Supporting Dental Therapy

A Meaningful Strategy for Implementing Equitable Oral Health



HRSA
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Advisory Committee on Training in Primary Care Medicine and Dentistry

Advisory Committee on Training in Primary Care Medicine and Dentistry (ACTPCMD)

Supporting Dental Therapy through Title VII Training Programs:

A Meaningful Strategy for Implementing Equitable Oral Health Care

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The Importance of Oral Health

People sometimes think about oral health as being separate from overall health. After all, in the US payment and health information systems for these services have historically been separate, with unique medical and dental payment programs. For these and other reasons, many fail to realize that oral health is an important component of overall health.

In 2000, David Satcher, MD, PhD, the former US Surgeon General, called attention to this issue in his seminal report *Oral Health in America.* He noted that the mouth is the "mirror of health or disease…" further stating that a person "cannot be healthy without oral health."[1]

The Surgeon General's report emphasized that oral health goes beyond simply having healthy teeth. The mouth is an entry point for infections that can affect other parts of the body as well as various diseases and conditions resulting from bacterial, viral, and fungal infections that can impact the health of the lip and oral mucosa.[2]

Although clear causation cannot be established, there is strong evidence associating periodontal disease to other conditions such as diabetes, heart disease, rheumatoid arthritis, adverse pregnancy outcomes, and cancer.[3,4] In 2017, a review examined the association between cancer and periodontal disease (also known as gum disease). The review, which included 46 studies involving cancer and periodontal disease, found a "positive association between gum disease and risk of lung, pancreatic, and head and neck cancers."[5]

A separate 2017 meta-analysis examined the connection between tooth loss and risk of cardiovascular disease and stroke. The analysis included 17 cohort studies involving more than 800,000 participants. The study found tooth loss to be associated with a higher risk of cardiovascular disease. In fact, for every 2 teeth lost there was a 3% increment in coronary heart disease.[6]

Other studies have found an association between tooth loss and all-cause mortality. An analysis of 49 studies found that in most studies lower tooth count was associated with a higher risk of death. And most studies in the analysis reported that mortality *decreased* with every tooth present.[7]

The association between tooth loss and mortality is not exclusively found in those ages 65 and older. An analysis of data for 41,000 of adults *younger* than 65 found an increased risk of death for those with complete tooth loss, compared to those without. This shows that tooth loss is an important public health issue not only for older adults but across the lifespan.[8]

These and other studies, show that improving the overall health of the nation requires us to acknowledge the importance of good oral health as well as the unequal burden of oral disease

among populations.[9] Oral disease, to include tooth loss, is preventable and clinicians can play an important role in educating patients about early prevention, decreasing the risk for disease and tooth loss.[10,11]

Oral health is important for other reasons as it impacts many factors that affect overall well-being. Tissues of the mouth and head can be essential in conveying certain emotions that we take for granted, such as smiling.[12] They also allow us to kiss, chew, swallow, and speak. In other words, our teeth, mouth, and other nearby structures are essential for expressing our humanity.

Preventing oral disease saves money for families, businesses, and taxpayers. There is an important and lasting economic impact of poor oral health along with associated increases in health care costs, missed work/school days, and oral health inequities.

Dentist Shortage and Maldistribution

Despite the importance of oral health, there may not be enough dentists in the US to serve everyone needing care. According to data obtained from HRSA's National Center for Health Workforce Analysis, there are approximately 155,000 general dentists actively practicing in the US.[13] The remainder (approx. 42,200) are specialized dentists focusing on pediatric dentistry, oral surgery, endodontics, orthodontics, periodontics, and other dental specialties.[14]

Despite these apparently large numbers, workforce projections from HRSA's Health Workforce Simulation Model estimate there will not be enough general dentists by 2030 to meet demand. In fact, it is estimated that there may be a shortage of 3,350 general dentists by that time.[15]

A second factor impacting access to oral health professionals is their distribution. Unfortunately, the distribution of dentists across the country is uneven. For instance, there are 104 dentists per 100,000 people in Washington, DC but only 41 per 100,000 in Alabama.[16] In addition, specific areas across the nation are more acutely impacted by a shortage of dentists.

