

# *APPLE TREE DENTAL*

## Research Reference

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## Introduction

The purpose of this Research Reference is to enhance the knowledge and capacity of potential research collaborators, to make the unique data resources of Apple Tree Dental more accessible, and to support effective research partnerships that will translate data through research investigations into evidence that will drive clinical and policy innovations to promote oral health equity. Such partnerships are now possible due to Apple Tree's unique longitudinal database, as envisioned by the founders and populated with over 3 decades of data from treatment provided to people of all ages and abilities by a team of skilled clinicians dedicated to improving oral health through utilizing a variety of clinical innovations.

The length and level of detail of this reference was designed for it to serve as a resource throughout the entire research process—from exploration to implementation and dissemination. The Table of Contents allows for readers to click on the section to which they wish to go for reference. If read in completion, redundancy may be noted given the overlap of information relevant to key sections that were designed for direct reference. As a living resource for research collaborators, additional recommendations are welcome and will be incorporated in its evolution as a research reference.

## History of Apple Tree Dental and Electronic Dental Record Evolution

### Organization Overview

In 1985, Apple Tree Dental was founded as a private, non-profit dental organization to address the lack of access to dental care for residents of nursing and assisted living facilities in the Twin Cities. The care delivery model was conceptualized by Dr. Michael Helgeson, Dr. George Goldhammer, Dr. Michael Gavino and Barbara Smith, RDH, MPH, PhD. At the time, the only non-profit dental practices in Minnesota were the School of Dentistry, at Hennepin County Medical Center or dental programs within larger organizations such as the Federally Qualified Health Centers.

Apple Tree was founded to address the longstanding lack of access to dental care for residents of nursing and assisted living facilities. However, barriers to care and the health consequences of dental disease were not yet widely accepted. In 1985, a Dental Health Professional Shortage Area (HPSA) designation was applied for on behalf of the long-term care population of the Twin Cities metropolitan area. HPSA designation is used as an eligibility requirement for loan repayment and grants. Although evidence of institutionalized elders' unmet needs and difficult access through the traditional care systems was known to direct care staff and geriatric health care providers, a shortage area designation application was denied. Similarly, the need to integrate dental into care settings outside the dental office had not yet become a part of health policy efforts.

As a non-profit and because Apple Tree's services are targeted at populations lacking financial resources, multiple funding streams are needed to support a sustainable business model. Apple Tree's multiple funding streams support a sustainable business model. Earned revenue from dental services is supplemented with federal, state, and local foundation grants, corporate support, individual gifts, and consulting services. Apple Tree's growth over 37 years demonstrates that a nonprofit group dental practice with a diversified patient and funding mix can successfully partner with communities to serve low-income, uninsured, and Medicaid-

Medicare enrolled patients. Although establishing Apple Tree as a 501(c)(3) organization required groundbreaking effort by Apple Tree's founders, that non-profit structure has proven essential to its sustainability.

Over its history, Apple Tree has been an early adopter of innovative approaches that increase the reach, efficiency, and effectiveness of the dental team. Since 1985, all patient dental records have included medical information as well as dental diagnosis and treatment for each patient. The electronic dental record is remotely accessible using multiple technologies to connect the operations of multiple Centers and mobile programs.

In addition to clinical innovation and an emphasis on robust record-keeping, career pathway and educational activities have been made available to high school through post-doctoral trainees. The desire to provide comprehensive, ongoing care across all settings has driven numerous delivery system and workforce innovations with a commitment to oral health equity, as demonstrated by the mission, vision, and strategies of the organization:

Mission: To overcome barriers to oral health.

Vision: To inspire partnerships that foster healthy communities.

Strategies:

- Leverage our skilled teams and unique strengths to build sustainable community collaborations that help people of all ages and abilities achieve health and well-being.
- Advance oral health care delivery, education, research, and public policy by developing and testing innovative solutions that influence local and national systemic change.
- Strengthen Apple Tree's financial health and sustainability by investing in purposeful employee development, optimal clinical facilities, and strong community partnerships.

#### Timeline

**In 1985**, Apple Tree was launched as a mobile dental program to address the unmet dental needs of frail elders living in long-term care settings the Twin Cities, subsequently growing to become the Coon Rapids Center. An electronic record system programmed by Dr. Helgeson was utilized to track medical conditions, medications, dental diagnoses, recommended/completed treatment, and treatment prognosis.

**In 1994**, Apple Tree opened its first outpatient dental clinic and laboratory in the Twin Cities to augment the services being provided through the mobile program.

**In 1995**, Apple Tree helped launch Carolina's Mobile Dentistry to serve nursing facility residents in Charlotte, North Carolina, becoming Apple Tree's first sister program.

**In 1997**, community leaders from the rural Red River Valley area in northwestern Minnesota asked Apple Tree to help solve one of Minnesota's worst dental access problems, resulting in the establishment of the Hawley Center. In response to community needs, Head Start services and dental care for low-income families and immigrant populations were added, while expanding services for residents of long-term care facilities in the Red River Valley area.

**In 1999**, Apple Tree helped launch Operation Smile in Sicily Island, Louisiana to serve Head Start preschoolers and institutionalized elders on-site, becoming Apple Tree's second sister program.

**During 1999-2001**, technology and equipment advances included conversion of Apple Tree's customized electronic health records systems (programmed by Dr. Helgeson) from Macintosh to Windows operating systems, increasing network capabilities for a larger scale delivery system. With research and development by A-dec founder, Ken Austin, and support from the Minnesota Department of Health, Patterson Dental and others, custom mobile bases were created for the same A-dec equipment used in the clinics. Custom power carts with vacuum systems, x-ray and sterilization carts and dental assistant carts were also designed and built. The resulting "Mobile Dental Offices" are Apple Tree's most well-known innovation and key to providing comprehensive care in community settings.

**During 2003-2005**, Apple Tree partners with Minnesota State Colleges, Mankato State University Dental Hygiene program, and the Madelia Community Hospital to establish an Apple Tree Madelia program within the hospital. Apple Tree also offered on-site dental care to Head Start programs in southwestern Minnesota. Prior to Apple Tree's involvement the clinic in Madelia offered preventive care by dental hygiene students and struggled to retain coverage by a dentist. Comprehensive dental care continues to be provided year-round at the clinic and a school-based program has been added. Two grant funded pilot projects provided successful tests of Telehealth technologies to increase access to care: "Expanded Functions Through Teledentistry" in partnership with Normandale Community College funded by Minnesota Department of Health and "The Apple Tree Head Start Teledentistry Project" in partnership with local Head Start programs funded by the federal Administration for Children, Youth and Families.

**In 2004**, Apple Tree opened the Madelia Center in the local hospital to help meet dental access needs among a low-income Hispanic population in southwestern Minnesota.

**In 2008**, two geriatricians from the Mayo Clinic were desperately seeking on-site dental care for their nursing facility residents, resulting in the Rochester Center. The program expanded through innovative partnerships to serve group homes, a residential mental health campus, and added general anesthesia services for severely disabled adults at a regional hospital in Winona.

**In 2009**, Apple Tree opened the Fergus Falls program in a former private practice clinic in response to requests from Otter Tail County public health leaders to help provide dental services and fill longstanding gaps in the region. Through a partnership with the West Central Initiative, it also provides on-site screening, prevention, and dental services at outreach sites in the region.

**In 2011**, IV sedation services for disabled adults expanded significantly to provide a safe and cost-effective alternative to general anesthesia for patients with disabilities and behavioral challenges. Adding nurse anesthetists further diversified the inter-professional care team.

**In 2014**, Apple Tree opened the Mounds View Center to expand services to nearly a thousand patients on waiting lists, and to create a new source of advanced dental services for people needing IV sedation services in the Twin Cities. The new outpatient clinic design, equipped with ceiling lifts for transferring patients, had space and plans to expand as an ambulatory surgery center designed for interdisciplinary outpatient services for people with special needs.

**In 2015**, Following 3 years of planning efforts with local leaders, Apple Tree opened the San Mateo Center for Dental Health with grant support from the Peninsula Health Care and Sequoia

Healthcare Districts, creating a dental program to meet growing gaps in the availability of geriatric and special care dentistry services in the area. This program was established through an affiliation with Sonrisas Community Dental Center, which was founded in 2001.

**In 2016**, Apple Tree opened the Little Falls Outreach Clinic co-located within the Family Medical Center on the St. Gabriel's Hospital campus in Little Falls, Minnesota. This program is pioneering medical-dental care management for people with diabetes, heart disease and other conditions.

**In 2017**, Apple Tree transitioned the management of the San Mateo and Sonrisas Centers to local leaders. The new organization managing these Centers is now called Sonrisas Dental Health.

**In 2017**, 3 years' planning and preparation culminates with launch of a NYU Langone Advanced Education in General Dentistry (AEGD) at Apple Tree's Mounds View Center. Through this accredited program, Apple Tree hosts 2 residents/year, providing pediatric, geriatric, and oral surgery mentored experiences treating complex patients of all ages, including providing care under IV Sedation.

**In 2018**, Apple Tree transitioned the Little Falls Outreach Clinic to the Little Falls Center for Dental Health, open five days a week with a full-time dentist. Apple Tree also partnered with North Metro Pediatrics to provide dental services at this pediatric primary care clinic. On-site clinical services by an Advanced Dental Therapist, teledentistry and care coordination increased access and convenience for families.

**In 2019**, Apple Tree pediatric specialist performed Apple Tree's first in-office general anesthesia case in collaboration with a dental anesthesiologist, at the Mounds View Center for Dental Health.

**During 2019-2024**, Apple Tree received funding to launch a four-phase, five-year project to establish the Fairmont Center for Dental Health within the Mayo Clinic Health System's Fairmont Campus. Apple Tree's mobile dental offices will provide initial access within the Clinic. In 2020, in the Mayo Clinic Health System in Fairmont, Apple Tree opened the Fairmont Center for Dental Health with mobile equipment. In April 2021, the Fairmont Center moved into a refurbished section of the same building and opened with a full team. Once remodeling for the Center for Dental is completed, a mobile program will deliver dental services in and around Martin County at long-term care facilities and in other community settings.

**In 2020**, a public-private partnership between Apple Tree and the Minnesota Department of Human Services resulted in the construction of a 11,000-square-foot facility for the Fergus Falls Center, in which each continue to have their own staff, dedicated treatment spaces, and separate entrances. Reduced cost and increased capacity for both organizations result from sharing state-of-the-art imaging and lab space, sterilization equipment and other expenses. This was the first custom-built Center Apple Tree had opened.

