiting the ED, which cannot adequately treat for dental issues, rather than accessing dental care directly. Some possible solutions include cost-effective treatment such as teledentistry, urgent care facilities for dental visits, and preventive dental care in the primary care setting. Additional solutions are discussed later in this report.

The intent of sharing the results of this analysis is to gather stakeholders at the same table to discuss strategies about oral health in Utah. This data offers a unique opportunity for stakeholders to tackle these challenges in the most informed fashion possible. Additionally, it may encourage thinking outside the box, as solutions will require greater collaboration and innovative approaches from members both inside and outside the oral health community. Ultimately, the data is indicative of a much broader and far-reaching problem, demonstrating the need for oral health to be more fully addressed in Utah.

In Utah, between 2007 and 2017, there were nearly 56,000 admissions to EDs for dental visits, resulting in charges of nearly 52 million dollars. Since EDs are not generally equipped to provide comprehensive dental services, most of these patients were simply treated for pain and/or infection, not the source of the actual dental complaint.

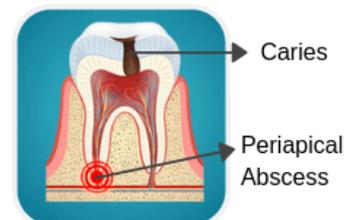
Of these nearly 56,000 admissions, the highest number of visits and dollars spent came from the working age population, ages 20-64. This was found in both rural and urban areas. The number one payer for this age group was self pay, or no charge, and or the patient was uninsured. For children ages 0-19 years, the number one payer was Medicaid/CHIP, which covers comprehensive dental care. For seniors ages 65 and older, the number one payer method was Medicare, which does not include a dental benefit. These findings are only the tip of the iceberg; a small representation of unmet oral health needs.

# Introduction

Between 2007 and 2017 in Utah, dental care related to non-traumatic and preventable diagnoses was responsible for nearly 52 million dollars in charges in the ED. Oral health is a critical component to overall health, with poor oral health being associated with increased use of health care services and increased risk for chronic diseases such as heart disease and diabetes.<sup>1,2</sup> Along with a connection to other diseases, oral health can impact time at work and school. Nationally, an estimated 51 million hours of instructional time per year is lost in schools due to dental decay.<sup>3</sup> Additionally, oral health issues result in the loss of approximately 160 million employee work hours nationally each year.<sup>4,5</sup> The World Health Organization and the FDI World Dental Federation identify oral disease as one of the most common non-communicable diseases (NCDs) affecting children and adults; however, dental decay is mostly preventable with routine dental visits and at home care.<sup>6,7</sup>

In the United States, 32% of adults ages 20-44 were reported to have untreated dental decay in 2016.<sup>8</sup> That same year, 27% of adults in Utah reported they had not seen a dentist the previous year.<sup>9</sup> Due to the availability of quality care and the likelihood of continuity of care, patients who present at an ED for a non-traumatic dental condition would be better served in a dental office.<sup>10</sup> Additionally, between 2008 and 2010, ED visits for non-traumatic dental conditions averaged \$760 per visit nationally. This method of treatment is ineffective in terms of cost, resources, and health outcomes.<sup>11</sup>

Individuals who do not receive preventive dental care and ED visits are not the only concerns related to hospital admission. In 2007, 7,886 hospitalizations in the United States were due to endodontic abscesses (infection at the tip of the root of the tooth), at a cost of 100 million dollars.<sup>12</sup> These abscesses commonly occur secondary to dental cavities and periodontitis (gum disease), all of which are preventable.<sup>13</sup> Additionally, these abscesses can lead to severe complications including sepsis, hemorrhage, and even death.<sup>14-16</sup>



For more information on definitions of diagnosis see Appendix A

The data clearly show a need for improvements in Utah's oral health issues. Patients who do not receive routine dental care experience negative health and financial outcomes related to this lack of care. Due to the gaps in the current system, "outside-the-box" thinking is encouraged while integrating oral health into other health systems.

# Purpose

The primary objective of this study was to assess the rate of dental-related ED visits to all Utah hospitals between 2007 and 2017, as well as financial charges associated with those visits. It is hoped these results will provide a basis for discussion by stakeholders (e.g., policymakers, health professionals, and legislators) regarding oral health in Utah and how to address Utah's unmet oral health needs. This data can be used to inform discussions regarding solutions to target this problem such as cost-effective treatment including teledentistry, urgent care facilities for dental visits, and preventive dental care in the primary care setting.



# Methods

## Data

This study was conducted as a retrospective analysis of Utah residents who were admitted to a Utah ED for an oral health-related issue, between 2007 and 2017. All Utah residents who were admitted to the ED with a primary diagnosis of a preventable oral health-related issue (non-traumatic) were included in the analysis. Utah Hospital Discharge Data were obtained from the Utah Department of Health (UDOH) Office of Health Care Statistics. Data elements provided include time of visit, patient age category (i.e., 0-19 years, 20-64 years, and 65 years and older), patient ZIP code (used to identify Utah residence), ICD-9 or ICD-10 diagnostic codes, source of payment (e.g., private health insurance, government funded, or self-pay), total charges for visit, race, ethnicity, and discharge status (e.g., home, admitted inpatient, or skilled nursing facility). Visits during non-regular business hours were defined as occurring from 6 p.m. to 7 a.m. However, day of the week was unavailable in the dataset. Thus, visits that occurred on weekends were not included as a non-regular business hour visit.

The specific list of ICD-9 and ICD-10 codes was selected to identify preventable dental diagnoses and did not include oral health visits related to accidents or trauma, i.e., not preventable. These codes were selected following review of the literature and consultation with the state dental director, who is a dentist, and used to identify patients with an oral health-related primary diagnosis to be included in analyses (Appendix B).<sup>17</sup> Following inclusion and exclusion criteria to select the study sample, these codes were then grouped into five categories: dental caries (from this point on referred to as cavities), cellulitis, periapical abscess with sinus, periapical abscess without sinus, and periapical or periodontal pathology (e.g., chronic apical periodontitis, acute gingivitis, periodontitis, and gingival recession). Appendix A outlines diagnosis definitions.

## Analysis

Frequencies and rates of oral health-related ED visits in Utah were calculated for each year, overall, and stratified by geographic location of hospital for patient age, payer, race, and ethnicity. Additionally, rates of primary payer by patient race/ethnicity were calculated. Population estimates for adjusted-rate calculations were obtained from the U.S. Census Bureau.<sup>18</sup> Cost comparisons between rural and urban hospitals were calculated as an average cost per visit. Hospital rural or non-rural status was defined in alignment with HRSA's census-based definitions.<sup>19</sup> In Utah, there are 21 hospitals (13 critical access and eight noncritical access) defined as rural under these guidelines. Of the 46 Utah facilities that admitted Utahns for emergency oral health-related complaints, 45.7% occurred in rural hospital settings.<sup>20</sup> The frequency of visits that occurred during non-regular business hours was also calculated. This data was analyzed using SAS Software Version 9.4.<sup>21</sup>

# Key Findings

Between 2007 and 2017, 55,239 people went to an ED in Utah hospitals for oral health-related issues. Of these visits, 9,921 of these were to rural hospitals (18.0%); however, Utah's rural population accounted for only 14.4% of the state's total population during that same time. (Appendix C, Table 1 shows a complete breakdown of admissions stratified by groups).

## Who Is Going To The ED For Non-traumatic Oral Health Visits?

### Who is visiting the most?

Overall, the working age group, 20-64 years of age, displayed the highest rate of ED visits for oral health-related diagnoses. A majority of the 55,239 visits to the ED for oral health diagnoses were from this age group (86.3% or 47,567). Visits among this age group represent a rate of 268.9 oral health ED visits per 100,000 population. Although it is not quantified in the analysis, the working age group almost certainly would have incurred indirect costs in loss of hours of work and productivity, which may impact Utah's economy as a whole.<sup>4,5</sup> Rural areas also have higher rates of ED visits among the working-age population.