HRSA designates Health Professional Shortage Areas (HPSAs) as geographic areas, populations, or facilities that have a shortage of primary, dental, or mental health care providers.[17] According to HRSA, there are 6,920 dental health HPSAs in the US—in other words, areas where few, if any, dentists practice.[18] Altogether, there are 67 million individuals living in both urban and rural dental shortage areas. In the rural space, roughly two in five rural Americans are practically without access to dental care.[19]

The reasons for the maldistribution and the existence of dental HPSAs are many. Dentists are some of the major health professionals with the highest educational debt.[20] The average dentist's

debt is $239,895 for public dental schools and $341,190 for private ones.[21] As a result, practicing in rural and/or high-poverty areas may imply lower payout-margins and therefore a longer period to discharge this debt.[22] Also, in the US almost two-thirds of dentists do not accept public insurance, in part due to low reimbursement rates and a higher administrative burden.[23]

Therefore, recruitment and retention of dentists serving those who are publicly insured in rural and urban low-income areas continues to be a challenge. This challenge has been partially mitigated by some programs, such as HRSA's National Health Service Corps (NHSC). Implemented for nearly 50 years, the NHSC provides loan repayment for general and pediatric dentists working at approved sites and scholarships for health professional education in exchange for service in underserved communities. Currently, more than 22,000 NHSC participants (1,938 dentists and dental hygienists) provide primary medical, dental, and behavioral and mental health care at nearly19,000 NHSC-approved sites, serving more than 23.6 million people across the country.[24]

The Impact of Oral Health Disparities

Nearly 20 years ago, the Surgeon General stated that "The great and enduring strength of American democracy lies in its commitment to the care and wellbeing of its citizens… [but] not all Americans are benefiting equally from improvements in health and health care."[25]

Unfortunately, despite the recognized importance of oral health, not everyone in the US benefits equally from the existing health care system. The burden of disease can impact different groups differently, thus creating health disparities. Disparities can be defined as "a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater obstacles to health…"[26]

Vulnerable and underserved populations in the US are groups commonly experiencing health disparities. They can include racial/ethnic minorities, individuals with special health care needs, those living with disabilities, rural populations, older adults, homeless individuals, incarcerated people, those who are uninsured/underinsured, individuals with low-socioeconomic status, lesbian, gay, bisexual, transgender, and queer (LGBTQ) individuals, and other groups.[27, 28, 29]

The reasons for the existence of these disparities are complex and can involve numerous factors including clinician shortages, maldistribution, income level, structural racism, costs, insurance status, clinician training, the patient's sexual orientation, education, health status, geographical location, and other factors.[30] Nonetheless, health disparities should be recognized and continuously addressed.

In the area of oral health, disparities exist based on type of insurance, socioeconomic status, age, sexual orientation, geography, disability, and various other factors. For example, in low-income households, the percentage of children age 2 to 5 years with untreated cavities in their primary teeth is nearly three times higher than those from higher-income households.[31]

Nearly twice as many adults enrolled in Medicaid reported that they had not visited a dentist in the past few years compared with non-enrolled Medicaid adults (30% vs 16.1%, respectively).[32] In addition, adults living in rural areas were less likely to receive preventive services, more likely to seek dental care in the emergency room, and had higher rates of cavities than their nonrural counterparts.[33] Also, adults living in rural areas had twice the prevalence of tooth loss compared with nonrural populations.[34] Tooth loss is a concern because studies have shown that tooth loss is related to poor quality of life and increased adverse health effects including cardiovascular disease.[35,36]

Oral health disparities are also present based on race and ethnicity. Reports show the prevalence of periodontal disease is higher among non-Hispanic Blacks and Mexican-Americans than Whites.[37] American Indian and Alaska Native (AI/AN) children ages 3 to 5 are nearly three times more likely to have dental caries compared with White children of the same age.[38] With respect to sexual orientation, individuals identifying as LGTBQ+ were found to be at an elevated risk for discrimination on the part of health practices.[39]

Financial Costs and System Burden

Estimates show that every 15 seconds someone visits an emergency room (ER) seeking treatment for a dental condition.[40] These visits occur for various reasons, including being uninsured or underinsured, difficulty in finding a provider accepting Medicaid, not knowing how to access the dental system, and not being able to find evening or weekend dental appointments.[41,42]

Unfortunately, dental treatment in the ER is often expensive.[43,44] Some estimates show that receiving ER dental care can be up to five times more expensive than receiving treatment at a dental office.[45] At a national level, these financial costs can be significant. For example, there were 2.1 million visits to the ER for nontraumatic dental conditions such as tooth decay, infections, swollen gums, and other similar conditions in 2012.[46,47] A study estimated the average cost per visit to be $749 and the total cost $1.6 billion for the year analyzed.[48]

For the 2.1 million ER dental visits described above, Medicaid paid for 61.8% of the pediatric visits for those 18 and under—a total of nearly $94 million. In addition, Medicare paid for 85.6% of ER dental visits for those 65 and over, a total of nearly $61 million. A study estimated

that 79% of these ER visits could have been diverted to a community setting, bringing considerable system savings.[49]