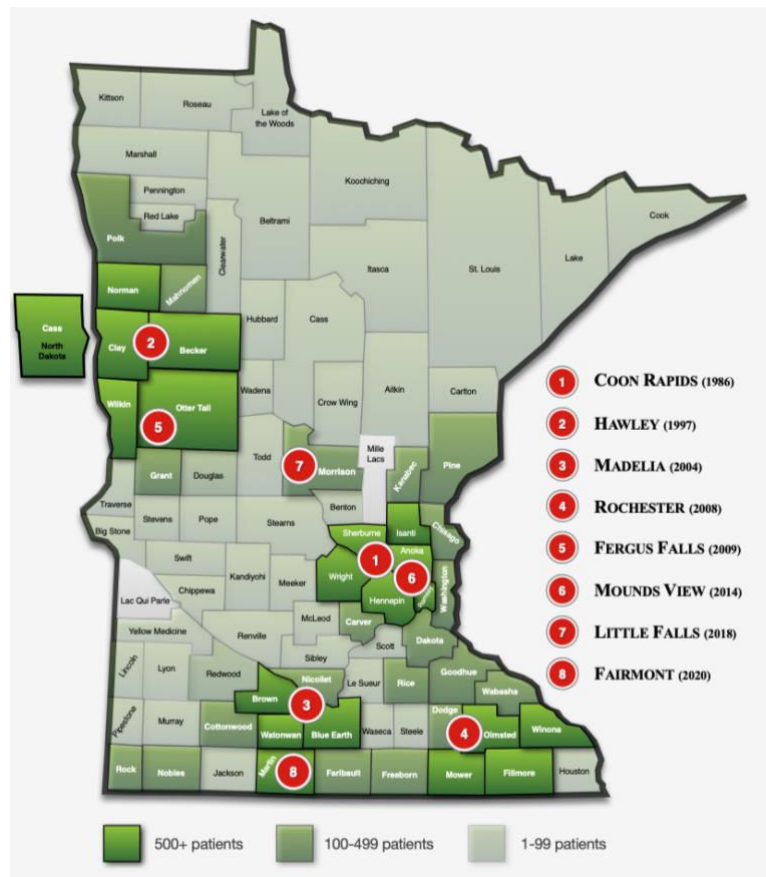
**In 2020**, with the outbreak of the COVID-19 pandemic, executive orders strictly limited routine dental care. 35% of our staff continued to provide urgent dental care services. 65% were temporarily furloughed. By December 2020, 95% of our staff had returned to work. In accordance with evolving information, Apple Tree created new workflows, modified clinic spaces, and increased direct to patient teledentistry to optimize the use of PPE, maintain physical distancing, and reduce aerosols that transmit COVID-19 infections.

In **2021**, a donor-funded documentary, “Uncovered: Minnesota’s Dental Crisis” aired on Twin Cities Public Television. This 26-minute film highlights the innovative approaches of Apple Tree and other Critical Access Providers as solutions for increasing access to dental care in Minnesota’s public programs. Uncovered can be viewed at: <https://www.tpt.org/uncovered-minnesotas-dental-crisis/>

## Model of Care Delivery

### Community Collaborative Practice/Mobile Dentistry

The “Community Collaborative Practice” care delivery model of Apple Tree Dental has evolved and grown over 37 years. As of 2022, 8 Centers for Dental Health serve as clinics for patients of all ages and abilities and as care coordination centers for a nationally-recognized mobile dental program that partners with over 150 community sites to serve patients from 85 of 87 counties in Minnesota. The Community Collaborative Practice model engages family members, long-term care facility staff and caregivers, medical providers, and other non-dental personnel as members of the care team for its patients. The goal of this model is to collaborate with community partners to deliver oral health services where people live, work, or receive other health and social services. Target patient populations include low-income children and their families, adults with disabilities, and older adults in long-term care settings.



An organization (school, day program, nursing home, etc.) that wishes to partner with Apple Tree’s mobile dental program enters into an Oral Health Services Agreement, which outlines Apple Tree’s role as Dental Director for that facility, describes the roles and responsibilities of the oral health team and community partner, and details the requirements for space, health record access, regulatory compliance, and liability within the partnership. Within its role as Dental Director, Apple Tree collaborates with a facility Medical Director to be part of the organizational structure of the facility, providing oversight of oral health policies and procedures for the entire facility. The frontline clinicians within this model are Collaborative Practice Dental Hygienists, the legislation for which Apple Tree advocated in 1999. They are members of the facility’s admission screening team and visit at least monthly to complete re-admission or annual screenings. They provide oral health education to nursing staff and caregivers, deliver preventive care and daily oral hygiene plans, provide dental screenings



within the Minimal Data Set or other surveillance system, assist with triage and care coordination for addressing urgent and non-urgent oral health needs, and provide the bulk of comprehensive dental care through dental prophylaxis and preventive services. The mobile dental program operates as a collaboration of dentists, dental therapists, dental hygienists, nurse anesthetists, dental assistants, lab technicians, dental liaisons, care coordinators, and truckers to deliver continuous comprehensive dental care to vulnerable patients in community settings.

#### Critical Access Dental Provider Program

The Critical Access Dental Provider Program was created by the Minnesota Legislature in May of 2001 to provide a set percentage increase in Medicaid reimbursement to dental providers who treat disproportionately higher numbers of publicly insured patients to counter low reimbursement, which was the most cited barrier to providing care to this population. Apple Tree Dental qualified for this designation when the program came into effect in 2002 and has participated throughout its operational history since then to maintain its sustainability. Participation in this program has also given cohesion to the network of participating providers to consolidate advocacy efforts to continuously improve the political and administrative context that enables effective care provision to publicly insured patient communities. Prior to the 2021 legislative session, Dr. Helgeson analyzed DHS' dental services data. The analysis revealed the significant contribution of Critical Access Dental Provider Program and has influenced discussion of program improvements with the Department, multiple managed care organizations and legislators. A recording of this presentation can be viewed at:

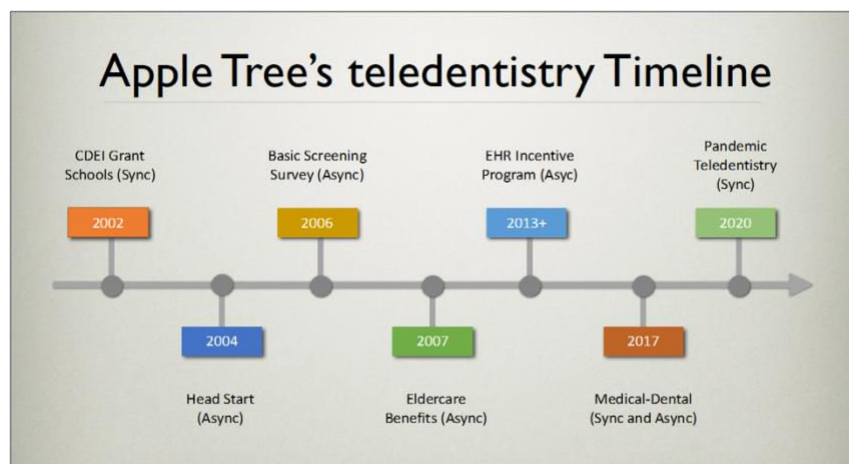
<https://youtu.be/1XIVRPjChac>

#### Teledentistry

As an early adopter of innovations, Apple Tree Dental began utilizing teledentistry in the early 2000's. Through two grant funded pilot projects, Apple Tree Dental successfully tested Telehealth technologies to increase access to care. These were titled "Expanded Functions Through teledentistry" in partnership

with Normandale Community College funded by Minnesota Department of Health and "The Apple Tree Head Start teledentistry Project" in partnership with local Head Start programs funded by the Federal Administration for Children, Youth and Families. Advocating for legislative advancements has further allowed Apple Tree Dental to integrate teledentistry services into its Community Collaborative Practice model of care delivery. The below timeline notes key milestones.

In 2020, Executive Orders under the COVID-19 pandemic required dental clinics across Minnesota to limit dental care to urgent cases only. Apple Tree expanded the use of teledentistry supported triage, which allowed patients to connect with their dentist while



preserving PPE and limiting the risk of disease transmission for patients and staff. This was particularly appreciated by patients residing in LTC settings with COVID-19 restrictions in place, those with compromised immune systems or other medical reasons, and when the dental concern could be resolved without an in-person appointment. The expanded use of teledentistry and other pandemic-driven changes will be maintained into the future to better and more efficiently serve our patients.

In 2022, the Minnesota legislature allocated funds to pilot projects that demonstrate best practices for supporting dental homes. Apple Tree Dental is piloting expanded teledentistry to ease waiting lists, improve matching of patients with the appropriate provider, and increasing the services provided at the first in-person appointment.

#### *Multi-Center Operations*

Apple Tree Dental has grown through being recruited by local champions who recognized unmet oral health needs in their communities. Multi-sector collaboration has often supported studying feasibility/sustainability, funding, and launching new Centers. The innovative characteristics of Apple Tree Dental, including its diverse workforce and flexible model of care delivery, matched with its commitment to overcoming barriers to care has made it a successful community partner. In 2022, Apple Tree operated 8 Centers for Dental Health, which served as clinics and as care coordination centers for its nationally recognized mobile dental program. Partnerships with over 150 community sites serve patients from 85 of 87 counties in Minnesota. Despite program growth, long new patient wait-lists highlight the continued need for the kind of oral care that Apple Tree Dental delivers.

Due to the locally-tailored history of each new Center's creation, each is unique in the demographic of patients served, specific set of services offered, and settings where care is delivered. The following timeline provides reference for each Center's development and unique attributes.

#### *Center Timeline and Characteristics:*

##### **1985: Mobile Dental Program**

Apple Tree Dental was established as a mobile dental program, delivering services in long-term care settings to serve older adults around the Twin Cities region of Minnesota.

##### **1994: Coon Rapids**

Apple Tree's first outpatient clinic opens to support mobile dental program, including employment of a laboratory technician to provide in-house prosthetic services. This Center continues to operate mainly as a mobile dental program coordination site. One such innovative partnership was established with North Metro Pediatrics to provide dental services at this pediatric primary care clinic. On-site clinical services by an Advanced Dental Therapist was supported by teledentistry and care coordination increased access and convenience for families.

##### **1997: Hawley**

Red River Valley local leadership recruited Apple Tree Dental to start this center, to provide access to children in Head Start Programs, low-income families, and immigrants. This marked the expanded patient population beyond the original focus on older adults in long-term care settings.

**2004: Madelia**

In collaboration with a local dental hygiene training program, this Center was established in the Madelia Community Hospital. It serves area Head Start Programs and has a year-round school-based program. This center served a larger Hispanic population than other centers.

