

Data Science Approaches to Better Serve our Aging Population

NIDCR Data Science — Patient-level and Population-level Health
Lyubov Slashcheva, DDS, MS

March 27, 2026

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Lyubov Slashcheva

**Chief Transformation Officer, Research
Director
Apple Tree Dental**

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Agenda



- About Apple Tree Dental
 - Community Collaborative Practice
 - Innovations/Learning Health System
- Research
 - Infrastructure to support aging research
 - Data linkages/collaborations

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About Apple Tree Dental

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APPLE TREE DENTAL

Access • Compassion • Excellence



A nonprofit, Critical Access Dental provider, founded in 1985

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APPLE TREE DENTAL

Access • Compassion • Excellence

*Our mission is to overcome
barriers to oral health*

*Our vision is to foster partnerships
that create healthy communities*



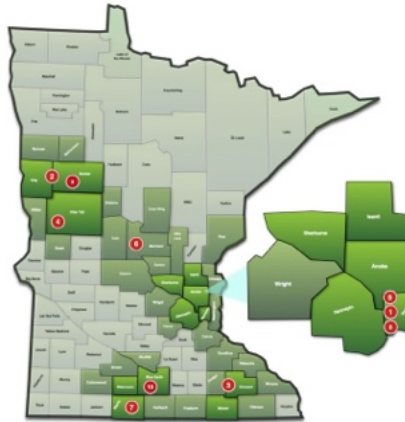
6

Apple Tree operates 10 Centers for Dental Health

*and delivers mobile care at
~140 community sites serving:*

- Low-income children and their families
- Adults with disabilities
- Seniors and elders in long-term care