Unfortunately, dental treatment in the emergency setting is often palliative and does not always address the root cause, which may result in the patient returning to the ER.[50] An estimated 90% of ER dental patients receive only pain medication or antibiotics for their infections. Most of these patients are then referred to dentists to address the underlying disease. Nonetheless, studies of children in Florida and Texas show that less than half of those enrolled in Medicaid or the Children's Health Insurance Program (CHIP) followed up with a dentist after an ER visit.[51] Dental therapists increase the workforce focused on prevention to reduce the financial as well as intangible costs of oral disease.[52] These can be especially high for children needing to be seen in operating rooms for dental care.[53,54]

The Dental Therapy Profession

Although dental therapy is a relatively new profession in the US, it has been in existence for more than a century worldwide. Dental therapists have practiced in more than 50 countries and territories. The profession originated in New Zealand in the 1920s and other countries that have adopted the profession since then include: Australia, South Africa, the United Kingdom, the Netherlands, Jamaica, Thailand, and many others.[55] There were some prior temporary efforts to establish professions similar to today's dental therapists in the US, but the first dental therapists began practicing in earnest in 2005.[56]

Dental therapists are members of the oral health team and provide "evaluative, preventive, restorative, and [sometimes] minor surgical dental care."[57] Essentially, they can provide a defined set of procedures under the supervision of a dentist.[58] For example, while general dentists can perform nearly 400 procedures, dental therapists can perform about 80-95 procedures, based on state licensure.[59]

The specific services provided by dental therapists can include those that can be performed by a dental hygienist such as oral health screenings, X-rays, applying fluoride/sealants, and teaching health promotion. However, in addition to the aforementioned services, dental therapists can drill and restore teeth and, in some states, perform simple extractions under the supervision of a dentist.[60] More importantly, dental therapists are able to address conditions that lead to pain, infection, and teeth damage, which is important in areas that have traditionally experienced lack of access to dental care.[61]

When patients require difficult extractions, advanced periodontal care, specialized surgical procedures, or complex restorations (such as adult crowns, bridges, implants, or dentures), dental therapists refer patients to dentists. The goal is to allow dental therapists to perform simpler

procedures to increase access and treat oral disease in its early stages, and reserve care that is more complex to be addressed by dentists.[62]

In 2015, the Commission on Dental Accreditation (CODA) authorized standards for accreditation of US dental therapy programs. To be accredited, a dental therapy curriculum must include a minimum of three years of full-time instruction (or equivalent) at the post-secondary level.[63]

Quality of Care

Various studies over the past 60 years have found that the technical quality of care provided by dental therapists within the scope of their competencies was comparable to that of a dentist.[64]

In the US, an initial examination of Alaska's dental therapy model conducted in 2010 evaluated therapists on their clinical performance. Fillings were assessed by blinded reviewers, which determined the rates of deficiencies to be similar among dentists and dental therapists. *The report concluded that the dental therapists were "technically competent to perform these procedures within their scope of practice."* The same evaluation showed high patient satisfaction with dental therapists in the areas of explaining things clearly, listening carefully, and treating patients with respect.[65]

A subsequent retrospective study over a 10-year period examined the utilization and outcome of treatment by dental therapists in Alaska Native communities. The study compared communities which received dental therapy treatment to those that did not. A total of 22,645 individuals in 48 Alaskan communities were involved. The study found that increased dental therapy treatment days were significantly associated with increased rates of preventive care for both children and adults.[66] The study also found increased utilization in children.[67] Children who received dental therapy treatment at the start of the study had a preventive utilization rate of 7.4%, which steadily increased to 35.6% by the end of the 10-year period.[68]

In Minnesota, an early evaluation of dental therapists was published in 2014 by the Minnesota Department of Health and the Minnesota Board of Dentistry. The study surveyed 1,382 patients and found that *dental therapists improved access for underserved patients.*[69] In addition, nearly one-third of the patients in the study experienced a reduction in appointment wait times, with a more pronounced impact seen in rural areas.[70]

The ability of dental therapists to provide quality care in a safe manner has been evaluated for several decades. A systematic review of 23 studies from industrialized countries involving dental therapists or specially trained hygienists dating from 1950 through 2011 showed that all but 2 studies concluded that dental therapists performed irreversible dental procedures at an

"acceptable level" compared with dentists. *While the studies in the systematic review were performed using different methodologies, they concur in the fact that dental therapists can provide services with an acceptable level of technical competence.*[71] Support for evaluation of educational program outcomes, and the impact this important workforce has on patient care and health status, is essential to inform future efforts to advance an interprofessional workforce designed to increase access and quality outcomes.