# Key Findings

## Race/Ethnicity

The analysis also calculated ED admission rates by patient race/ethnicity. These rates were calculated as a rate of admission per 100,000 population by race/ethnicity (Figure 1). Among the racial and ethnic groups analyzed, people who are Black/African American had the highest rate of visits to the ED for oral health-related complaints. For every 100,000 Black/African American residents in Utah, about 350 went to the ED between 2007 and 2017 for an oral health-related visit. By comparison, people who are Native Hawaiian/Pacific Islander had the lowest rate among racial/ethnic groups analyzed, with 40 visits for every 100,000 Native Hawaiian/Pacific Islander Utah residents.

### Oral Health ED Visits by Race/Ethnicity

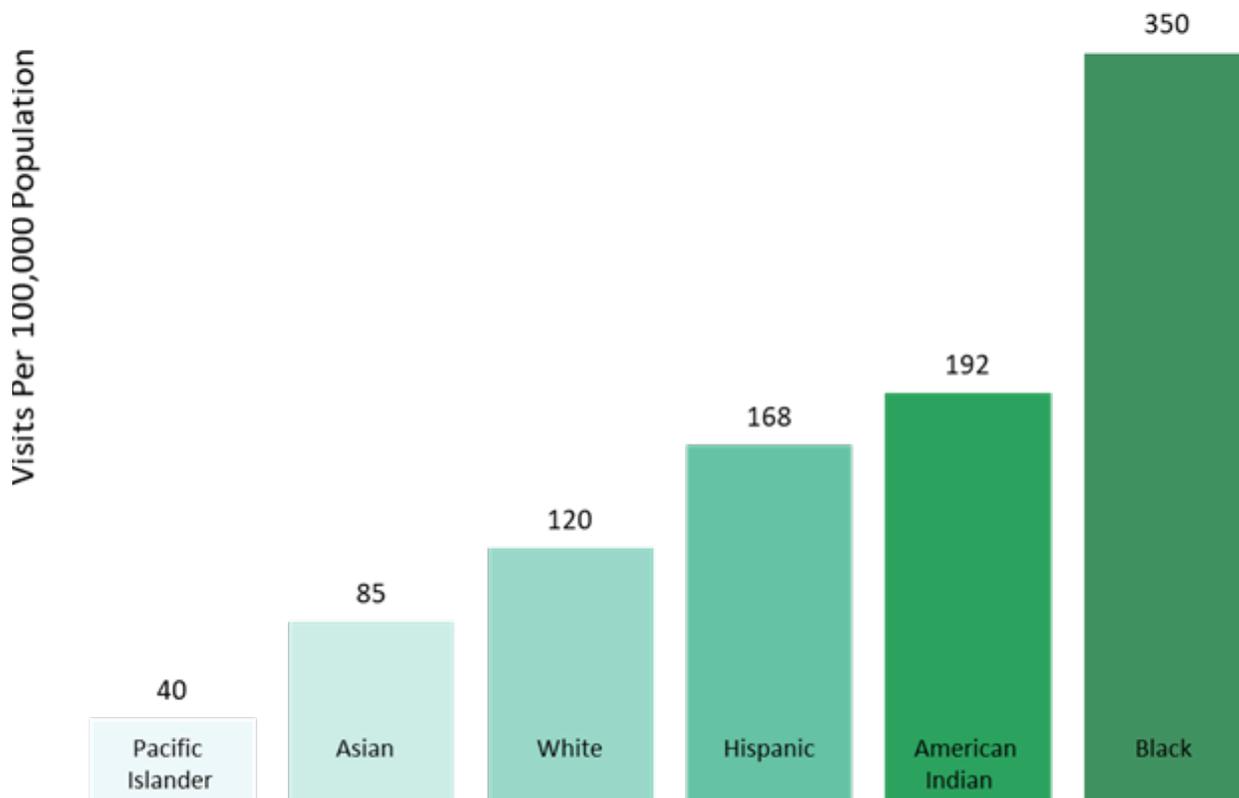


Figure 1. Oral Health ED visits per 100,000 population between 2007-2017, by race/ethnicity.

Note. Rates were adjusted by population estimates for patient race/ethnicity; See Table 1 for frequencies.

# Key Findings

## Geographic location of admitting hospital (i.e., rural vs. urban)

Between 2007 and 2017, ED admission rates by age were calculated for both urban and rural hospitals. These age-adjusted rates were calculated as a rate of admission per 100,000 population; either rural or urban (Figure 2). Figure 2 displays a consistent rate of admissions comparing urban and rural hospitals for individuals in two age categories, 0-19, and 65 years of age and older. However, for individuals ages 20-64, individuals presented to rural EDs for oral health-related issues at a higher rate than non-rural hospitals. For example, in rural hospitals in 2017, about 345 of every 100,000 individuals ages 20-64 and living in a rural county in Utah, went to an ED for an oral health-related visit. By comparison, individuals in non-rural counties visited an ED for an oral health-related complaint at a rate of 249 out of every 100,000 individuals. This was a consistent trend during the study period.