*We serve patients from all 87 of
Minnesota's counties*

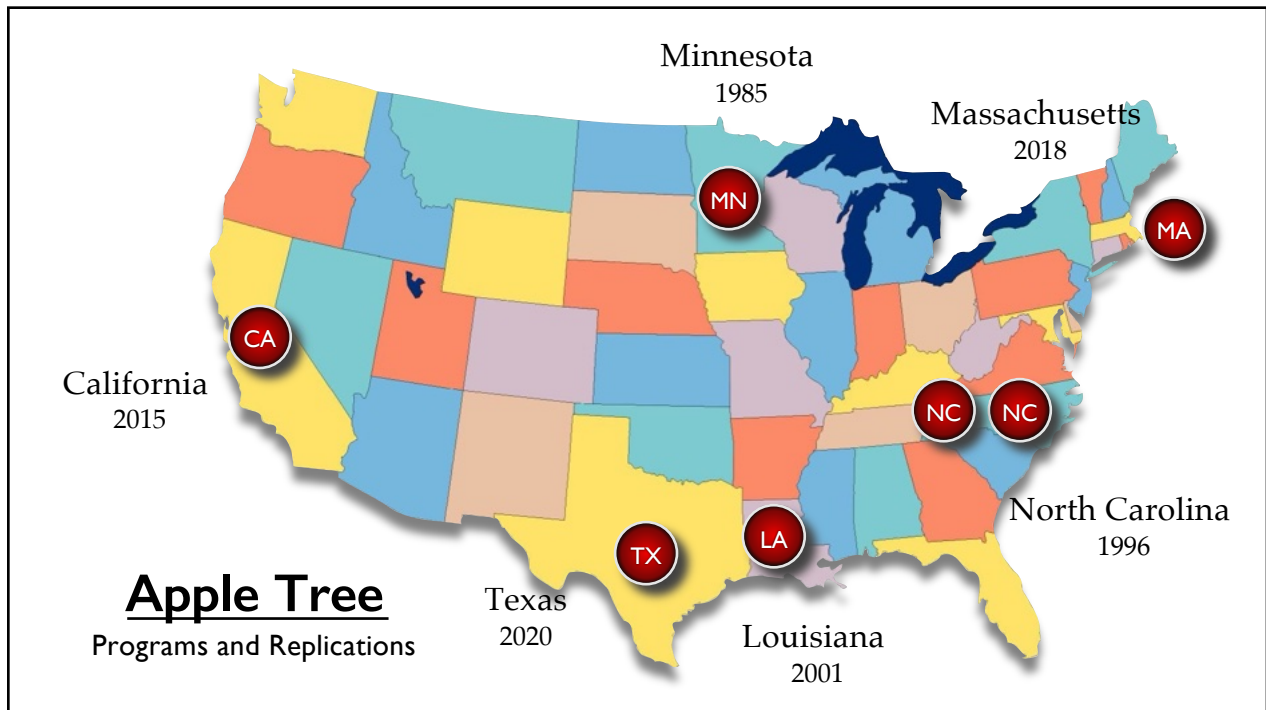


Dental Clinic Locations

www.appletreedental.org

- 1 NEW BRIGHTON (1986)
- 2 HAWLEY (1997)
- 3 ROCHESTER (2008)
- 4 FERGUS FALLS (2009)
- 5 MOUNDS VIEW (2014)
- 6 LITTLE FALLS (2018)
- 7 FAIRMONT (2020)
- 8 ST. PAUL (2025)
- 9 DETROIT LAKES OUTREACH CLINIC (2025)
- 10 MANKATO OUTREACH CLINIC (2025)

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Apple Tree's Community Collaborative Practice Model

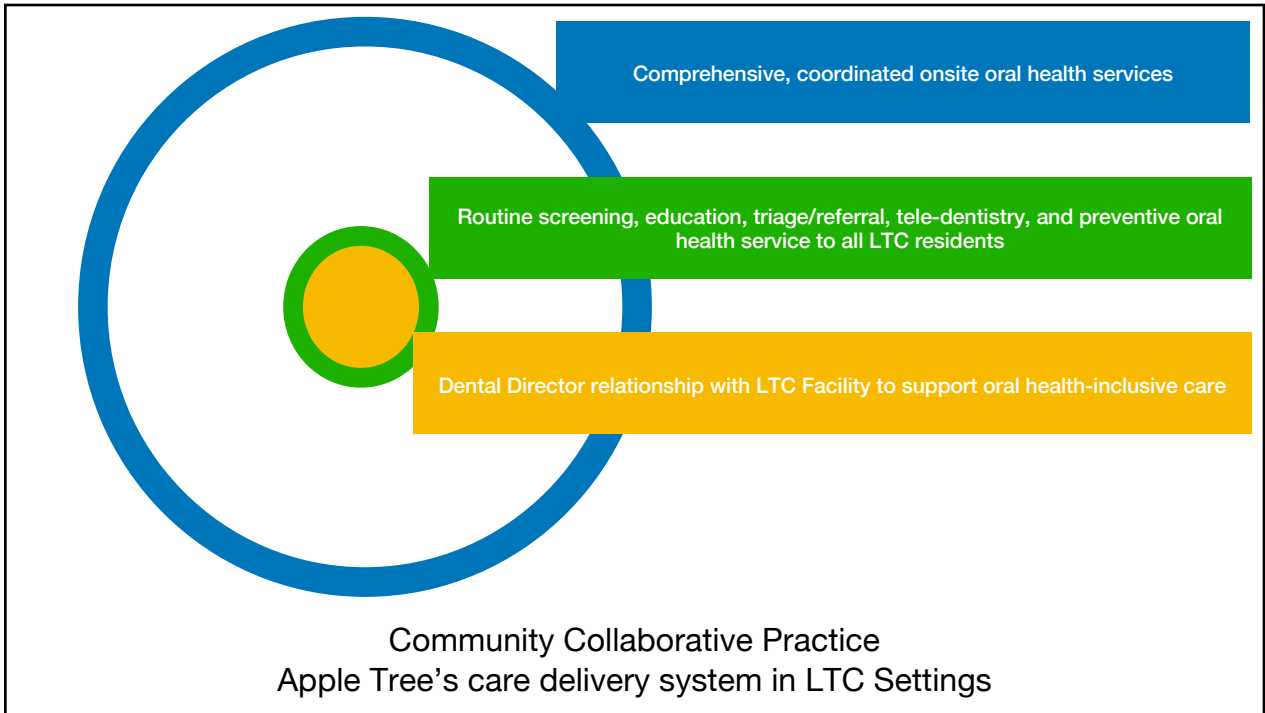
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Community Collaborative Practice