**2008: Rochester**

Two geriatricians from the Mayo Clinic championed the establishment of this Center to address the unmet needs of older adults around Olmsted County. The program expanded through innovative partnerships to serve group homes, a residential mental health campus, and added general anesthesia services in 2012 for severely disabled adults at a regional hospital in Winona. In 2014, the Rochester Center began Apple Tree's first IV sedation program by contracting with a nurse anesthetist to provide care to adults with disabilities, anxiety, and behavioral challenges. The Rochester Center was the first to begin with its initial electronic dental record fully on Open Dental Software, without any paper charts or record transfers.

**2009: Fergus Falls**

Apple Tree opened the Fergus Falls program in a former private practice clinic in response to requests from Otter Tail County public health leaders to help provide dental services and fill longstanding gaps in the region. Through a partnership with the West Central Initiative, it also provides on-site screening, prevention, and dental services at outreach sites in the region. In 2020, a public-private partnership between Apple Tree and the Minnesota Department of Human Services resulted in the construction of a 11,000-square-foot facility, in which each continue to have their own staff, dedicated treatment spaces, and separate entrances. Reduced cost and increased capacity for both organizations result from sharing state-of-the-art imaging and lab space, sterilization equipment and other expenses. In 2021, this Center also became certified to host AEGD residents.

**2014: Mounds View**

Apple Tree opened the Mounds View Center to expand services to nearly a thousand patients on waiting lists, and to create a new source of advanced dental services for people needing IV sedation services in the Twin Cities. The new outpatient clinic design, ceiling lifts for transferring patients, with space and plans to expand as an ambulatory surgery center designed for interdisciplinary outpatient services for people with special needs. In 2017, 3 years' planning and preparation culminates with launch of a NYU Langone Advanced Education in General Dentistry (AEGD) at Apple Tree's Mounds View Center. Through this accredited program, Apple tree hosts 2 residents/year, providing pediatric, geriatric, and oral surgery mentored experiences treating complex patients of all ages, including providing care under IV Sedation. In 2019, Apple Tree pediatric specialist performed Apple Tree's first in-office general anesthesia case in collaboration with a dental anesthesiologist.

**2016: Little Falls**

During 2014-2017, Apple Tree Dental and Catholic Health Initiatives (CHI) St. Gabriel's Health began an interprofessional partnership to improve access to oral health care in Morrison County. Apple Tree established an outreach program with staffing from their Twin Cities programs while recruiting local staff. In 2016, Apple Tree opened the Little Falls Outreach Clinic co-located within the Family Medical Center on the St. Gabriel's Hospital campus in Little Falls, Minnesota. This program includes medical-dental care management for people with diabetes,

heart disease and other conditions. In July 2018, Apple Tree transitioned the Little Falls Outreach Clinic to the Little Falls Center for Dental Health, open five days a week with a full-time professional team including a dentist, dental hygienist, and dental therapist.

#### **2020: Fairmont**

During 2019-2024, Apple Tree received funding to launch a four-phase, five-year project to establish the Fairmont Center for Dental Health within the Mayo Clinic Health System's Fairmont Campus. Apple Tree's mobile dental offices provided initial access within the Clinic. In April 2021, the Fairmont Center moved into a refurbished section of the Mayo Clinic Health System and opened with a full team. A mobile program will deliver dental services in and around Martin County at long-term care facilities and in other community settings. Collaboration with Mayo Clinic Health Systems on medical-dental integration initiatives has been a priority for this Center since its establishment, including emergency department diversion, oral health rounds to medical providers, and colocated services in the outpatient and mobile setting.

#### **Workforce**

Apple Tree employs unique workforce teams that include general dentists and specialists in oral surgery, pediatrics, and dental public health, nurse anesthetists, advanced dental therapists, dental hygienists, dental assistants, community care coordinators, and lab technicians, with support from corporate and administrative staff. As of early 2021, Apple Tree has over 200 employees. The vast majority (approximately 2/3) are clinicians: 32 dentists including 2 full time residents, 10 advanced/dental therapists, 22 dental hygienists, and 65 dental assistants. An in-house dental laboratory with 6 technicians reduces the costs to fabricate full and partial dentures. Truck drivers deliver Mobile Dental Offices between community partner locations and Centers. Community care coordinators communicate with partner sites to create mobile dental program schedules and relay treatment, financial, and other information to care and guardian representatives. Clinic care coordinators function more like traditional dental office staff and schedule appointments at the Centers. All coordinators ensure that the patient's Treatment Plan is authorized and that any needed medical consultations occur in advance of the appointment. Business office staff includes a finance manager, billing and collections specialists, and office managers. Apple Tree's 17-member leadership team has expertise in human resources, information systems, program planning, management and evaluation, fundraising, finance and administration, implementing internal and external education programs, scientific research, and promoting policy development and dental access legislation.

Notable is within Apple Tree's intentional support of collaborative dental hygiene practice and dental therapy workforce. In 1999, Apple Tree Dental advocated for the establishment of collaborative practice for dental hygienists in Minnesota. Collaborative practice dental hygienists are an essential part of the care team providing oral health screenings, preventive services, and education for patients, caregivers, and staff in long-term care settings. Less than a decade later, Apple Tree sought to find common ground in the contentious discussion about midlevel providers. In 2009, legislation was enacted authorizing the education and licensure of dental therapists and advanced dental therapists. Beginning with graduates of the first class in 2011, Apple Tree has employed dental therapists and advanced dental therapists who serve patients of all ages. Apple Tree Dental has collaborated with

numerous research partners to showcase the evidence about the effectiveness and safety of dental therapy as a workforce model.

#### *Specialty Care Services*

##### *Geriatric Dentistry*

Apple Tree Dental was founded with a focus on providing care to older adults in long-term care settings. This has been maintained as a core commitment for the organization throughout nearly four decades of expansion and evolution. The continuity of comprehensive care provided to older adults in mobile and outpatient settings has created a unique resource for understanding oral and systemic conditions at this specific life stage. Apple Tree Dental has implemented clinical protocols and innovations that have been cited as best practices in geriatric dentistry.

##### *Special Needs Dentistry*

Apple Tree Dental has also become recognized throughout Minnesota and nationally for its clinical expertise and advocacy efforts on behalf of individuals with special needs. The Community Collaborative Practice model of care has been sought out by residential, day, and therapeutic programs that serve adults with disabilities. Additionally, the Mounds View, Rochester, and Fergus Falls Centers are equipped to provide IV Sedation services to these patients. Apple Tree Dental has served as a reliable dental home for many of these behaviorally and medically complex individuals.

##### *Pediatric Dentistry*

Since 1997 when Apple Tree began offering mobile dental program services to Head Start Programs and a year-round in-school mobile program in the early 2000's, children have received screening, preventive, and therapeutic services within the organization by dentists, dental hygienists, dental assistants, and trainees from partnering academic institutions. The addition of dental therapists in 2011 boosted Apple Tree Dental's ability to provide comprehensive dental care to children since the scope of practice for dental therapy includes most pediatric dental needs. In 2018, Dr. Nathaniel Cook joined Apple Tree Dental as the organization's first board-certified pediatric dental specialist, becoming Director of Pediatrics for Apple Tree Dental in 2021 to inform best-practices for providing dental care for children across the organization.

##### *Intra-Venous Sedation*

With the mission to overcome barriers to oral health, Apple Tree has served adults with intellectual/developmental disabilities, pediatric populations with a high burden of oral disease, and adults who experience high dental anxiety. Beyond Apple Tree, these populations commonly face barriers for dental care due to insurance status, geography, or willingness of community dental providers to treat behaviorally challenging patients.

In 2011, The Rochester Center launched Apple Tree's first IV sedation services for disabled adults by contracting with a nurse anesthetist, significantly expanding capacity to provide a safe and more cost-effective alternative to general anesthesia for patients with disabilities and behavioral challenges. In 2014, Apple Tree opened the Mounds View Center to expand services to nearly a thousand patients on waiting lists, and to create a new source of advanced dental services for people needing IV sedation services in the Twin Cities.

### *General Anesthesia*

Several Apple Tree dentists have held privileges for General Anesthesia dentistry practice in community and academic hospitals. Due to shortages in operating room space and limitations, Apple Tree has sought to meet gaps in access to sedation services by offering IV sedation with contracted nurse anesthetists. Some patients, however, still need General Anesthesia to be safely sedated for dental treatment. The Mounds View Center, which was launched in 2014, included a novel outpatient clinic design, ceiling lifts for transferring patients, with space and plans to expand as an ambulatory surgery center designed for interdisciplinary outpatient services for people with special needs. Apple Tree's first in-office general anesthesia case in collaboration with a dental anesthesiologist was performed in 2019 at the Mounds View Center for Dental Health. While this service will likely remain available mostly to children, the built infrastructure exists to expand General Anesthesia services to adults in the future.

### *Dental Education/Residency Programs*

Apple Tree Dental has engaged trainees through pathway programs in high school and at all levels of dental education through internship and rotation opportunities. Advocacy efforts enabled inclusion of dental assisting and dental hygiene in Minnesota's Dual Training Program scholarships. With support from multiple Minnesota Department of Health Clinical Dental Education Innovation grants, Apple Tree has offered new learning experiences in partnership with the University of Minnesota School of Dentistry, Minnesota State Colleges and Universities System and other dental education programs. Dental, dental therapy, dental hygiene, dental assistant, and nursing students have experienced interprofessional care for elders and children, oral health screening and assessment, safe patient handling, dental laboratory procedures and the use of telehealth technologies.

In 2017, 3 years' planning and preparation culminated with launch of a New York University (NYU) Langone Dental Medicine Advanced Education in General Dentistry (AEGD) Postdoctoral Residency Programs at Apple Tree's Mounds View Center. Through this accredited program, Apple tree hosts 2 residents/year, providing pediatric, geriatric, and oral surgery mentored experiences treating complex patients of all ages, including providing care under IV Sedation. Residents not only build their clinical skills but also broaden their view of available dental career options. Exposure to a non-profit, mission-oriented practice may lead them to consider inter-professional practice that includes people of all ages and abilities including those with complex medical conditions or who are insured through Medicaid and Medicare. In 2021, Fergus Falls became the second Center to host AEGD residents.