Financial Benefits

The financial benefits of growing the dental therapist workforce can not only impact individuals and communities, but also have a significant systemic financial impact. At the systems level, an increase in preventive care could result in a reduction in emergency room visits to treat nontraumatic dental conditions. At the individual practice level, it could help maintain or increase the bottom line and enable providers to work at the top of their scope of practice.[72]

A 2010 report by The Pew Charitable Trusts reviewed the impact of dental therapists on the productivity and profits of private dental practices.[73] This is important because it is estimated that 93% of dentists deliver care primarily in private practice in the US.[74] In the report, researchers modeled the impact of the addition of a dental therapist to three types of practices: 1) A pediatric practice, 2) A solo dental practice, and 3) A group dental practice. *In all three cases, modeling showed that the addition of one dental therapist increased profits as well as productivity.*[75]

In a solo pediatric practice serving only privately insured patients, modeling showed that adding a dental therapist increased net, pre-tax profits by 29% (or $93,032) and productivity by 30%. In a solo dental practice, adding one dental therapist increased profits by 27% and productivity by 30%. In a group dental practice, adding one dental therapist increased profits by 12% and productivity by 10%.

In the pediatric and solo dental practices, this increase was also seen in modeling of practices serving Medicaid patients (assuming a 20% Medicaid patient enrollment at a reimbursement rate of 60%). In the pediatric and solo dental practices there was a profit increase of 7% and 6%, respectively, while serving publicly insured patients. *The report concluded that most dentists adding a dental therapist to their team could treat more Medicaid enrollees while preserving or increasing their bottom line.*[76]

A subsequent report supports these findings. The report examined the economic viability of working dental therapists over a one-year period. The combined salaries of the dental therapists were found to be 29% of the total revenue generated. In other words, the dental therapists' salaries were paid with 29% of the income they generated, leaving the remaining 71% of the

income available for other uses. *This shows that dental therapists are indeed a cost-effective way for practices to expand the number of people they serve while maintaining or increasing the bottom line.*[77]

An Emerging Profession

In the US, dental therapists began practicing in Alaskan communities in 2005. Since then, the following states and tribes have adopted laws allowing dental therapists to practice: Arizona, Connecticut, Idaho, Maine, Michigan, Minnesota, Montana, Nevada, New Mexico, Oregon, Vermont, and Washington. An additional eight states are considering bills authorizing dental therapists.[78,79]

While 13 states and tribes have passed laws authorizing dental therapists to practice, only 5 states/tribes currently have dental therapists practicing on the ground (Alaska, Minnesota, Maine, Oregon, and Washington). Dental therapy is still considered an emerging profession, with fewer than 150 dental therapists practicing across the US and fewer than 100 graduating annually.[80,81]

Most states that have passed laws authorizing dental therapists have limited the populations or settings where they can practice following graduation.[82] For example, except for Vermont, dental therapists are required to be employed by the Indian Health Service (IHS), practice on tribal lands, in a public health setting, a dental HPSA, or in a practice treating Medicaid or uninsured patients. Five states have limited dental therapists to practice in tribal lands only.[83]

Currently, all 13 states and tribes allow dental therapists to provide preventive care, and most of states allow for restorations and simple tooth extractions after consultation with a dentist. It is important to note that in all states that allow dental therapists to practice, dental therapists are required to work under the supervision of a dentist.[84]

Exemplary Programs

Alaska

Alaska is the largest state by area and also the least densely populated, with a population of approximately 733,000 people.[85] Those identifying as American Indians/Alaska Natives (AI/AN) constitute 21.9% of the state's population, and the state is home to 229 federally recognized Alaska Native villages.[86,87] Most of the Native population in Alaska lives in remote areas, accessible only by airplane, boat, or snowmobile. Prior to the introduction of dental therapists, services were traditionally provided by itinerant dentists under contract from IHS or tribal organizations.[88]

Traditionally, AI/AN children have had the poorest oral health of all population groups in the country.[89] In 2007, about 87% of Alaska Native children ages 4 to 5 years had dental caries,

compared with 35% of all US children in the same age group.[90] A total of 83% of AI/AN adults ages 40-64 have permanently lost *at least* one tooth, compared with 66% in the US population.[91]

To address these and other disparities, the Alaska Native Tribal Health Consortium in collaboration with Alaska's Tribal Health Organizations spearheaded a pilot program to introduce alternative dental practitioners called Dental Health Aid Therapists. In 2003, a cohort of students traveled to New Zealand to study dental therapy at the University of Otago and in 2005, 6 dental therapists began practicing in Alaska.[92] At the time no universities offered a dental therapy program in the US, although currently some US universities do.[93] Today, Alaskan dental therapists currently serve approximately 45,000 people in tribal communities.[94]

In Alaska dental therapists are recruited locally and return to their communities to provide services as trusted members of their community. Most dental therapy graduates are AN/AI individuals and approximately 78% of them practice in their village or region of origin.[95,96,97] The retention rate for dental therapists in the state has been 81% over an 11-year period.