### Oral Health ED Visits Occurred at a Higher Rate in Rural Hospitals vs. Non-Rural Hospitals

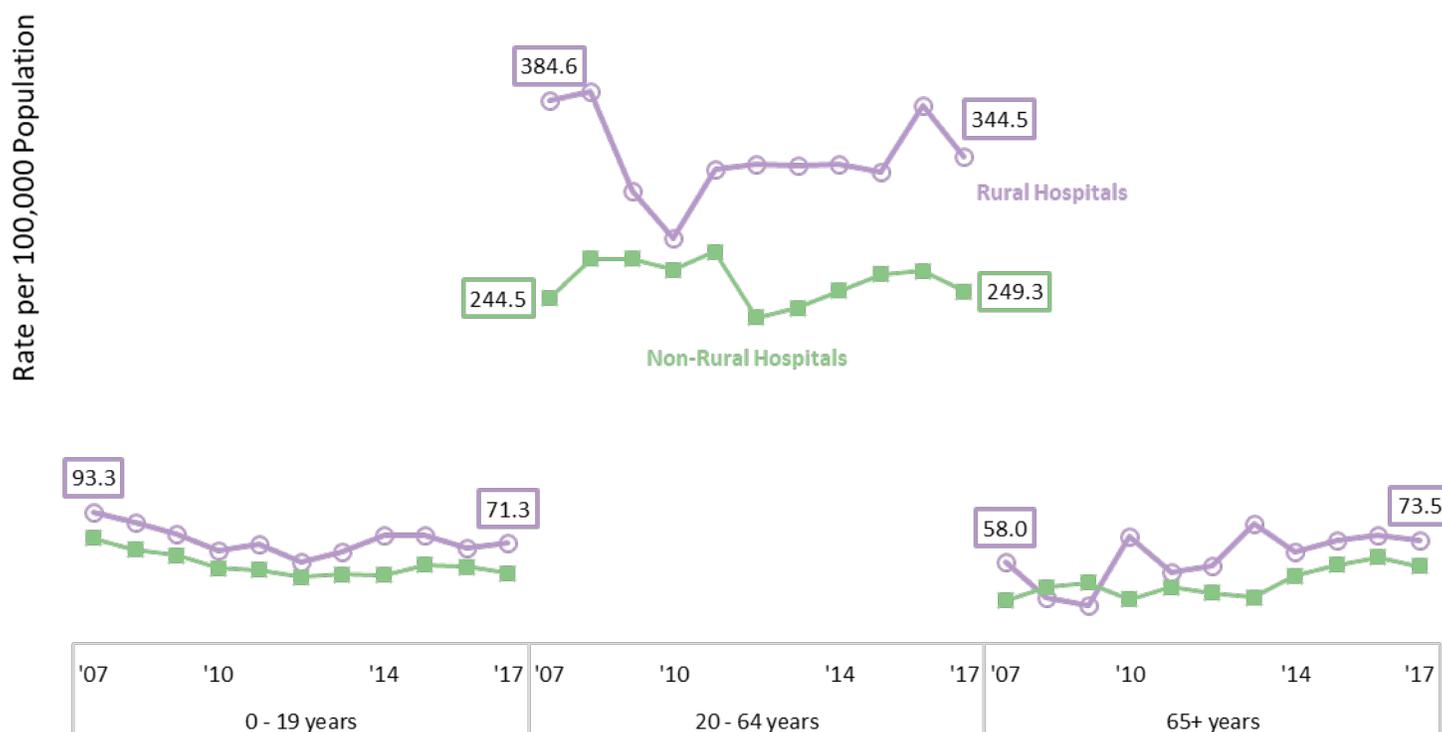


Figure 2. Age-adjusted rates of oral health ED visits per 100,000 population between 2007-2017.

Note. Rates were adjusted by population estimates for patient age and geographic residence; See Table 1 for frequencies.

# Key Findings

## Primary payer by patient age group

Primary payer was also stratified by age due to the availability of coverage from public insurance for different ages. Percentages were calculated based on total charges, only where the primary payer was known.

For children ages 0-19, more than 4.7 million dollars was spent on oral health visits to the ED. Medicaid/CHIP covered 45.7% of charges, private health insurance covered 38%, and 13.8% were self-pay/no charge. Of particular interest to this discussion is the fact that Medicaid covers comprehensive dental for children ages 0-19.

Patients ages 20-64 had the highest rate of visits overall. More than 44.8 million dollars was spent on oral health visits for this age group. The number one payer for these patients was self-pay/no charge, which covered 37.5% of the charges, Medicaid covered 28.9%, and private health insurance covered 25.2%. In conjunction with these direct costs, there were also indirect costs, such as loss of work and productivity in the community.

Between 2007 and 2017, more than two million dollars was spent on oral health ED visits for patients ages 65 and older. Medicare was the number one payer method at 84.3% of charges for oral health-related ED visits.



# Key Findings

## Charges for Oral Health ED Visits by Primary Payers

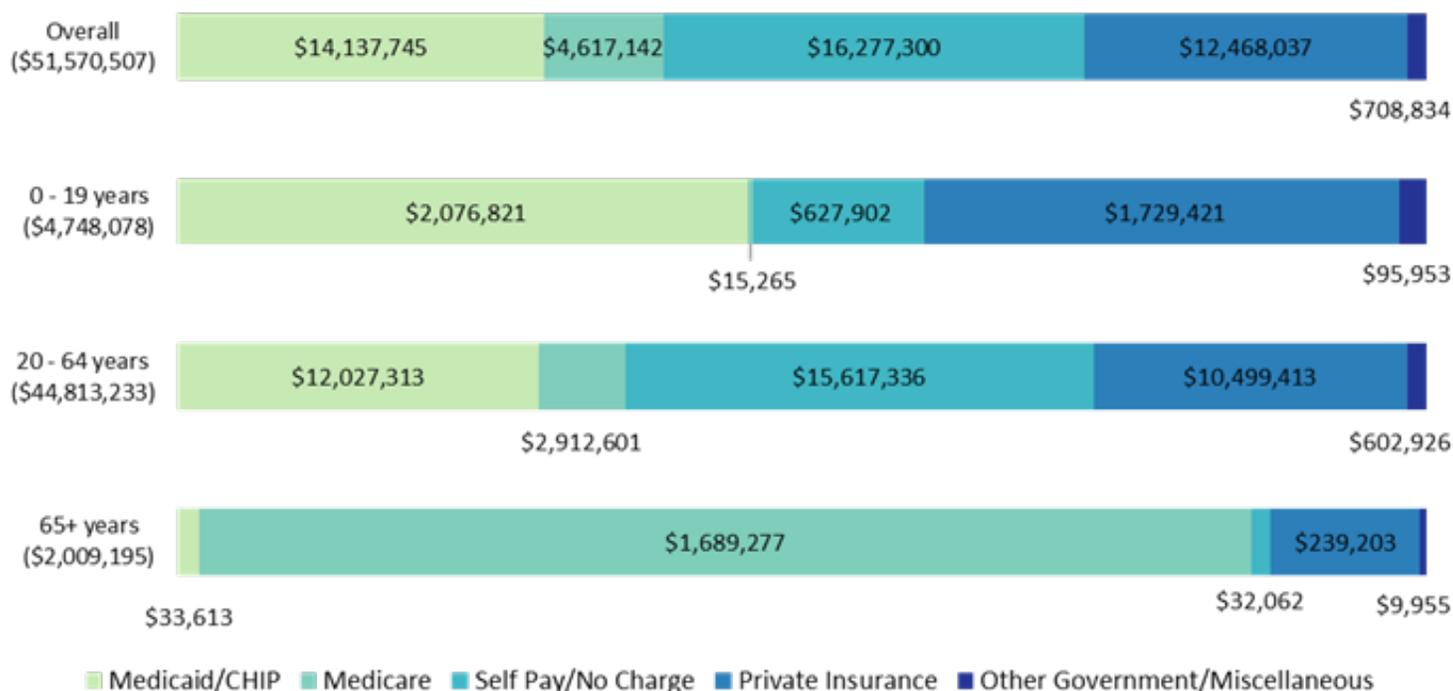


Figure 3. Primary payer for oral health ED visits between 2007-2017, by age group.

Note. Totals include charges where payer was unknown and not represented in the graph; See Table 1 for frequencies.

# Key Findings

## What Was The Average Cost For Each Emergency Department Visit?

Overall, between 2007 and 2017, the average cost for an ED visit for an oral health-related diagnosis was \$1,033. Figure 4 indicates that for both non-rural and rural hospitals, the average cost per visit increased annually. The annual percentage change of average cost per visit from 2007 to 2017 in rural hospitals was 14.1% [95% CI = 11.9% to 16.4%] and 11.8% in non-rural hospitals [95% CI = 10.9% to 12.7%]. Although, non-rural hospitals displayed consistently higher costs per visit for oral health ED visits compared with rural hospitals. Thus, although the average cost per visit was lower at rural hospitals compared with non-rural hospitals, the average cost per visit for rural hospitals increased at a higher rate.