### *Electronic Dental Record Milestones*

Evidence-based clinical innovation and advocacy were among the founding values of Apple Tree Dental. Understanding that robust clinical records are the source of data for such evidence, Dr. Helgeson developed a custom practice management software using the UK-based application development tool Omnis, to launch the organization's clinical activities in 1985. Clinicians recorded treatment information in paper charts and data entry personnel transferred key information to the dental software that was used to track and manage patient treatment needs and billing information. In the late 1990's, the custom software was converted from Macintosh to Windows operating systems, increasing network capabilities for a larger scale delivery system. At this time, management of the electronic dental record was transferred from

the Executive Director to an Information Systems Specialist. The main purpose of this early electronic record was to track and manage dental treatment needs for long term care residents, creating schedules for each mobile facility based on planned treatment, billing completed treatments, communicating with guardians/patients, and tracking overall dental status (missing teeth and treatment performed over time by the organization).

In 2008, Apple Tree began using Open Dental Software at its then new Rochester Center. This electronic dental record is continually in use today across all 8 Centers. Clinicians and staff enter information directly into Open Dental, eliminating the previously required data entry step. Phased conversion between 2008-2011 occurred for all Centers to operate fully on Open Dental and to convert all pre-2011 records into Open Dental format for unified storage and export. Utilizing Open Dental's certified electronic health record allowed Apple Tree to participate in the Medicaid HER Incentive program between 2012-2018 and complete two stages of meaningful use. Meaningful use of health records is aimed at improving the efficiency, safety, and overall quality of care. At Apple Tree Dental, this included ensuring collection of specific patient-reported information (such as tobacco use status) and providing educational resources within the record for tobacco cessation and other health promotion activities. Various Open Dental customizations allowed for the electronic dental record of Apple Tree Dental to be more robust than is typical in conventional dental practices. Apple Tree records contain dental diagnosis, prognosis, and treatment coding, collects detailed medical (ICD-10) and demographic data, location where services were provided, whether teledentistry was used, and which provider type provided the service.

Beyond the electronic dental record, radiographs are linked to the record via cloud-based storage. In addition, Human Resources data from ADP tracks staff qualifications, hours, and pay. Lastly, QuickBooks tracks expenses at the Center level relating to equipment, materials, and other transactional costs.

### [Key State Legislative Milestones](#)

Apple Tree has sought to increase the reach, efficiency, and effectiveness of the dental team through workforce expansion, integrated care, and inter-professional collaboration. Apple Tree's policy director and paid lobbyists work with the board of directors and leadership to monitor and influence oral health policy including public program reimbursement. Leadership offers testimony in nearly every legislative session. Examples of favorable outcomes achieved in collaboration with other dental organizations, associations and coalitions include workforce innovations, funding for dental access grants, creation of a Critical Access Dental Provider Program, restoration of specific services for people with special needs when adult benefits were cut, inclusion in pandemic relief programs, and allocation of state funding for innovative programs in value based dental care. Following is a timeline of several key advocacy efforts to which Apple Tree Dental has contributed and those that have had an impact on its care delivery.

**In 1999**, Apple Tree Dental advocated for the establishment of Collaborative Practice for dental hygienists in Minnesota. Collaborative practice dental hygienists are an essential part of the care team providing oral health screenings, preventive services, and education within their scope for patients, caregivers in community settings. When additional treatment is needed, Apple Tree uses the electronic health record to schedule appointment in its mobile program or at the nearest Center.



**In 2001**, the Minnesota legislature created the Critical Access Dental Provider Program to increase in Medicaid reimbursement to dental providers who treat disproportionately higher numbers of publicly insured patients to counter low reimbursement, which was the most cited barrier to providing care to this population. Apple Tree Dental qualified for this designation when the program came into effect in 2002 and has participated throughout its operational history. Participation in this program has helped sustain Minnesota's safety-net and given cohesion to the advocacy efforts to improve policy, funding, and administration of the State's Medicaid dental program. A recent example is an analysis that revealed the significant contribution of Critical Access Dental Provider Program, which has influenced discussion of program improvements with the Department, multiple managed care organizations and legislators. A recording of this presentation can be viewed at: <https://youtu.be/1XIVRPiChac>

Apple Tree sought to find common ground in the contentious discussion of midlevel providers. **In 2009**, legislation was enacted authorizing the education and licensure of dental therapists and advanced dental therapists. Beginning with dental therapists from the first graduating class in 2011, Apple Tree has employed advanced/dental to serve our patients of all ages.

**In 2009**, Medicaid dental benefits were cut significantly due to a budget deficit. While preservation of a limited adult benefit set was preferable to complete elimination, the loss of periodontal coverage and other limitations created new barriers to care and discouraged many dentists from taking patients covered by Medicaid.

**In 2020**, with the unfolding of the COVID-19 pandemic, a series of executive orders were issued by the Minnesota Governor to contain the transmission of the pandemic. Among these orders was a seven-week restriction for dental practices to provide only urgent care services.

Minnesota's teledentistry legislation and regulation has been generally progressive, evolving prior to and during the COVID-19 pandemic. Medicaid includes coverage for both live/synchronous and "store and forward"/asynchronous teledentistry.

**In 2022**, Medicaid dental benefits were restored to include comprehensive periodontal therapy for adults. A consensus-building approach to oral health advocacy enabled a significant increase in public program dental reimbursement, with a regular schedule for reimbursement update, administrative simplification and accountability measures, and report to the legislature to guide multi-year demonstration projects focused on testing value-based payment models, medical-dental integration, and comprehensive care models to address health disparities.

#### [Research Authorization Considerations](#)

The state of Minnesota statutes on research using patient clinical records requires health records generated on or after January 1, 1997 to have either active or passive Research Authorization (RA) consent from the patient in order for their records to be utilized in research by the requesting entity. If active signed consent is not received, written documentation must be sent to the patient's last known address with paid return envelopes twice with at least 60 days after the second mailing before passive consent may be assumed.



Apple Tree Dental collaborated with the Mayo Clinic Rochester Epidemiology Project (REP) to meet this requirement for participation in the REP health record linkage system. The REP collaborates with community partners to facilitate obtaining RA for patients in those settings to enable those health records to be merged into the linkage system. Each fall, an updated census is created within the linkage system for the previous year's participating data partners and their patient records to enable use within the linkage system for longitudinal investigation of clinical diagnoses, treatments, and other health factors with accurate time and space information. In 2019, Apple Tree Dental completed a mailing campaign to 9,117 patients who were seen within two years in Centers within the REP region and secured 6,675 RA consents. In addition, Centers in the REP region adapted their clinical workflows to recruit RA consent during patient visits, alongside other intake document workflows. On January 24, 2022, Apple Tree Dental implemented a new Research Authorization process at all 8 Centers that enables identifiable components of Apple Tree Dental records to be utilized for research with collaborators. Of the patients seen since implementation, 12,165 patients (46% of the patients seen) have provided active Research Authorization consent (in addition to passive consent that was obtained from the 2019 mailing campaign). As of mid-2022, Research Authorization is positive for a total of 18,486 patients. With the transition to a new practice management software in late-2022, an email and text messaging campaign may be pursued as an economical alternative to a physical mailing campaign to obtain RA for patients who have not been seen physically at a Center for several years but whose past records could be utilized in research utilizing identifiable components.

Prior to having RA, Apple Tree Dental was only able to share deidentified or aggregate data with external research collaborators. Having RA allows for identifiable components of the data at the individual record level to be shared with research collaborators. In addition to representing more granular information, identifiable information allows for collaborators to independently link the dental records from Apple Tree with other data, such as claims records, census block information, and other external sources of data.

#### [Differentiation of Electronic Dental Record](#)

The longitudinal records of Apple Tree Dental contain a significant patient volume and history. In mid-2020, Apple Tree had delivered nearly 1.5 million dental visits, served about 190,000 unique patients, and delivered over \$383 million in service value. This includes data from traditionally under-represented patient populations (older adults, adults with special needs, low-income children) and payers (Medicaid). Extraordinary longitudinal depth exists in the dental record, with over 3,000 patients with a "time under care" of 10 years or more. A richer clinical record beyond dental treatment is captured, including detailed examination forms in structured format, diagnosis and prognosis of dental treatments, sequence of treatment within an overall treatment plan, treatment referrals with narrative documentation by referral type and procedure, record of prosthetic fabrication or replacement and date of original prosthesis, recall frequency of preventive, diagnostic, and other services, treatment completion and outstanding treatment needs, meaningful use dental criteria (tobacco use and medication reconciliation), and robust medical information (ICD-10 condition codes, comprehensive medication and allergy lists, and medical alerts for blood thinners, antibiotic prophylaxis, mobility limitations, or behavioral needs). The setting of care delivery is recorded by treatment code among a variety of unique sites of service, including outpatient Centers,

long-term care facilities, assisted living facilities, schools, Head Start Programs, group homes/day programs, inpatient hospital settings, IV sedation suites, teledentistry, and rural/urban sites of care. The treating clinician is also represented in the record, including dental hygienists, dental therapists, advanced dental therapists, and dentists. In addition to including a variety of demographic factors (age, sex, race, residential address), insurance status inclusion in the dental record allows for investigations on payer type (public/private) and extrapolated socioeconomic status. Because the commitment to collecting research quality data came about at the time of the organization's founding, the organization places an emphasis on quality assessment at numerous levels to ensure a high rate of completeness and formal structure within the record.

### Sample Data Dictionary

Following is a table of variables from Apple Tree's dental record that are commonly used for research projects. Dataset complexity is determined in the exploration stage of research collaboration and depends on the number of variables and their complexity, that is if they are readily available in structured form within the record or if variables need to be created from variables that exist in the electronic dental record.