In Alaska dental therapists provide diagnostic, preventive, and basic restorative dental care by working under the general supervision of a dentist. They can also perform simple extractions after consultation with a dentist.[98,99] Studies show that dental therapists in Alaska provide similar care, in terms of clinical quality, compared with a dentist.

Other studies have shown decreased patient wait times and increased preventive care in children and adults.[100,101] In addition, a qualitative study found that dental therapists are well accepted in Alaska villages.[102] Understanding of cultural norms and continuity of care were found to be key drivers for the satisfaction of village members.[103]

Minnesota

In 2020, the state's estimated population was 5,706,494, with more than 20% (1,255,788) living in rural areas.[104] Minnesota's dentist workforce is aging and nearing retirement, with approximately half (45%) of all licensed dentists being 55 or older as of 2012.[105]

In 2009, the governor of Minnesota signed a law authorizing dental therapists to practice, and the first dental therapists began practicing in 2011.[106,107] Dental therapists in Minnesota can provide diagnostic, preventive, and basic restorative dental care as well as simple extractions. They must work under the general supervision of a dentist.[108]

In Minnesota, dental therapists can only practice in a public health setting, dental HPSAs, or facilities treating at least 50% of Medicaid or uninsured patients.[109] They are therefore focused on serving low-income and underserved patients.[110]

Since passage of the 2009 law, the University of Minnesota's Dental School and a partnership between the Metropolitan State University and Normandale Community College have each developed a dental therapy program.[111] In 2018, the Minnesota Board of Dentistry listed 92 dental therapists with active licenses practicing in the state. The median age of these therapists was 33 years old. In a survey, 83% of the dental therapists responded that they planned to practice in Minnesota for 10 years or more.[112]

A review of the impact of dental therapists in Minnesota working in a variety of practices after 5 years found *"a positive impact on patient access, clinic productivity and clinic finances without a reduction in quality of care, safety, or patient satisfaction."*[113] Another study found a strong correlation between dental therapist utilization and increasing access to care in both Minnesota and Alaska.[114]

Both the Alaska and Minnesota programs have demonstrated that dental therapists can provide competent dental care to vulnerable and underserved populations in a cost-effective manner. Evaluation of program outcomes will help identify best and promising practices.

Summary

An existing lack of access to dental care and a predicted shortage of dentists in the future calls for solutions that can maximize the impact of preventive care and early intervention for dental disease. Dental therapists can play an important role in serving vulnerable and underserved populations, especially for those living in rural and other geographic areas that have a shortage of dental health care providers. Therefore, growing a dental therapy workforce supports the increase access to care and help improve the oral health of all Americans.

Within the scope of their practice, dental therapy programs in Alaska and Minnesota have already demonstrated improved patient access, decreased wait times, and the provision of quality care that is similar to that of a dentist. In addition, dental therapist support increased preventive care in their communities for both children and adults.

Given the numerous benefits that dental therapists offer to serve the vulnerable and underserved, it makes sense that this workforce be further developed. HRSA can make a valuable contribution to this effort by helping fund student and faculty dental therapy training programs and evaluate the effectiveness of those programs, as well as offer scholarships and loan repayment to those interested in pursuing the profession.

This can assist in increasing access to oral health care, reducing the burden of disease in vulnerable and underserved populations, reducing disparities, and supporting the improvement of oral health in all populations.

List of Acronyms and Abbreviations

ACTPCMD	Advisory Committee on Training in Primary Care Medicine and Dentistry
AI/AN	American Indian / Alaska Native
BHW	Bureau of Health Workforce
DFLRP	Dental Faculty Loan Repayment Program
ER	Emergency Room
HHS	Department of Health and Human Services
HPSA	Health Professional Shortage Area
IHS	Indian Health Service
NHSC	National Health Service Corps
PHSA	Public Health Service Act

Endnotes

[1] U.S. Public Health Service Commissioned Corps (USPHS), *Oral Health in America: A Report of the Surgeon General* (Rockville: U.S. Department of Health and Human Services, 2000).

[2] U.S. Public Health Service Commissioned Corps, *Oral Health in America: A Report.*

[3] U.S. Public Health Service Commissioned Corps, *Oral Health in America: A Report.*

[4] Yvonne Kapila, "Oral Health's Inextricable Connection to Systemic Health: Special Populations Bring to Bear Multimodal Relationships and Factors Connecting Periodontal Disease to Systemic Diseases and Conditions," *Periodontology 2000* 87, no. 1 (2021).

[5] Dominique Michaud et al, "Periodontal Disease, Tooth Loss, and Cancer Risk," *Epidemiologic Reviews* 39, no. 1 (2017).

[6] Fei Cheng et al., "Tooth Loss and Risk of Cardiovascular Disease and Stroke: A Dose-Response Meta Analysis of Prospective Cohort Studies," *PLoS One* 13, no. 3 (2018).