### Average Cost Per Visit for Oral Health Related ED Visits was Higher in Non-Rural vs. Rural Hospitals

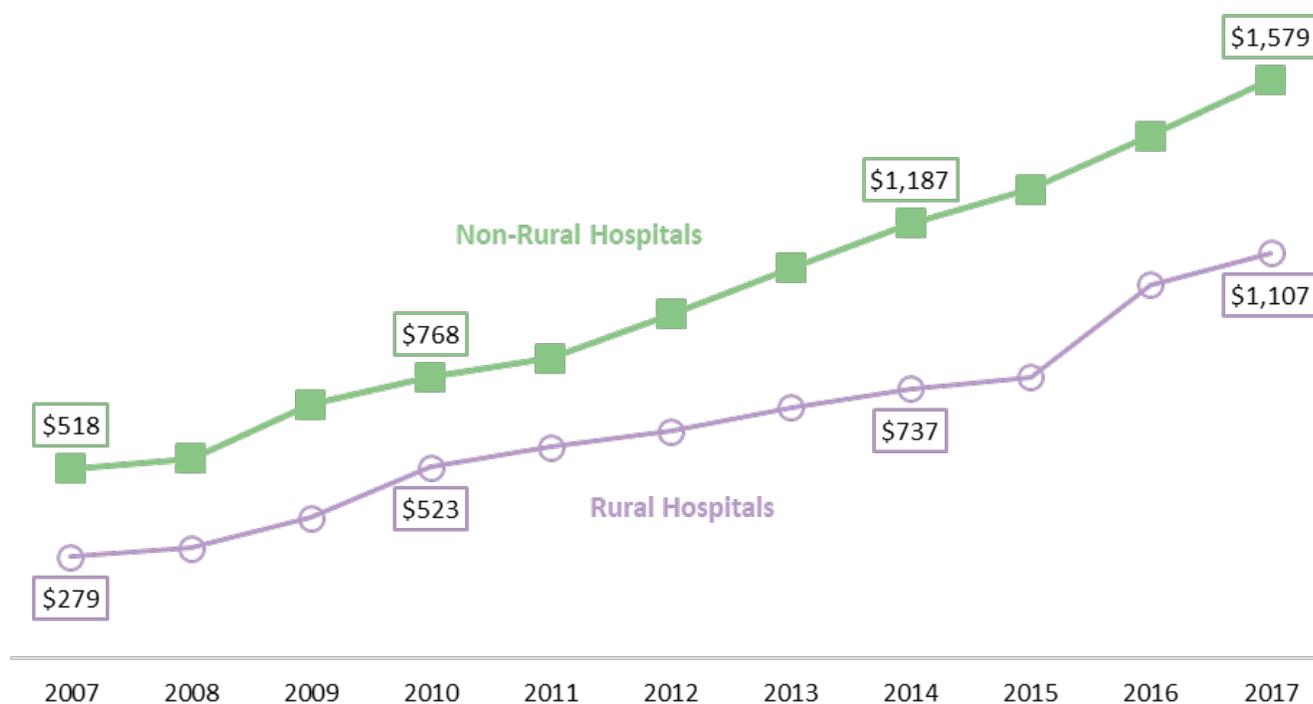


Figure 4. Average cost per oral health ED visit between 2007-2017, by hospital geographic region.

# Key Findings

## Why Are People Going To The ED For Oral Health Issues?

The average cost per oral health visit was calculated by diagnosis and geographic location of hospital (Figure 5). The most common primary diagnosis across all ages was periapical abscess without sinus (infection at the tip of the root of the tooth), followed by dental cavities (Figure 6). On average, for all diagnoses included in this analysis, oral health-related ED visits cost more in non-rural hospitals compared with rural hospitals.

### Average Cost Per Oral Health ED Visit was Higher in Non-Rural vs. Rural Hospitals

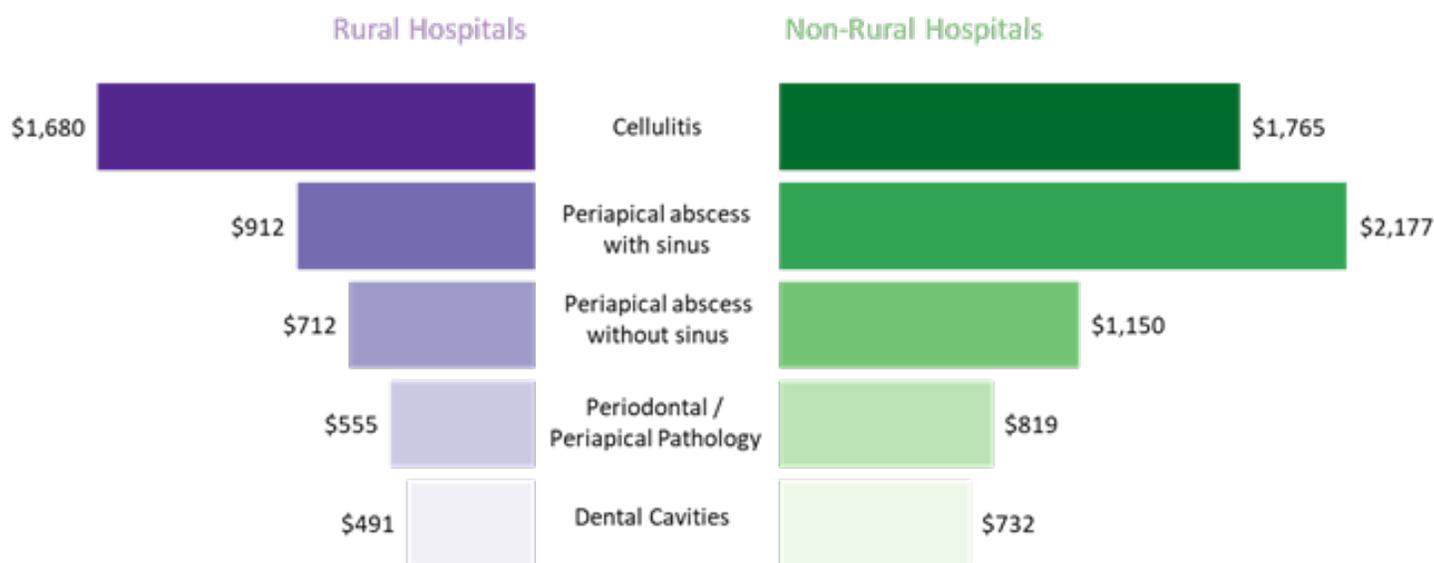


Figure 5. Average cost per ED visit for non-traumatic oral health primary diagnoses between 2007-2017, by hospital geographic location.

# Key Findings

## When Are People Going To The ED For Oral Health Issues?

Of the oral health-related ED visits that occurred between 2007 and 2017 (n = 55,239), the majority of the visits occurred around 1:30 p.m. The analysis also calculated the frequency of visits during non-business hours. Of the 55,239 visits, 48.4% occurred after regular business hours (i.e., between 6:00 p.m. and 7:00 a.m.). The day of the week is not included in this report. Thus, the frequency of visits during non-business hours is likely an underestimation as visits on Saturdays and Sundays were not included. According to the American Dental Association, about 67% of dental visits to the ED occur outside regular business hours.<sup>23</sup>