Category	Variable Name	Format
Allergies	Allergy	categorical
	Reaction	text
	Active	categorical
Appointments	Provider	categorical
	Appt type	categorical
	Appt date	date
	Age at appt	continuous
	Procedures	categorical
	Center/Program	categorical
	Appt length	continuous
	Insurance type	categorical
Medical Condition	Disease	categorical
	Notes	text
Medications	Medication	categorical
	Notes	text
	Med start date	date
	Med stop date	date
	ATD prescribed	categorical
	Provider	categorical

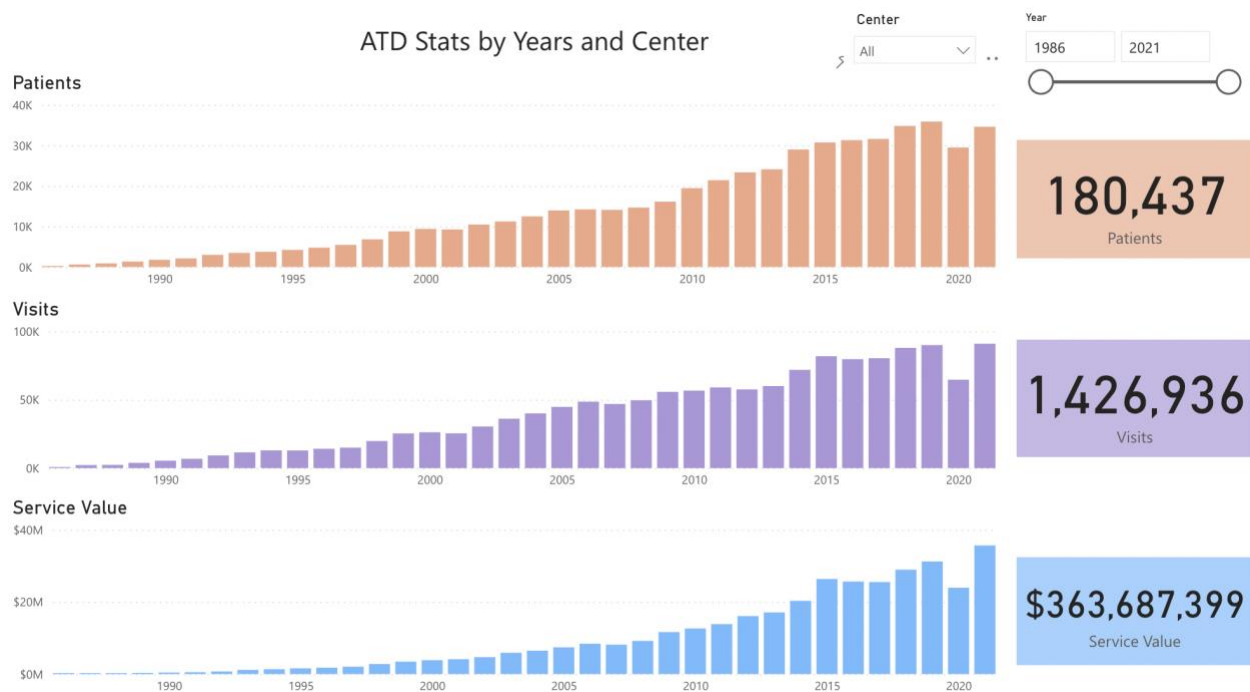
Oral Exam Form	Exam date	date
	Exam type	categorical
	Brushing frequency	categorical
	Flossing frequency	categorical
	TMJ signs	categorical
	Extraoral exam findings	categorical
	Intraoral exam findings	categorical
	Oral cancer screening	categorical
	Occlusion	categorical
	Incisor relationship	categorical
	Orthodontic referral	categorical
	Oral exam notes	text
	Periodontal diagnosis	categorical
	Gingival condition	categorical
	Food debris presence	categorical
	Plaque presence	categorical
	Calculus presence	categorical
	Staining presence	categorical
	Bleeding presence	categorical
	Oral care dependency	categorical
	Hygiene effectiveness	categorical
	Patient cooperation ability	categorical
	Extra treatment time	categorical
	Pedo enamel effects	categorical
	Pedo oral habits	categorical
	Pedo occlusion	categorical
	Pedo arch length	categorical
	Pedo eruption characteristics	categorical/text
	Prosthesis presence	categorical
	Prosthesis new/reline date	date
	Prosthesis type	categorical
	Denture deposits	categorical
	Patient prosthesis factors	categorical
	Prosthetic articulation	categorical
	Prosthesis satisfaction/use	categorical
	Prosthesis design	categorical
	Prosthesis condition	categorical
	Prosthesis function	categorical
	Alveolar ridge condition	categorical

Patients	Care status (active)	categorical
	Gender	categorical
	Age at first visit	continuous
	Zip code	continuous
	Guarantor	categorical
	Responsible Party	categorical
	Urgent medical note	text
	Center/Program	categorical
	Pre-medication	categorical
	Primary language	categorical
	Admission year (nursing home)	continuous
	Tobacco assessment	categorical
	Medical summary	text
	Race	categorical
	Ethnicity	categorical
Procedures	Procedure date	continuous
	Procedure code	categorical
	Status (planned, complete, etc.)	categorical
	Surface	categorical
	Tooth	continuous
	Tooth range	continuous
	Diagnosis	categorical
	Prognosis	categorical
	Priority	categorical
	Provider	categorical
	Place of service	categorical
	Prosthesis type	categorical
	Center/Program	categorical
	Insurance type	categorical
	Fee	continuous
Vital Signs	BP systolic	continuous
	BP diastolic	continuous
	Pulse	continuous
	Date taken	date
Tobacco Assessment	Smoking status	categorical

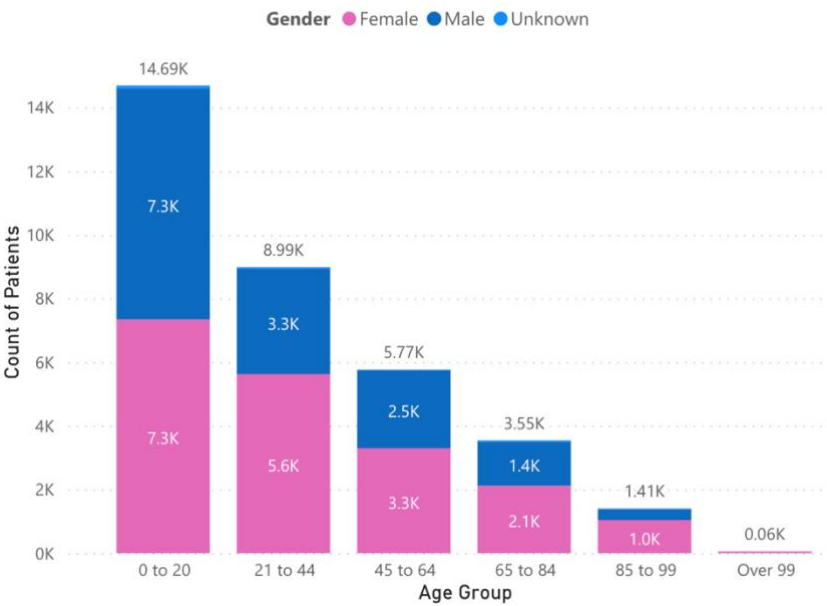
## Sample Descriptive Statistics

Following is a sample of graphics from PowerBI reports and internal analyses to showcase descriptive values of interest regarding Apple Tree Dental service delivery volume, patient reach, and care value, as well as characteristics of dental services, patients, and workforce. Most values are shown through the service year 2021, though additional data exists for part of 2022. Additional descriptive statistics, and manipulation of these values using filters can be accomplished by using PowerBI. Information about training and access to PowerBI is included in the Self Exploration section of the Research Collaborator Protocol portion of this research reference.

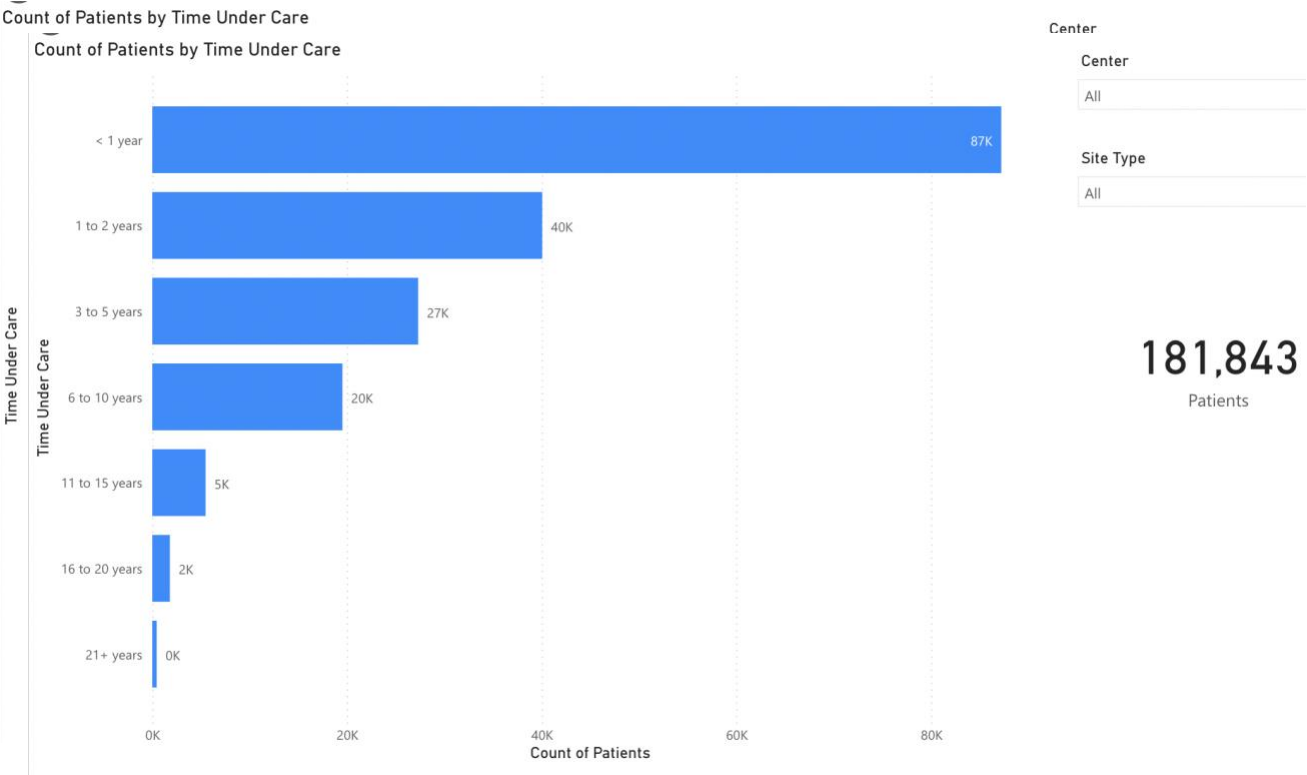
### Organization Care Delivery Overview



Patient Age Distribution in 2021



Time Under Care



## Care Setting

1986-2021

### Patients by Site Type, Center and Years

Center

All

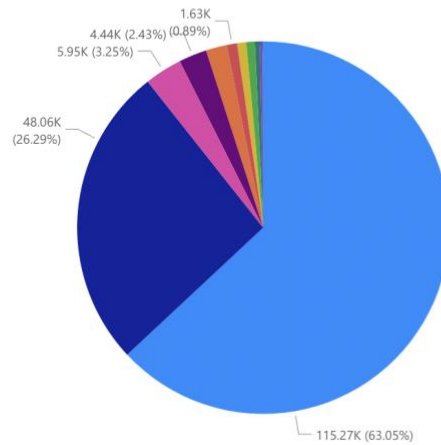
Site Type

All

1986 2021

Site Type	Facilities	Patients
Assisted Living	24	1462
Group Home	5	480
Head Start	35	5950
Hospital - OR Cases	1	39
Nursing Home	156	48059
Nursing Home and Assisted Living	16	4441
OP Clinic	11	115270
Other	14	1627
Outreach	3	1354
School	8	787
WCI Outreach	11	3354
<b>Total</b>	<b>284</b>	<b>177896</b>