[7] Sreenivas Koka and Avni Gupta, "Association between Missing Tooth Count and Mortality: A Systematic Review," *Journal of Prosthodontic Res*earch 62, no. 2 (2018).

[8] David Brown, "Complete Edentulism Prior to the Age of 65 Years Is Associated with All-Cause Mortality," *Journal of Public Health Dentistry* 69 no. 4 (2009).

[9] Rena D'Souza, Francis Collins, and Vivek Murthy, "Oral Health for All - Realizing the Promise of Science," *New England Journal of Medicine* 386, no. 9 (2022).

[10] "Severe Tooth Loss and Chronic Diseases," Centers for Disease Control and Prevention, accessed April 1, 2022, https://www.cdc.gov/oralhealth/infographics/severe-tooth-loss.html.

[11] U.S. Public Health Service Commissioned Corps, *Oral Health in America: A Report.*

[12] U.S. Public Health Service Commissioned Corps, *Oral Health in America: A Report.*

[13] "Workforce Projections," Health Resources and Services Administration (HRSA), accessed April 1, 2022, https://data.hrsa.gov/topics/health-workforce/workforce-projections.

[14] HRSA, "Workforce Projections."

[15] HRSA, "Workforce Projections."

[16] National Institutes of Health (NIH). *Oral Health in America: Advances and Challenges* (Bethesda: US Department of Health and Human Services, 2021). https://www.nidcr.nih.gov/sites/default/files/2021-12/Oral-Health-in-America-Advances-and-Challenges.pdf.

[17] "What Is Shortage Designation?" Health Resources and Services Administration, last modified February 2021, https://bhw.hrsa.gov/workforce-shortage-areas/shortage-designation#hpsas.

[18] "Shortage Areas," Health Resources and Services Administration, last modified April 29, 2022, https://data.hrsa.gov/topics/health-workforce/shortage-areas.

[19] NIH, *Oral Health*.

[20] NIH, *Oral Health*.

[21] NIH, *Oral Health*.

[22] Sarah Childress, "Do You Live in a 'Dental Desert'? Check Our Map," accessed April 1, 2022, https://www.pbs.org/wgbh/frontline/article/do-you-live-in-a-dental-desert-check-our-map/.

[23] Jane Koppelman and Rebecca Singer-Cohen, "A Workforce Strategy for Reducing Oral Health Disparities: Dental Therapists," *American Journal of Public Health* 107, no. S1 (2017):S13-S17.

[24] Health Resources and Services Administration, "National Health Service Corps Guide" (Rockville: U.S. Department of Health and Human Services, 2022). https://nhsc.hrsa.gov/sites/default/files/nhsc/nhsc-sites/nhsc-site-reference-guide.pdf.

[25] U.S. Public Health Service Commissioned Corps. *National Call to Action to Promote Oral Health* (Rockville: U.S. Department of Health and Human Services, 2003).

[26] "Health Equity in Healthy People 2030," U.S. Department of Health and Human Services, accessed April 1, 2022, https://health.gov/healthypeople/priority-areas/health-equity-healthy-people-2030.

[27] Institute of Medicine and National Research Council. *Improving Access to Oral Health Care for Vulnerable and Underserved Populations*. (Washington, DC: The National Academies Press, 2011).

[28] USPHS, *National Call to Action*.

[29] NIH, Oral Health.

[30] NIH, *Oral Health*.

[31] "Disparities in Oral Health," Centers for Disease Control and Prevention, last modified February 5, 2021. https://www.cdc.gov/oralhealth/oral_health_disparities/index.htm.

[32] NIH, *Oral Health*.

[33] NIH, *Oral Health*.

[34] Keppel G. Doescher, "Dentist Supply, Dental Care Utilization, and Oral Health among Rural and Urban U.S. residents," (Seattle: Washington, Wyoming, Alaska, Montana, Idaho Rural Health Research Center, 2015). http://depts.washington.edu/uwrhrc/uploads/RHRC_FR135_Doescher.pdf.

[35] NIH, *Oral Health*.

[36] NIH, *Oral Health*.

[37] NIH, *Oral Health*.

[38] NIH, *Oral Health*.

[39] NIH, *Oral Health*.

[40] American Dental Association, "Emergency Department Visits for Dental Conditions – A Snapshot," (American Dental Association, April 2020).

[41] NIH, *Oral Health*.

[42] Jennifer Minjarez and Sal Nuzzo, "Dental Therapists: Sinking Our Teeth Into Innovative Workforce Reform," (Tallahassee: The James Madison Institute, 2019). https://www.jamesmadison.org/wp-content/uploads/2019/01/PolicyBrief_DentalTherapy_2019_v01.pdf.