### Primary Diagnosis for Oral Health ED Visits

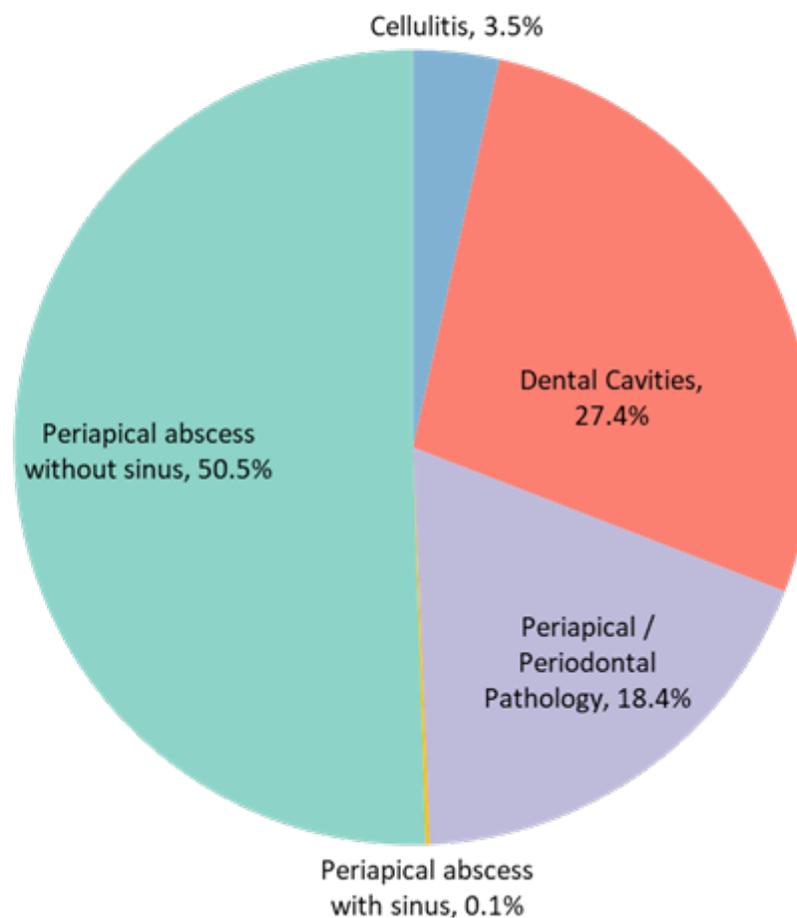


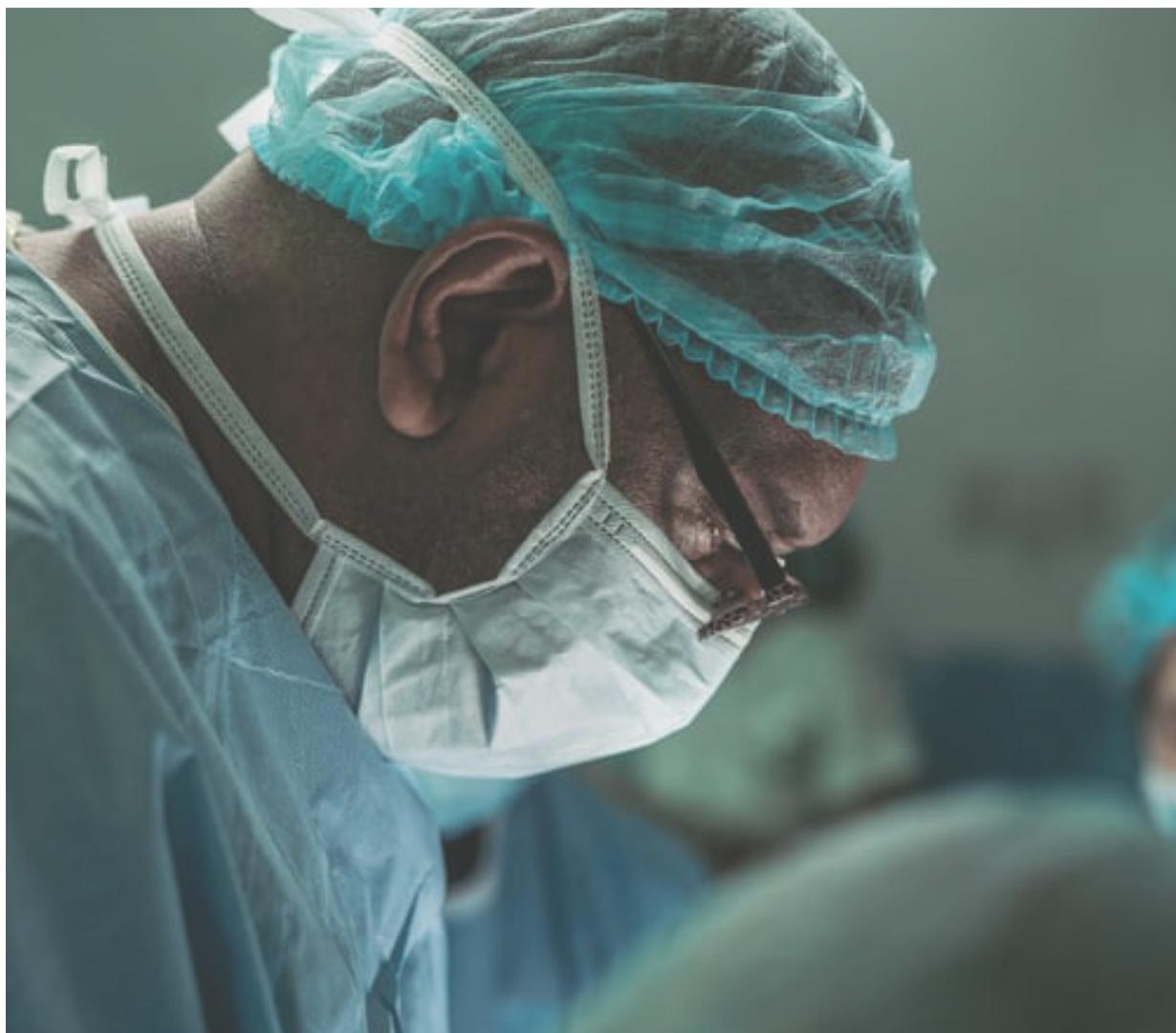
Figure 6. Primary diagnosis for oral health ED visits between 2007-2017.

Note. See Table 1 for frequencies.

# Key Findings

## Where Are People Going Following ED Admissions For Oral Health Issues?

This study also analyzed discharge status of the 54,659 patients who visited Utah hospitals for oral health-related complaints, whose discharge status was known. Overall, 99.4% of patients were discharged home and 137 were admitted for inpatient care (0.3%). Additionally, during this study period, one individual expired following admission to the ED for an oral health-related visit. The primary diagnosis for this individual at admission to the ED was for a periapical abscess without sinus.



# Discussion

## Possible Contributing Factors

### Challenges with insurance coverage and access to dental care in Utah

Individuals with private dental insurance are more likely to follow the standard recommendation of receiving a preventive dental visit every six months.<sup>24</sup> For families and individuals without dental insurance, preventive dental care can become a challenge. The more high-risk or vulnerable the person, the greater the challenges. Over the last few decades, dental coverage for Utah adults enrolled in Medicaid has been sporadic and inconsistent. Other states have seen increases in oral health-related visits to EDs following elimination of Medicaid dental benefits.<sup>25</sup>

### Access to dental care in Utah

Approximately 54% of people in Utah reside in a dental Health Professional Shortage Area (HPSA).<sup>19</sup> HPSAs are determined based upon multiple factors including the population-to-provider ratio, travel time and distance to the nearest source of accessible care, and the percentage of the patient population at 100% of the Federal Poverty Line (FPL) or below. For dental care, an additional factor considered for HPSA includes water fluoridation.

#### Some challenges with rural areas include:

- Lack of dental providers
- Transportation to care
- Many residents in rural areas are on Medicaid which does not cover adult dental care
- Little, if any, community water fluoridation in rural areas in Utah<sup>26</sup>
- Higher levels of poverty and individuals who are uninsured or underinsured<sup>27</sup>
- Finding child care
- No after-hours clinics
- Cost of dental care

# Discussion

**Jen Sadoff, Hospital Administrator of Moab Regional Hospital stated the following regarding this report:**

*I am an advocate in increasing access to data that will help healthcare organizations prioritize their limited resources to impact community health. There are many visits to Moab Regional Hospital's emergency department every year for preventable dental issues.*

*There are direct costs to the hospital for providing uncompensated care in the emergency department for preventable dental issues. However, there are also indirect costs that continue to impact the hospital and the patient long after the visit is over. Dental issues can lead to days lost at work or school, the impact of which directly contributes to the cycle of intergenerational poverty. If we want to find a way to deliver more value in healthcare, we need to move upstream in our delivery. The ability to access data on the utilization of healthcare for dental issues will help us target populations and make community health initiatives more effective.*

Individuals who reside in Utah's more urban areas experience many of the same challenges present in rural areas, along with a few additional issues. For example, along with transportation, a patient might have a hard time finding interpretation services or navigating the health care system if he or she is a refugee or has not been to the dentist before.