Patients by Site Type



Site Type

- OP Clinic
- Nursing Home
- Head Start
- Nursing Home and Assisted Living
- WCI Outreach
- Other
- Assisted Living
- Outreach
- School
- Group Home
- Hospital - OR Cases

2021

Center

All

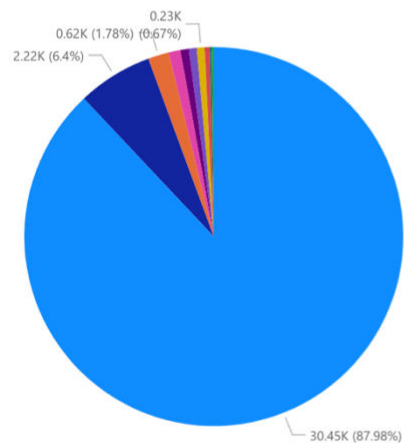
Site Type

All

2021 2021

Site Type	Facilities	Patients
Assisted Living	24	231
Group Home	5	232
Head Start	35	346
Hospital - OR Cases	1	2
Nursing Home	156	2216
Nursing Home and Assisted Living	16	253
OP Clinic	11	30453
Other	14	148
Outreach	3	53
School	8	63
WCI Outreach	11	615
<b>Total</b>	<b>284</b>	<b>34489</b>

Patients by Site Type

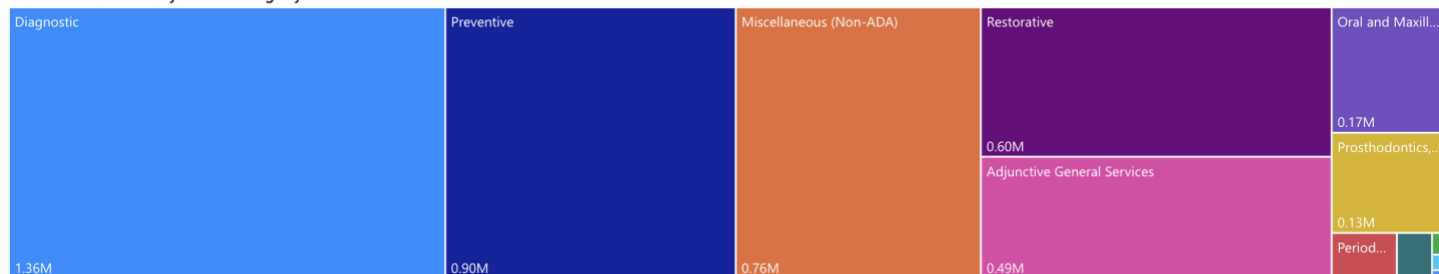


Site Type

- OP Clinic
- Nursing Home
- WCI Outreach
- Head Start
- Nursing Home and Assisted Living
- Group Home
- Assisted Living
- Other
- School
- Outreach
- Hospital - OR Cases

## Dental Procedure Category 1986-2021

Procedure Count by ADA Category



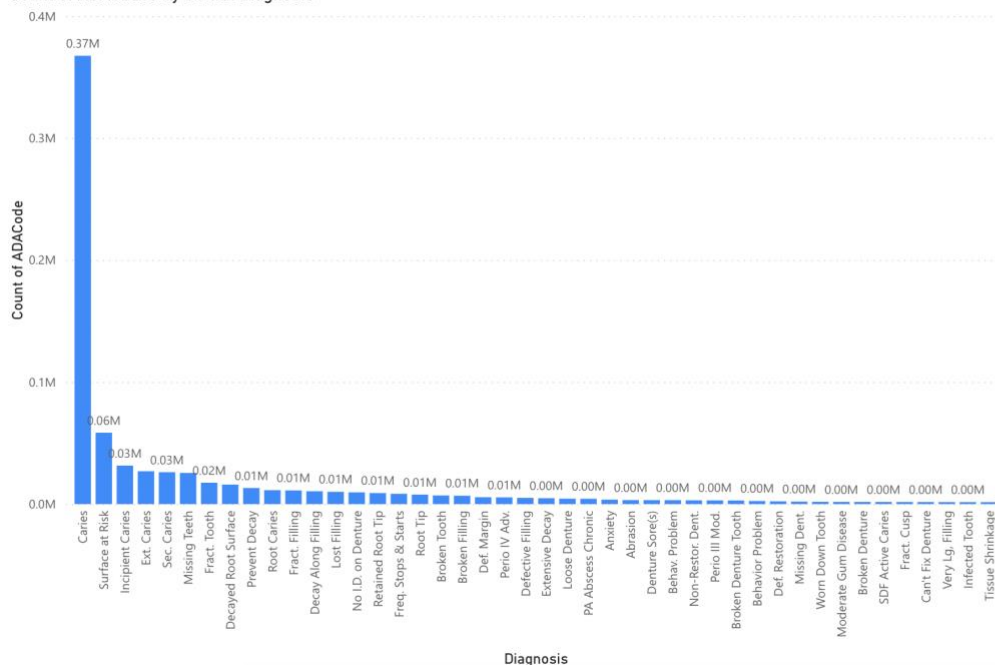
2021

Procedure Count by ADA Category



## Dental Diagnoses 1986-2021

Count of ADA Codes by Dental Diagnosis



### ADA Category

- ☒ Select all
- ☒ Adjunctive General Services
- ☒ Diagnostic
- ☒ Endodontics
- ☒ Implant Services
- ☒ Maxillofacial Prosthetics
- ☒ Miscellaneous (Non-ADA)
- ☒ Oral and Maxillofacial Surgery
- ☒ Orthodontics
- ☒ Periodontics
- ☒ Preventive
- ☒ Prosthodontics, fixed
- ☒ Prosthodontics, removable
- ☒ Restorative

### Center

All

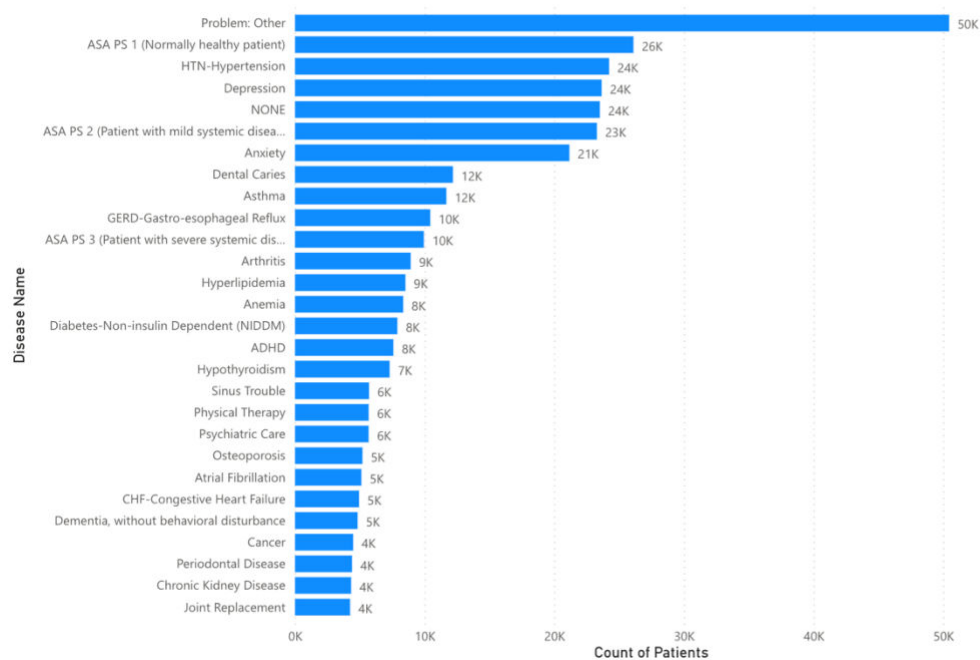
### Year

1986 2021



## Medical Diagnosis (Top 50 Conditions)

Top 50 Medical Diagnoses



Center

All

Site Type

All

Year

1986

2021

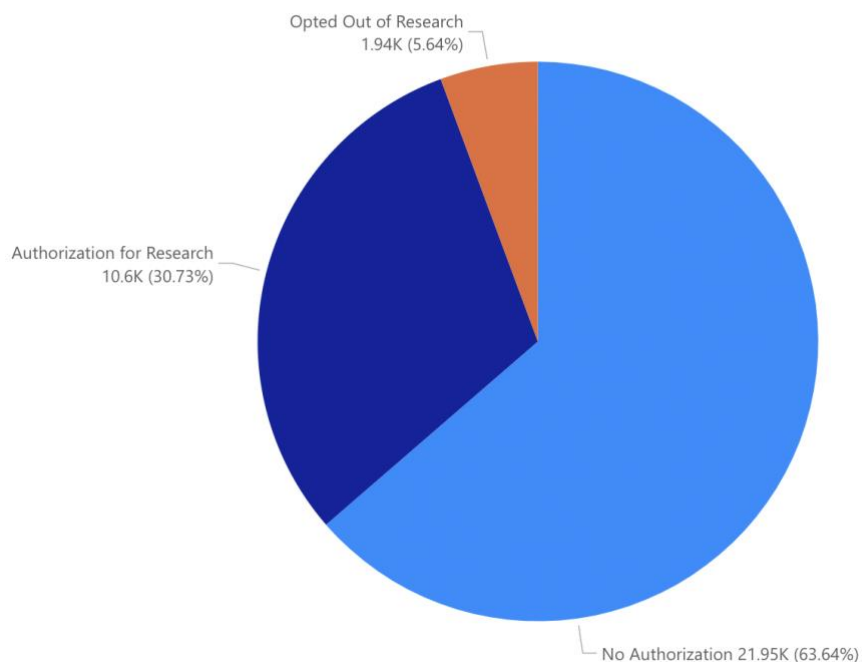
\* Prior to Open Dental, medical diagnoses were not stored as structured data. For patients that were never seen after the conversion to Open Dental this data will be missing or incomplete.