[43] NIH, *Oral Health*.

[44] Minjarez, "Dental Therapists."

[45] Minjarez, "Dental Therapists."

[46] Sy Nakao et al., "Non-Traumatic Dental Condition-Related Emergency Department Visits and Associated Costs for Children and Adults with Autism Spectrum Disorders," *Journal of Autism and Developmental Disorders* 45, no. 5 (2015):1396-1407.

[47] Thomas Wall and Marko Vujicic, "Emergency Department Use for Dental Conditions Continues to Increase," (American Dental Association, 2015). https://mediad.publicbroadcasting.net/p/wusf/files/201802/ADA.pdf.

[48] Wall, "Emergency Department Use."

[49] Wall, "Emergency Department Use."

[50] Minjarez, "Dental Therapists."

[51] NIH, *Oral Health*.

[52] Ng, Man Wai et al., "Disease Management of Early Childhood Caries: Results of a Pilot Quality Improvement Project," *Journal of Health Care for the Poor and Underserved* 23, no. 3 (Suppl 2012): 193-209.

[53] Rashewsky, Stephanie et al., "Time and Cost Analysis: Pediatric Dental Rehabilitation with General Anesthesia in the Office and the Hospital Settings," *Anesthesia Progress* 59, no. 4 (2012): 147-53.

[54] Keels, Martha et al. (eds). *Denial of Access to Operating Room Time in Hospitals for Pediatric Dental Care*. (Chicago: American Academy of Pediatric Dentistry, 2021).

[55] David A. Nash et al. *A Review of the Global Literature on Dental Therapists* (East Battle Creek: W.K. Kellogg Foundation, 2012).

[56] Minjarez, "Dental Therapists."

[57] Collen M. Brickle and Karl D. Self, "Dental Therapists as New Oral Health Practitioners: Increasing Access for Underserved Populations," *Journal of Dental Education* 81, no. 9 (September 2017): eS65-eS72, https://doi.org/10.21815/JDE.017.036.

[58] E. Phillips and H.L. Shaefer, "Dental Therapists: Evidence of Technical Competence," *Journal of Dental Research* 92, no. 7 (2013):11S-5S.

[59] Minjarez, "Dental Therapists."

[60] Jane Koppelman and Rebecca Singer-Cohen, "A Workforce Strategy for Reducing Oral Health Disparities: Dental Therapists," *American Journal of Public Health* 107 no. S1 (2017):S13-S17.

[61] Brian S. Cladoosby, "Indian Country Leads National Movement to Knock Down Barriers to Oral Health Equity," *American Journal of Public Health* 107 no. S1 (2017):S81-S84.

[62] The Pew Center on the States, "Help Wanted: A Policy Maker's Guide to New Dental Providers," (Washington, DC: The Pew Charitable Trusts, 2009). https://www.pewtrusts.org/-/media/legacy/uploadedfiles/wwwpewtrustsorg/reports/state_policy/dentalreportfinallow20respdf.pdf

[63] Commission on Dental Accreditation, "Accreditation Standards for Dental Therapy Education Programs," accessed April 1, 2022. https://coda.ada.org/~/media/CODA/Files/dental_therapy_standards.pdf?la=en.

[64] Nash et al., *A Review of the Global Literature.*

[65] Scott Wetterhall et al., *Evaluation of the Dental Health Aide Therapist Workforce Model in Alaska: Final Report*. (Research Triangle Park: RTI International, 2010). https://www.rti.org/publication/evaluation-dental-health-aide-therapist-workforce-model-alaska-final-report/fulltext.pdf.

[66] Donald L. Chi et al, *Dental Utilization for Communities Served by Dental Therapists in Alaska's Yukon Kuskokwim Delta: Findings from an Observational Quantitative Study*. (Seattle: University of Washington, 2017). https://faculty.washington.edu/dchi/files/DHATFinalReport.pdf.

[67] Donald L. Chi et al., "Dental Therapists Linked to Improved Dental Outcomes for Alaska Native Communities in the Yukon-Kuskokwim Delta," *Journal of Public Health Dentistry* 78, no. 2 (2018):175-182.

[68] Chi et al., *Dental Utilization.*

[69] Minnesota Department of Health and Minnesota Board of Dentistry, "Issue Brief: Dental Therapy in Minnesota," (St. Paul: Minnesota Department of Health, 2018). https://www.health.state.mn.us/data/workforce/oral/docs/2018dtb.pdf.

[70] Minnesota Department of Health and Minnesota Board of Dentistry, "Report to the Minnesota Legislature 2014: Early Impacts of Dental Therapists in Minnesota," (St. Paul: Minnesota Department of Health, 2014). https://mn.gov/boards/assets/2014DentalTherapistReport_tcm21-45970_tcm21-313376.pdf.