## Economic Challenges

During 2016-2017, 23% of pregnant women in Utah who needed to see a dentist regarding an oral health problem, said they could not afford to go to the dentist.<sup>28</sup> Many people, such as the aging population, live on fixed incomes. In 2017, 70.1% of adults in the United States aged 65 years of age and older did not have dental insurance.<sup>29</sup> This lack of insurance coverage can result in individuals having to choose between paying an electric bill, rent, or treatment for a toothache. By having to choose, older adults often delay seeking necessary treatment, which can result in a trip to the ED. This disparity of unmet dental needs was even more pronounced in aging people who are Hispanic and non-Hispanic black people.<sup>29</sup>

# Discussion

## What can be done about these challenges?

Many of the excessive costs of ED-related oral health visits are preventable with routine dental care. Additionally, efforts to increase dental coverage and care may have significant positive effects on the physical and mental well-being of many individuals.

### Policy changes and programs that could impact or be adapted to address these issues in Utah

- Increase after-hours dental clinics.<sup>30</sup> According to the American Dental Association, about 67% of dental visits to the ED occur outside regular business hours.<sup>23</sup> In this sample, after-hours ED visits accounted for 48.4% of visits. Following the implementation of a pilot program at one ED in Virginia where patients were referred to an urgent care clinic following triage, the ED noted a reduction of oral health ED visits by 52% during the first year and a 66% percent reduction in repeat admissions for individual patients.<sup>30</sup>
- Integrate oral health into primary care settings. Children who have dental services performed during a well-child visit are more likely to have a preventive dental visit.<sup>31</sup> This practice is associated with a decreased risk of dental cavities in children.<sup>32</sup> Children are more likely to see a pediatrician or family doctor before they see a dentist.
- The American Academy of Pediatrics has created an Oral Health Risk Assessment Tool (OHRA) that can be used in the primary care setting in addition to providing training of the placement of fluoride varnish for high-risk populations.<sup>33,34</sup> This can be used on children, as well as modified for aging adults. According to the U.S. Preventive Services Task Force (USPSTF), recommendations for primary care providers are made to provide fluoride supplements to those who live in areas of non-community water fluoridation (CWF).<sup>35</sup> It's also recommended primary care providers treat the primary teeth of all infants and children with fluoride varnish starting with the first tooth up to age five.<sup>35</sup>

# Discussion

- Increase areas with community water fluoridation. Studies show a decreased risk of dental decay in areas that provide community water fluoridation.<sup>36</sup>
- Increase cooperation between dental hygienists/dentists and teledentistry in public health settings such as long-term care facilities and homebound and school-based programs.<sup>37</sup> Teledentistry in other states has demonstrated, through the use of technology, it is possible to facilitate the connection between provider and patients, decreasing access issues.<sup>37</sup> Teledentistry has even been incorporated into the curriculum at multiple dental schools around the country.<sup>37</sup>
- Implement comprehensive adult dental Medicaid coverage, which is associated with decreased charges from EDs for oral health-related diagnoses.<sup>25</sup> Following elimination of adult dental Medicaid coverage, California experienced an annual increase of 68% in charges for oral health-related ED visits.<sup>25</sup>
- Increased Medicaid reimbursement by multiple states resulted in more provider enrollment and increased patient utilization.<sup>38</sup>
- Professionals practicing at the top of the scope of their licenses, such as dental hygienists, are associated with positive oral health outcomes.<sup>39</sup> For example, effective 2015, in collaboration with a dentist, hygienists in Utah have provided care to vulnerable populations in public health settings.
- Implement the practice of dental therapy.<sup>40</sup> In 2015, the Commission on Dental Accreditation (CODA) approved accreditation standards for dental therapy educational training programs.<sup>41</sup> Therapists are members of the dental team who provide preventive and restorative care to vulnerable populations. Programs in other states have utilized dental therapy to serve vulnerable individuals and families by improving access to care. Specifically, since the reimbursement rate for a dental therapist is lower than the rate for a dentist, this practice helps reach those covered by Medicaid.<sup>40</sup>

# Conclusion

Utahns who rely on public assistance such as Medicaid and CHIP and those who are uninsured, who must self-pay for ED visits make up a majority of the burden of cost for ED dental visits. This report displays evidence of a severe expense to individuals, families, and communities for preventable dental conditions. The present analysis did not include calculation of indirect costs such as missed time from work or school, although these costs have been previously documented.<sup>3-5</sup> Policymakers are encouraged to use this data and these conclusions to improve access to care for high-risk populations. The hope, in sharing this data, is to encourage the implementation of ideas to lower health care costs, improve access to care, and encourage diverse health care systems to work together. In turn, these efforts may help create a collective impact, ultimately minimizing this costly problem. Finally, this report displays a much broader and more extensive problem, demonstrating the need for oral health to be further addressed in Utah.

# References

1. Lee PH, McGrath CP, Kong AY, Lam TH. Self-report poor oral health and chronic diseases: the Hong Kong FAMILY Project. *Community Dent Oral Epidemiol.* 2013;41(5):451-8.
2. VanWormer JJ, Acharya A, Greenlee RT, Nieto FJ. Oral hygiene and cardiometabolic disease risk in the survey of the health of Wisconsin. *Community Dent Oral Epidemiol.* 2013;41(4):374-84.
3. Gift HC. Oral health outcomes research-challenges and opportunities. *Measuring oral health and quality of life.* 1997:25-46.
4. Reisine ST. Dental Disease and Work Loss. *Journal of Dental Research.* 1984;63(9):1158 - 61.
5. Gift HC, Reisine ST, Larach DC. The Social Impact of Dental Problems and Visits. *American Journal of Public Health.* 1992;82(12):1663 - 8.
6. Petersen PE. The World Oral Health Report 2013: Continuous improvement of oral health in the 21st century - the approach of the WHO Global Oral Health Programme. World Health Organization. *Oral Health Programme Noncommunicable Disease Prevention and Health Promotion.*; 2003.
7. The Challenge of Oral Disease - A call for global action. 2015.
8. Centers for Disease Control and Prevention (CDC). National Center for Health Statistics (NCHS). National Health and Nutrition Examination Survey Data. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2016.
9. Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2016.
10. Okunseri C, Okunseri E, Thorpe JM, Xiang Q, Szabo A. Patient characteristics and trends in nontraumatic dental condition visits to emergency departments in the United States. *Clin Cosmet Investig Dent.* 2012;4:1-7.
11. Allareddy V, Rampa S, Lee MK, Allareddy V, Nalliah RP. Hospital-based emergency department visits involving dental conditions: profile and predictors of poor outcomes and resource utilization. *J Am Dent Assoc.* 2014;145(4):331-7.
12. Allareddy V, Lin CY, Shah A, Lee MK, Nalliah R, Elangovan S, et al. Outcomes in Patients Hospitalized for Periapical Abscess in the United States. *J Am Dent Assoc.* 2010;141(9):1107-16.
13. Chavez de Paz LE. Redefining the persistent infection in root canals: possible role of biofilm communities. *J Endod.* 2007;33(6):652-62.
14. Wong T-Y. A nationwide survey of deaths from oral and maxillofacial infections: The Taiwanese experience. *Journal of Oral and Maxillofacial Surgery.* 1999;57(11):1297-9.
15. Green AW, Flower EA, New NE. Mortality associated with odontogenic infection! *British Dental Journal.* 2001;190(10):529-30.
16. Baqain ZH, Newman L, Hyde N. How serious are oral infections? *The Journal of Laryngology & Otology.* 2004;118(7):561-5.
17. Manz MC. Recommended Guidelines for Surveillance of Non-Traumatic Dental Care in Emergency Departments. Reno, NV: Association of State and Territorial Dental Directors; 2017.
18. Single-race Population Estimates, United States, 2010-2017. July 1st resident population by state, county, age, sex, single-race, and Hispanic origin, on CDC WONDER Online Database. Vintage 2017 estimates released by U.S. Census Bureau on June 21, 2018.
19. Defining Rural Population: HRSA - Health Resources & Services Administration; 2018 [Available from: <https://www.hrsa.gov/rural-health/about-us/definition/index.html>].
20. Rural Hospitals Map: Utah Department of Health: Office of Primary Care & Rural Health; [Available from: <https://ruralhealth.health.utah.gov/portal/rural-hospitals-map/>].
21. SAS [computer program]. Version 9.4 ed. Cary, NC: SAS Institute Inc.; 2014.
22. Medicaid U. Medicaid Services for Optional Adult Dental Services: Utah Department of Health; 2017.