177,896

Patients

## Research Authorization Status (2021)

Count of Patients by Research Authorization Status



## Representation within the Rochester Epidemiology Project (May 2020)

<b>A. Active RA and Matched to REP</b>				
<b>AgeGroup</b>	<b>Female</b>	<b>Male</b>	<b>Unknown</b>	<b>Total</b>
0 to 20	1245	1217	5	2467
21 to 44	1279	655	2	1936
45 to 64	652	554	0	1106
65 to 84	336	202	0	538
85 to 99	150	42	0	192
100+	9	4	0	13
	3671	2674	7	6252
<b>B. Projected Overlap of Dental Records within REP 27 County Region</b>				
<b>AgeGroup</b>	<b>Female</b>	<b>Male</b>	<b>Unknown</b>	<b>Total</b>
0 to 20	2141	2163	9	4313
21 to 44	1595	845	1	2441
45 to 64	896	649	0	1545
65 to 84	431	278	1	710
85 to 99	231	58	0	289
100+	12	2	0	14
	5306	3995	11	9312
<b>C. Proportion of Active RA/REP Matched from Projected Overlap</b>				
<b>AgeGroup</b>	<b>Female</b>	<b>Male</b>	<b>Unknown</b>	<b>Total</b>
0 to 20	58.15%	56.26%		57.20%
21 to 44	80.19%	77.51%		79.31%
45 to 64	72.77%	85.36%		71.59%
65 to 84	77.96%	72.66%		75.77%
85 to 99	64.94%	72.41%		66.44%
100+	75.00%	200.00%		92.86%
	69.19%	66.93%		67.14%

## Workforce

Apple Tree Dental employs dentists (some of whom have residency and/or specialty training), advanced dental therapists, dental therapists, dental hygienists, dental assistants, care coordinators, lab technicians, equipment truck drivers, administrative support staff, and administrative director staff. For reference from a recent employee census, Apple Tree Dental employed a total of 218 staff, with 142 total clinicians and 76 total support staff. Of the 142 clinicians, 37 were clinical assistants, 33 were dental assistants, 29 were dental hygienists, 2 were dental therapists, 7 were advanced dental therapists, and 34 were dentists. Of the 76 support staff, 35 were clinic and community care coordinators, 14 were corporate team members, 9 were center directors and office managers, 9 were transportation and maintenance staff, 6 were lab technicians, and 3 were billing/collections staff. The workforce is distributed across outpatient and mobile clinical settings, specialty/niche practice types, and functions that fulfill the mission of the organization.

## Examples of Research Conducted Using Apple Tree's Records

### Care Delivery Model

#### Oral Health Stability in Long-Term Care Settings

Dr. Barbara Smith, as a PhD graduate student at the University of Michigan, partnered to evaluate the effect of access to continuous comprehensive dental care through Apple Tree Dental's Community Collaborative Practice model of mobile dental care delivery in long-term care facilities. The Information Systems Director assisted her with creation of a cohort of patients served in long-term care settings to capture numerous "periods" between an initial examination and subsequent periodic examinations to determine how long it took to stabilize the patient's oral health so that they did not need additional treatment at the time of a periodic examination. Functional status case mix data of the cohort was ascertained by linking data from the Department of Health internally by Apple Tree Dental staff before exporting the deidentified dataset for analysis. Records of nursing home residents receiving continuous dental care were reviewed for 24 months. The research question was whether continuous care and treatment of diagnosed initial dental needs would result in oral health stability, defined as no new treatment needs at the time of a periodic exam following completion of treatment. Her study found that 44% of the study group achieved oral health stability. The association of achieving oral health stability was positively associated with fewer initial treatment needs, being younger, or being female. These data provided evidence for the feasibility of improving and maintaining oral health in nursing home residents by providing dental treatment in a comprehensive and continuous manner. After graduating with a PhD in 2003, her work was published in 2005 by the Journal for Special Care Dentistry and presented at national conferences. The study proposed the novel concept of "oral health stability," as a value metric for older adults in long-term care settings. The outcomes of the study supported the effectiveness of Apple Tree Dental's model of Community Collaborative Practice in enabling 44% of the older adults in the study cohort to achieve oral health stability within two years of participating in the program.

### Workforce

#### Dental Therapy Case Studies

The Pew Charitable Trusts funded two case studies representing dental therapists working in two distinct niche settings within Apple Tree Dental. ["An Advanced Dental Therapist in Long-Term Care: Heather Luebben's Case Study"](#) depicts the role that an advanced dental therapist played in stabilizing the oral health of long-term care residents, featuring her work at the Minnesota Veterans Home. ["An Advanced Dental Therapist in Rural Minnesota: Jodi Hager's Case Study"](#) is the second of two profiles of advanced dental therapists who are expanding access to care at Apple Tree. This case study features Jodi's work as part of the dental care team at our Madelia Center for Dental Health located within the Madelia Hospital in rural southern Minnesota.

These two case studies illustrate that the work of these dental therapists is fulfilling the role envisioned by Minnesota's dental therapy legislation. By providing access to restorative and preventive care for public program patients of all ages, these dental therapists are helping to improve access to oral health care for an underserved rural population. They have been well accepted by their patients, dentists, and other dental team members, dynamically responding

to meet changing patient and practice needs. In the clinical experience at Apple Tree, adding dental therapists as primary care clinicians has increased access to care for children and adults, extended the reach of dentists and other team members, and reduced staffing costs to deliver care. Minnesota's Medicaid reimbursement rates for dental services are among the lowest in the nation and far too few enrollees have access to timely dental care. Finding new ways to cost-effectively extend Apple Tree's reach to underserved populations groups is essential.

#### Dental Therapy Economic Evaluation

In August 2020, The Center for Workforce Studies in the School of Public Health at SUNY Albany, published ["The Contributions of Dental Therapists and Advanced Dental Therapists in the Dental Centers of Apple Tree Dental in Minnesota."](#) Their research covered 10 years of data to highlight the safety of dental therapists and the favorable economics of their employment at Apple Tree Dental.

#### Provider and Patient Satisfaction with the Dental Therapy Workforce

In May 2022, The Center for Workforce Studies in the School of Public Health at SUNY Albany, published ["Provider and Patient Satisfaction With the Dental Therapy Workforce at Apple Tree Dental."](#) This consisted of original survey data from clinical, support, and administrative staff who work with dental therapists on their perspectives on the workforce, as well as patient survey data on satisfaction of seeing a dental therapist relative to dental hygienists and dentists in the practice. "The overall survey findings attest to high levels of satisfaction with the dental therapy workforce model among the staff throughout Apple Tree Dental's mobile programs and dental centers with overall agreement that dentists can work more effectively and efficiently using dental therapists on dental teams...Findings relative to patient satisfaction suggest that the clinical teams at Apple Tree Dental, which include dental therapists and advanced dental therapists, are providing services that meet the needs of their patient population. Furthermore, patient satisfaction, as a component of quality measurement, indicates that this workforce has not, as opponents feared, diminished quality of patient care."

#### Utilization/Economic Evaluation

##### Long-Term Care vs Community-Dwelling Older Adults

The West Health (WH) Foundation The foundation supports research, policy, and care provision. A research team from the WH Institute partnered with Apple Tree to investigate dental utilization patterns among seniors and the characteristics of dental cost for this population, given the Institute's focus on the cost of healthcare delivery systems. The study drew from a cohort of patients first seen between 2012 and 2013 in long-term care (LTC) and outpatient (OP) settings and followed these patients through 2015 in terms of dental utilization and cost variables. Through a generalized estimating equation repeated measures analysis for each residence type group, significant contributors to service cost were identified. The study found that costs for providing comprehensive dental care in OP and LTC settings were similar, modest, and declined over time. Dentate patients with functional dentition and edentulous patients were less costly to treat. LTC patients had lower utilization than OP patients. Care patterns shifted over time to increased preventive care and decreased restorative care visits. Published in PLOS ONE in 2020, this evidence offers important comparative information of LTC and OP older adults on their dental treatment costs and the patterns of preventive versus restorative dental utilization over time in each of the groups.

Collaboration with the WH Institute also explored the creation of consolidated measures of disease (for caries, periodontitis, edentulism). This existing dataset has a depth of opportunities for continued research around the topics of medical-dental comorbidities, additional economic evaluations, and differences between OP and LTC dental patients.

#### Critical Access Dental Provider Program Analysis

As part of Apple Tree Dental's advocacy efforts, state level public claims data were analyzed to determine how effective the Critical Access Dental Provider Program (CADPP) was in addressing the needs of publicly insured individuals. This analysis demonstrated that in 2018 CAD providers delivered twice the number of dental visits compared to non-CAD providers and increased access by more than 500,000 dental visits in just three years. With roughly one million more publicly insured enrollees in Minnesota since the CADP Program was created in 2001, this analysis affirmed its effectiveness in expanding access to dental care. A recording of these presented findings can be viewed at: <https://youtu.be/1XIVRPjChac>

#### Coronavirus Pandemic Era Utilization

Clinical dental practice operations were uniquely challenged in the wake of the coronavirus pandemic, making access for underserved populations with a baseline high oral need even more difficult. In Spring 2020, the Centers for Disease Control (CDC) and American Dental Association (ADA) created recommendations on safety in dental practice operations and definitions of risk and urgency of various dental procedures. While state Boards of Dentistry further adapted ADA/CDC guidelines for the reference of their licensed providers, regulatory mandates for restrictions in dental practice were issued by executive order of Governors in most states. In Minnesota, dental practices were restricted to providing only urgent care for a seven-week period during which some dental practices closed altogether, and others remained open for urgent dental services only.

A data set was created to enable demonstration of characteristics of patients who sought emergency dental care at Apple Tree Dental Centers, which remained open during the described seven-week period. A key preliminary finding from this internal review is that about a third of patients seen during the study period were new patients who either did not have a dental home or whose dental home was closed. Further analysis of this dataset is possible to describe the characteristics of both new patients and patients of record according to a variety of demographic, social, health, and dental variables surrounding their care within the "stay at home" order period. Characterizing patients who experienced a dental emergency during pandemic-related restrictions in access to dental care in this way highlights the factors that make underserved populations vulnerable to emergent oral events.

#### Other

##### Internal Analyses

##### *Yearly Backup*

At the conclusion of each year, the Information Systems Director creates a yearly backup of the database for historical purposes. This allows for a yearly snapshot of the dental record to be archived for referencing data elements that become overwritten due to the living nature of the dental record. For example, medical conditions are updated at each visit and are not linked to dental treatment codes, so they always appear in the record as active present-day

information. If medical conditions/prescriptions over time is of interest to an investigator, these archived annual snapshots are an invaluable resource.

#### [Data Pulls](#)

For specific initiatives, quality improvement projects, grant proposals, regulatory requirements, or research collaborations, the Information Systems Director composes queries to create datasets to suit the needs of the situation.