[71] E. Phillips and H.L. Shaefer, "Dental Therapists: Evidence of Technical Competence," *Journal of Dental Research* 92, no. 7 (2013):11S-5S.

[72] The Pew Center, "Help Wanted."

[73] The Pew Center, "Help Wanted."

[74] NIH, *Oral Health*.

[75] The Pew Center, "Help Wanted."

[76] The Pew Center, "Help Wanted."

[77] Frances M. Kim, "Economic Viability of Dental Therapists," (Boston: Community Catalyst, 2013). https://www.communitycatalyst.org/doc-store/publications/economic-viability-dental-therapists.pdf.

[78] Lisa Simon, R. Bruce Donoff, and Bernard Friedland, "Dental Therapy in the United States: Are Developments at the State Level a Reason for Optimism or a Cause for Concern?" *Journal of Public Health Dentistry* 81, no. 1 (2021):12-20.

[79] Elizabeth Mertz et al., "Dental Therapists in the United States: Health Equity, Advancing," *Medical Care* 59, supplement 5 (2021):S441-S448.

[80] Simon, "Dental Therapy in the United States."

[81] Mertz et al., "Dental Therapists in the United States."

[82] Mertz et al., "Dental Therapists in the United States."

[83] Simon, "Dental Therapy in the United States."

[84] Simon, "Dental Therapy in the United States."

[85] "Alaska: 2020 Census," United States Census Bureau, last modified August 25, 2021, https://www.census.gov.

[86] United States Census Bureau, "Alaska."

[87] Wendell Potter. *The Rise of Dental Therapy Movement in Tribal Nations and the U.S.* (East Battle Creek: W.K. Kellogg Foundation, 2012).

[88] Wetterhall et al., *Evaluation of the Dental Health.*

[89] Kirsten Senturia et al., "Dental Health Aides in Alaska: A Qualitative Assessment to Improve Paediatric Oral Health in Remote Rural Villages," *Community Dentistry and Oral Epidemiology* 46, no. 4 (2018): 416-424.

[90] Donald Chi et al., "Supply of Care by Dental Therapists and Emergency Dental Consultations in Alaska Native Communities in the Yukon-Kuskokwim Delta: A Mixed Methods Evaluation," Community Dental Health 37, (2020): 190–198.

[91] NIH, *Oral Health*.

[92] Kavita R. Mathu-Muju, "Chronicling the Dental Therapist Movement in the United States," *Journal of Public Health Dentistry* 71, no. 4 (2011):278-288.

[93] Minjarez, "Dental Therapists."

[94] Cladoosby, "Indian Country Leads National Movement."

[95] Mertz et al., "Dental Therapists in the United States."

[96] Chi et al., *Dental Utilization.*

[97] Chi et al., "Dental Therapists Linked."

[98] Chi et al., *Dental Utilization.*

[99] Simon, "Dental Therapy in the United States."

[100] Chi et al., *Dental Utilization.*

[101] Chi et al., "Dental Therapists Linked."

[102] Senturia et al., "Dental Health Aides."

[103] Senturia et al., "Dental Health Aides."

[104] "Minnesota," Rural Health Information Hub, last modified April 5, 2021. https://www.ruralhealthinfo.org/states/minnesota#:~:text=Minnesota%20covers%2079%2C610%20square%20miles,Bloomington%2C%20Duluth%2C%20and%20Rochester.

[105] Minnesota Department of Health, "Report to the Minnesota Legislature 2014."

[106] Mathu-Muju, "Chronicling the Dental Therapist Movement."

[107] Minjarez, "Dental Therapists."

[108] Simon, "Dental Therapy in the United States."

[109] Simon, "Dental Therapy in the United States."

[110] Minnesota Department of Health, "Report to the Minnesota Legislature 2014."

[111] The Pew Center on the States, "The Minnesota Story," (Washington, DC: The Pew Charitable Trusts, 2010). https://www.pewtrusts.org/~/media/legacy/uploadedfiles/pcs_assets/2011/minnesotastorybrief1pdf.pdf.

[111] NIH, *Oral Health*.

[112] Minnesota Department of Health and Minnesota Board of Dentistry, "Minnesota's Dental Therapist Workforce: September 2019," accessed April 1, 2022. https://www.health.state.mn.us/data/workforce/oral/docs/2019dt.pdf.

[113] Minnesota Department of Health and Minnesota Board of Dentistry, "Dental Therapy Toolkit: A Resource for Potential Employers," (St. Paul: Minnesota Department of Health, 2017). https://www.health.state.mn.us/facilities/ruralhealth/emerging/dt/docs/2017dttool.pdf.

[114] Minjarez, "Dental Therapists."



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