# References

23. Wall T, Nasseh K, Vujicic M. Majority of Dental-Related Emergency Department Visits Lack Urgency and Can Be Diverted to Dental Offices. Health Policy Institute Research Brief. American Dental Association. 2014.
24. Manski RJ, Brown E. Dental Use, Expenses, Private Dental Coverage, and Changes, 1996 and 2004. Rockville, MD: Agency for Healthcare Research and Quality; 2007. MEPS Chartbook No. 17.
25. Singhal A, Caplan DJ, Jones MP, Momany ET, Kuthy RA, Buresh CT, et al. Eliminating Medicaid adult dental coverage in California led to increased dental emergency visits and associated costs. Health Aff (Millwood). 2015;34(5):749-56.
26. My Water's Fluoride (MWF): Centers for Disease Control and Prevention; [Available from: [https://nccd.cdc.gov/DOH\\_MWF/Default/WaterSystemList.aspx](https://nccd.cdc.gov/DOH_MWF/Default/WaterSystemList.aspx)].
27. Barriers to Oral Healthcare in Rural Communities: Rural Health Information Hub; [Available from: <https://www.ruralhealthinfo.org/toolkits/oral-health/1/barriers>].
28. Utah Pregnancy Risk Assessment Monitoring System (PRAMS) 2016 - 2017.
29. Kramarow EA. Dental Care Among Adults Aged 65 and Over, 2017. NCHS Data Brief. No. 337. U.S. Department of Health and Human Services. Centers for Disease Control and Prevention. National Center for Health Statistics; 2019.
30. McCormick AP, Abubaker AO, Laskin DM, Gonzales MS, Garland S. Reducing the Burden of Dental Patients on the Busy Hospital Emergency Department. Journal of Oral and Maxillofacial Surgery. 2013;71(3):475-8.
31. Tiwari T, Rai N, Brow A, Tranby EP, Boynes SG. Association between Medical Well-Child Visits and Dental Preventive Visits: A Big Data Report. JDR Clin Trans Res. 2019;4(3):239-45.
32. Kressin NR, Nunn ME, Singh H, Orner MB, Pbert L, Hayes C, et al. Pediatric clinicians can help reduce rates of early childhood caries: effects of a practice based intervention. Med Care. 2009;47(11):1121-8.
33. Ramos-Gomez FJ, Crystal YO, Ng MW, Crall JJ, Featherstone JDB. Pediatric Dental Care: Prevention and Management Protocols Based on Caries Risk Assessment. J Calif Dent Assoc. 2010;38(10):746-61.
34. American Academy of Pediatrics Section of Pediatric Dentistry. Oral health risk assessment timing and establishment of the dental home. Pediatrics. 2003;111(5):1113-6.
35. Dental Caries in Children from Birth Through Age 5 Years: Screening. Summary of Recommendations and Evidence: U.S. Preventive Services Task Force; 2014 [Available from: <https://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/dental-caries-in-children-from-birth-through-age-5-years-screening>].
36. Health effects of water fluoridation: A review of scientific evidence. Royal Society of New Zealand and the Office of the Prime Minister's Chief Science Advisor; 2016.
37. Association of State and Territorial Dental Directors (ASTDD). Teledentistry: How Technology Can Facilitate Access To Care 2019.
38. Borchgrevink A, Snyder A, Gehshan S. The Effects of Medicaid Reimbursement Rates on Access to Dental Care. National Academy for State Health Policy. 2008.
39. Langelier M, Continelli T, Moore J, Baker B, Surdu S. Expanded Scopes Of Practice For Dental Hygienists Associated With Improved Oral Health Outcomes For Adults. Health Aff (Millwood). 2016;35(12):2207-15.
40. Koppelman J, Corr A. Dental Therapy Seen as a Best Practice for Boosting Access to Care. PEW Trusts. 2019.
41. Commission on Dental Accreditation. Accreditation Standards for Dental Therapy Education Programs. Educational Program. Chicago, Illinois: American Dental Association; 2015.

# APPENDIX A

## Dental Terminology

**Dental abscess:** Acute or chronic localized inflammation, probably with a collection of pus, associated with tissue destruction, and frequently, swelling. These abscesses usually occur secondary to infection. Usually caused by an untreated deep cavity.

**Acute periradicular or acute apical abscess:** An inflammatory reaction to pulpal (root) infection and necrosis (infected dead tissue) characterized by rapid onset, spontaneous pain, tenderness of the tooth to pressure, pus formation, and eventual swelling of associated tissues. May also be known as acute periapical abscess, acute alveolar abscess, phoenix abscess, recrudescence abscess, or secondary apical abscess.

**Dental caries:** Commonly used term for tooth decay/cavity.

**Periapical:** The area surrounding the end/apex of the tooth root.

**Periapical abscess with sinus:** Bacterial infection from an abscess with a draining sinus tract. The sinus tract can drain intraorally, to the skin on the face, or to other locations.

**Periapical abscess without sinus:** Bacterial infection of pulp and periapical tissues without a sinus tract.

**Periodontal:** Pertaining to the supporting and surrounding tissues of the teeth (gums).

**Periodontal Pathology:** Bacterial infection of the gum or bone support surrounding teeth.

**Cellulitis:** A potentially serious bacterial infection of the face or soft tissue that may have spread from an abscess. The affected skin appears swollen and red and is typically painful and warm to the touch. It has the potential to spread to lymph nodes, bloodstream, and deeper tissues, rapidly becoming life threatening.

# APPENDIX B

ICD-9 Description	ICD-9 Code	ICD-10 Code	ICD-10 Description	Oral Health Diagnosis Category
Arrested dental caries	52104	K023	Arrested dental caries	Dental Cavities
Dental caries pit and fissure	52106	K0251	Dental caries pit and fissure surface limited to enamel	Dental Cavities
Dental caries pit and fissure	52106	K0252	Dental caries on pit and fissure surface penetrating into dentin	Dental Cavities
Dental caries extending into pulp & Dental caries pit and fissure	52103 & 52106	K0253	Dental caries on pit and fissure surface penetrating into pulp	Dental Cavities
Dental caries limited to enamel	52101	K0261	Dental caries on smooth surface limited to enamel	Dental Cavities
Dental caries of smooth surface	52107	K0261	Dental caries on smooth surface limited to enamel	Dental Cavities
Dental caries extending into dentine	52102	K0262	Dental caries on smooth surface penetrating into dentine	Dental Cavities
Dental caries of smooth surface	52107	K0262	Dental caries on smooth surface penetrating into dentine	Dental Cavities
Dental caries extending into pulp	52103	K0263	Dental caries on smooth surface penetrating into pulp	Dental Cavities
Dental caries of smooth surface	52107	K0263	Dental caries on smooth surface penetrating into pulp	Dental Cavities
Dental caries of root surface	52108	K027	Dental root caries	Dental Cavities
Dental caries, unspecified	52100	K029	Dental caries, unspecified	Dental Cavities