#### [Advocacy Projects](#)

##### [Resin Partial Dentures](#)

At one time, public dental coverage in Minnesota did not cover prosthetic devices. Apple Tree Dental used internal analysis to demonstrate the cost effectiveness of resin partial dentures and advocated for its inclusion as a public dental benefit.

##### [Periodontal Therapy](#)

During a major economic recession in 2009, the comprehensive public dental benefit for periodontal therapy was eliminated. Internal analysis of Apple Tree Dental records was used to demonstrate the prevalence of periodontitis among publicly insured patients, many of whom did not pursue periodontal therapy due to out-of-pocket costs, and raise awareness about the links between oral and systemic health aided in the reinstatement of a periodontal therapy benefit in the state dental benefit in 2022.

##### [Health Plan Reimbursement](#)

Multiple Managed Care Organizations (MCO'S) administer the public dental benefit plan in Minnesota, each with unique differences in prior-authorization requirements and reimbursement rates. An internal analysis of these differences and demonstration of the volume of patients within these plans that Apple Tree Dental serves has allowed for negotiating improvement in administrative protocols and reimbursement.

## [Linkage to Other Data Sources](#)

### [Research Authorization Implications](#)

Please see the above section on RA Considerations for the legislative and organizational context on Research Authorization. For research collaborators wishing to use identifiable information, only records for which there is positive RA may be shared. This is useful for external linkage to other data sources by using identifiable information. Studies whose focus relates to identifiable information would also require records with positive RA. Many studies can be completed by sharing de-identified datasets, so limitations of a cohort to records with positive RA may not apply to all studies. As of mid-2022, Research Authorization is positive for a total of 18,486 patients.

### [Historical Linkages](#)

#### [Department of Health Services Claims](#)

Public insurance claims data are available for purchase from the state Department for Human Services and have been utilized for internal analysis that informs advocacy efforts, grant reporting/applications, and quality improvement projects.

#### State Health Department Records

For Dr. Barbara Smith's dissertation project, functional status case mix data was requested from the Minnesota Department of Health and linked internally by the Apple Tree Dental Information Systems Director before exporting the de-identified dataset to the researcher for analysis.

#### Human Resources Data (ADP Software)

Workforce studies have utilized Human Resources data to augment clinical dental records in investigations around scope of practice, economic sustainability, and allocation of team resources.

#### Census Data (Legislative Districts)

For exploratory/feasibility studies to determine the best location of a new Center that would best address the needs of the most publicly insured patients based on geographic distribution, geomapping has been used. The epicenter of publicly insured individuals without a dental visit was utilized to guide the establishment of one of the Centers for Apple Tree Dental. For effective advocacy efforts, internal analyses by legislative district informs evidence-based policy requests. Competitive pursuit and reporting on grant funds has also benefited from spatial analyses.

#### Opportunities for Linkage

##### Rochester Epidemiology Project, Representing Comprehensive Medical Records

Since 2019, Apple Tree Dental has collaborated as a community partner with the Mayo Clinic Rochester Epidemiology Project to provide its robust dental records within the longitudinal health record linkage system. This enables a subset of Apple Tree Dental records to be linked to detailed medical, public health, and hospital records for longitudinal analysis enabling robust investigation into oral-systemic interactions.

##### American Dental Association DERE Data Registry

In 2020, Apple Tree Dental served as a pilot for the American Dental Association's launch of the Dental Experience and Research Exchange (DERE), a data registry aimed at building capacity for quality measurements at the office level and aggregate level. Due to Apple Tree Dental's above-average record detail, participation as a pilot program within the DERE has inspired expansion of the overall measurements represented in the registry as well as work toward encouraging value-based metrics among all participating practices.

##### Financial Data (QuickBooks Software)

Operating expenses, including purchase of equipment and materials, are tracked in QuickBooks and have the potential to be linked to clinical data to evaluate efficiency or waste and impact of clinical outcomes based on key purchase decisions.

##### Private Insurance Claims

With the post- Affordable Care Act advent of private Managed Care Organizations (MCO's) administering public insurance dental coverage for participants of the expansion marketplace, internal analyses of reimbursement rates among MCO's have equipped Apple Tree Dental for advocacy efforts within the dynamic evolution of this sector of the insurance industry. Additionally, Foundation grants that are associated with private insurance companies allow and sometimes require reports that specify outcomes for participants of their plans.



## Research Collaboration Protocol

It is tempting to identify an interest or idea and allow the energy around that topic to drive collaborative research activities. While slowing down momentum, intentionally framed protocols create an important container that can successfully carry important research topics through the rigorous scientific process that produces high-quality evidence capable of supporting clinical and policy innovation.

### Collaborator Inquiry Form

Individuals accessing this research reference and other resources have completed a Research Collaborator Inquiry Form on the website and may have communicated with Apple Tree Dental's Research Director about gaining access to detailed research collaborator resources and exploring collaborative research.

### Collaboration Framework

A well-designed and effectively executed research study deserves intentionality, time, and active engagement from key stakeholders. Following are several components of a research collaboration framework to which Apple Tree Dental holds itself and its collaborators accountable.

#### Mission-driven, value-focused

Apple Tree Dental supports a Research Director and Research Team, who allocate time and resources to partner with research collaborators at various stages of research projects. Apple Tree Dental is a mission-driven non-profit organization that aims to overcome barriers to oral health through inspiring partnerships that foster healthy communities; research collaborations are pursued as a key component of this mission. While partners come from a variety of settings (public/private, for-profit/non-profit), collaborative research projects are expected to align with the mission and values (access, compassion, excellence) of Apple Tree Dental.

#### Engaged

The intimate knowledge that Apple Tree Dental has of its data resources, the experience of conducting numerous research projects, and the commitment and allocation of resources to research as a core activity within the organizational all support our active engagement within collaborative research opportunities. From inquiry to formal partnership and study exploration to dissemination of results, our Research Team is available to support research collaborators in successfully transforming their research interests into evidence that promotes health equity. There are rare instances where research collaborators require minimal or no engagement from Apple Tree Dental's Research Team, but this is uncommon due to the mission-driven and value-focused concordance of most of our research collaborators.

#### Supported

Research projects require appropriate structural, functional, and financial support to be conducted effectively. Structural support for a project is to be provided by the organization(s) represented by research collaborators. Functional support for a project relies on the expertise and active engagement of all members of the research team. Finally, financial support from grant funding agencies allows for a project to be feasible given the limited in-kind capacity of most non-profit organizations.



### *Stage-defined*

We recognize that not all research ideas will or should be realized into studies that generate evidence, but we believe that ideas are more likely to progress toward a successful outcome if given effective support at specific stages. The following are described stages of most research projects on which Apple Tree Dental partners.

#### *Introduction/Inquiry*

An initial connection is made to establish mutual interest in exploring a collaboration. Besides public-facing materials on the Apple Tree Dental website and public domain, a Research Collaborator Inquiry Form can be completed to request access to protected resources related to research collaboration. An introductory meeting may be scheduled with the Research Director for general introductions and to address any questions related to a potential research collaboration.

#### *Self-guided exploration*

Access to protected research resources allows potential research collaborators to gain knowledge about Apple Tree Dental as a data source and research partner. Effective engagement of these resources also increases the capacity of a potential research collaborator to determine the feasibility of answering the specific research question or topic of interest by collaborating with Apple Tree Dental. Intentionality during this phase is critical to the success of embarking on formal collaborative research planning or partnership stages. Focused communication with the Apple Tree Dental Research Director is welcome during this period, through email correspondence or arranged calls to clarify any questions about the detailed research collaborator resources and how they may relate to collaborator interests.

#### *Collaborative planning*

If self-guided exploration of the research collaborator resources affirms the feasibility of a research collaboration, a collaborative planning stage is usually required and always highly recommended so that key stakeholders can be fully engaged to inform the detailed planning of a study—including refining the research question, designing the study methodology, identifying funding, and defining the level of capacity and engagement from all research partners. This stage will engage the Apple Tree Dental Research Director, the Research Team, and administrative personnel from the Finance Department through email correspondence and scheduled meetings. Engagement in this stage requires agreement to general confidentiality standards and a nominal financial commitment to ensure effective use of Apple Tree Dental personnel. In our experience, this stage usually takes 4-8 months with 1-3 Research Team meetings each month and ample communication and collaborative drafting of project proposal, research agreement, or grant proposal documents. While not recommended, if a potential research collaborator wishes to complete the planning stage without collaboration from Apple Tree Dental, they may submit a project proposal for consideration by the Research Team. It is likely that there will be a recommendation for a proposal refinement component within the collaborative partnership stage.

#### *Collaborative research*

After a research proposal has been approved by the Apple Tree Dental Research Team and research agreement documents have been executed, the collaborative research stage engages research collaborators as outlined in the agreements to conduct the study and

disseminate the results. If circumstances change, disabling the accomplishment of activities outlined in research agreements, both parties renegotiate the terms of those agreements.

### [Self-Guided Exploration Resources](#)

Given the importance of self-guided exploration, following is a description of available resources for this stage of research collaboration.

#### [Research Reference](#)

The Research Reference offers extensive detail on organizational and data resource history, a data profile, descriptions of past research collaborations and activities, and details on pursuing a research collaboration.

#### [PowerBI Reports and Dashboards](#)

Interactive reports from PowerBI enhance research collaborators' ability to obtain tailored descriptive statistics and assist with planning study methodology. Depending on collaboration stage and support, Research Team members may assist with navigating PowerBI reports or grant access for collaborators who complete PowerBI training modules or have prior experience with the resource to independently utilize this resource. Reports with custom variables may be created upon request as part of the collaborative planning stage.

### [Project Proposal Outline](#)

Each project will have its own specific criteria to describe, but below is a suggested outline of components of a Project Proposal that the Research Team will review in consideration of a formal Research Collaboration.

- [Research question/hypothesis](#)

- [Cohort and variable selection](#)

- [Proposed methodology](#)

- [Anticipated results](#)

- [Suitability of ATD data for project](#)

- [Scope of ATD engagement](#)

- [Funding mechanism](#)

### [Research Agreement Components](#)

Research Agreements can be tailored to meet the needs of a collaborator, granting agencies, and the organization that supports them. Sample agreements in the Research Collaborator Library are examples of commonly included components that Apple Tree Dental's administrative, financial, and legal personnel will review and approve for execution of a collaborative research project.

- [Internship Agreement](#)

- [Confidentiality and Nondisclosure Agreement](#)

- [Collaborator Agreement](#)

- [Data Use Agreement](#)