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ICD-9 Description	ICD-9 Code	ICD-10 Code	ICD-10 Description	Oral Health Diagnosis Category
Dental caries, unspecified	52109	K029	Dental caries, unspecified	Dental Cavities
Pulpitis	5220	K040	Pulpitis	Periapical / Periodontal Pathology
Necrosis of the pulp	5221	K041	Necrosis of the pulp	Periapical / Periodontal Pathology
Pulp degeneration	5222	K042	Pulp degeneration	Periapical / Periodontal Pathology
Acute apical periodontitis of pulpal origin	5224	K044	Acute apical periodontitis of pulpal origin	Periapical / Periodontal Pathology
Chronic apical periodontitis	5226	K045	Chronic apical periodontitis	Periapical / Periodontal Pathology
Periapical abscess with sinus	5227	K046	Periapical abscess with sinus	Periapical abscess with sinus
Periapical abscess without sinus	5225	K047	Periapical abscess without sinus	Periapical abscess without sinus
Other and unspecified diseases of pulp and periapical tissues	5229	K0490	Unspecified diseases of pulp and periapical tissues	Periapical / Periodontal Pathology
Other and unspecified diseases of pulp and periapical tissues	5229	K0499	Other diseases of pulp and periapical tissues	Periapical / Periodontal Pathology
Acute gingivitis, plaque induced	52300	K0500	Acute gingivitis, plaque induced	Periapical / Periodontal Pathology
Acute gingivitis, non-plaque induced	52301	K0501	Acute gingivitis, non-plaque induced	Periapical / Periodontal Pathology
Chronic gingivitis, plaque induced	52310	K0510	Chronic gingivitis, plaque induced	Periapical / Periodontal Pathology

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ICD-9 Description	ICD-9 Code	ICD-10 Code	ICD-10 Description	Oral Health Diagnosis Category
Chronic gingivitis, non-plaque induced	52311	K0511	Chronic gingivitis, non-plaque induced	Periapical / Periodontal Pathology
Aggressive periodontitis, unspecified	52330	K0520	Aggressive periodontitis, unspecified	Periapical / Periodontal Pathology
Acute periodontitis	52333	K0520	Acute periodontitis	Periapical / Periodontal Pathology
Aggressive periodontitis, localized	52331	K0521	Aggressive periodontitis, localized	Periapical / Periodontal Pathology
Aggressive periodontitis, generalized	52332	K0522	Aggressive periodontitis, generalized	Periapical / Periodontal Pathology
Chronic periodontitis, unspecified	52340	K0530	Chronic periodontitis, unspecified	Periapical / Periodontal Pathology
Chronic periodontitis, localized	52341	K0531	Chronic periodontitis, localized	Periapical / Periodontal Pathology
Chronic periodontitis, generalized	52342	K0532	Chronic periodontitis, generalized	Periapical / Periodontal Pathology
Periodontitis	5235	K0540	Periodontitis	Periapical / Periodontal Pathology
Other specified periodontal diseases	5238	K055	Other periodontal diseases	Periapical / Periodontal Pathology
Unspecified gingival and periodontal disease	5239	K056	Periodontal disease, unspecified	Periapical / Periodontal Pathology
Gingival recession, unspecified	52320	K060	Gingival recession	Periapical / Periodontal Pathology
Gingival recession, minimal	52321	K060	Gingival recession	Periapical / Periodontal Pathology

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ICD-9 Description	ICD-9 Code	ICD-10 Code	ICD-10 Description	Oral Health Diagnosis Category
Gingival recession, moderate	52322	K060	Gingival recession	Periapical / Periodontal Pathology
Gingival recession, severe	52323	K060	Gingival recession	Periapical / Periodontal Pathology
Gingival recession, localized	52324	K060	Gingival recession	Periapical / Periodontal Pathology
Gingival recession, generalized	52325	K060	Gingival recession	Periapical / Periodontal Pathology
Other specified periodontal diseases	5238	K061	Gingival enlargement	Periapical / Periodontal Pathology
Other specified periodontal diseases	5238	K068	Other specified disorders of gingiva and edentulous alveolar ridge	Periapical / Periodontal Pathology
Cellulitis and abscess of oral soft tissues	5283	K122	Cellulitis and abscess of mouth	Cellulitis
Cellulitis and abscess of face	6820	L03211	Cellulitis of face	Cellulitis*
Cellulitis and abscess of neck	6821	L03221	Cellulitis of neck	Cellulitis*

*Note.* \*Only if occurred secondary to any of the above non-traumatic oral diagnoses

# APPENDIX C

Table 1.

*Frequencies of ED Visits for Non-Traumatic Oral Health Related Diagnoses*

	Patient Age			
	Ages 0 – 19 (n = 6240)	Ages 20 – 64 (n = 47567)	Ages 65+ (n = 1432)	All visits (n = 55239)
	n* (%) <sup>a</sup>	n* (%) <sup>a</sup>	n* (%) <sup>a</sup>	n* (%) <sup>a</sup>
Visits				
Rural	1140 (18.3)	8465 (17.8)	316 (22.1)	9921 (18.0)
Non-rural	5100 (81.7)	39102 (82.2)	1116 (77.9)	45318 (82.0)
Charges \$ (%) <sup>b</sup>	4748078 (9.2)	44813234 (86.9)	2009196 (3.9)	51570507
Primary Payer				
Private insurance	2006 (33.5)	10248 (23.4)	187 (13.1)	12441 (24.3)
Medicaid/CHIP	2843 (47.5)	12575 (28.8)	22 (1.5)	15440 (30.2)
Medicare	7 (0.1)**	2507 (5.7)	1179 (82.5)	3893 (7.2)
Other government	114 (1.9)	640 (1.5)	15 (1.1)	769 (1.5)
Self-pay/No charge	1016 (17.0)	17775 (40.6)	27 (1.9)	18818 (36.8)
Unknown Payer	254	3822	--	4078
Race/Ethnicity				
White	2696 (60.4)	26421 (77.1)	912 (85.3)	30029 (75.5)
Black/African American	119 (2.7)	969 (2.8)	8 (0.8)**	1096 (2.8)
Hispanic	1334 (29.9)	5503 (16.1)	104 (9.7)	6941 (17.5)
American Indian/Alaska Native	99 (2.2)	480 (1.4)	9 (0.8)**	588 (1.4)
Asian	132 (3.0)	418 (1.2)	21 (2.0)	571 (1.0)
Native Hawaiian/Pacific Islander	12 (0.3)	96 (0.3)	5 (0.5)**	113 (0.3)
Other	71 (1.6)	364 (1.1)	10 (0.9)**	445 (1.1)
Unknown	1777	13316	363	15456
Primary diagnosis				
Cellulitis	265 (4.3)	1589 (3.3)	72 (5.0)	1926 (3.5)
Dental cavities	1259 (20.2)	13732 (28.9)	152 (10.6)	15143 (27.4)
Periapical abscess with sinus	13 (0.2)	64 (0.1)	--	80 (0.1)
Periapical abscess without sinus	3279 (52.6)	23838 (50.1)	785 (54.8)	27902 (50.5)
Periapical/Periodontal Pathology	1424 (22.3)	8344 (17.5)	420 (29.3)	10188 (18.4)

Note. \*n = number of visits; \*(%) = column percentages calculated on valid n; <sup>b</sup>\*(%) = row percent of total charges; \*\* Use caution in interpreting, the estimate has a relative standard error greater than 30% and does not meet UDOH standards for reliability; -- This estimate has been suppressed because the relative standard error is greater than 50% or when the relative standard error can't be determined