- Fundamentally an interprofessional practice model
- Proactive oral health delivery to patients and communities with high needs
- Actively engaged with other health, education, and social services professionals
- Integrates dental care into health care homes



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Innovations Teams



-  **Clinical Innovations**
-  **Education**
-  **Research**
-  **Advocacy**
-  **Fundraising**
-  **Public Relations**

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Apple Tree's Learning Health System



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HealthAffairs TOPICS JOURNAL BLOG SUBSCRIBE FOR AUTHORS

Let's Not Make Children Wait 17 Years

Neel Koyawala, Yasmi O. Crystal, Martin A. Makary

APRIL 5, 2019 10.1377/hblog20190328.92628



“Research shows that it takes approximately 17 years for evidence to become broadly adopted into clinical practice. In the case of silver diamine fluoride (SDF) therapy, a simple and painless treatment alternative to drilling dental caries in children, we should move faster.”

<https://www.healthaffairs.org/doi/10.1377/hblog20190328.92628/full/>

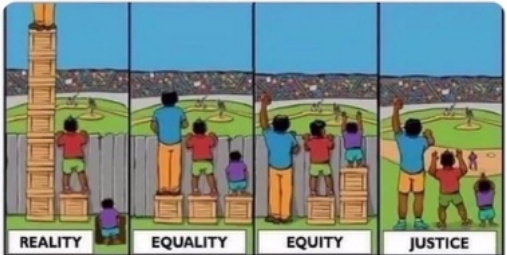
17

Operating as an Equity-Focused LHS

- "The best interest of the patient is the only interest to be considered," Dr. William J. Mayo in 1910
- We believe our patient populations deserve the highest quality care and that the health system must be responsive to their needs.
- We seek to eliminate ageism, ableism, racism, and socio-economic barriers that persist in our oral health care delivery systems.

Eshaddai White, PhD
@BikBoiScientist

Y'all be forgetting the "Justice" part.



REALITY	EQUALITY	EQUITY	JUSTICE
One gets more than is needed, while the other gets less than is needed. Thus, a huge disparity is created.	The assumption is that everyone benefits from the same supports. This is considered to be equal treatment.	Everyone gets the support they need, which produces equity.	All 3 can see the game without supports or accommodations because the cause(s) of the inequity was addressed. The systemic barrier has been removed.

9:59 PM · Sep 10, 2021 · Twitter for iPhone

31.9K Retweets 819 Quote Tweets 139.6K Likes


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Research Infrastructure Development

The screenshot shows a web browser window with the URL appletruedental.org/research/. The page features a navigation bar with "PATIENT LOGIN", "OUR LOCATIONS", and "DONATE TODAY". Below the navigation is a header for "APPLE TREE DENTAL" with a menu including "ABOUT US", "PATIENTS", "INNOVATION", and "CAREERS". The main content area has three columns: "RESEARCH" (Learn more about how Apple Tree is involved in data-driven research to produce better health outcomes), "APPLE TREE TECHNOLOGY" (We utilize innovative dental technology to provide you with the best oral health care), and "COMMUNITY COLLABORATIONS" (We partner with long-term care facilities, schools, higher education, and more). A photograph of dental staff is visible in the background. A QR code is located to the right of the screenshot.



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Research Strategic Plan 2023-2026

Research is essential to Apple Tree Dental's mission to overcome barriers to oral health and our vision of fostering partnerships that create healthy communities.

- **Objective:** Sustain and increase Apple Tree Dental's capacity to operate as a Learning Health System. Apply evidence and evaluation in engaging community partners in the design, implementation, and evaluation of programs and projects that support our advocacy for improving access to oral health and whole person care through integrated services and our Community Collaborative Practice.



PhD in Epidemiology Dissertation

- Barbara Smith, RDH, MPH, PhD
- University of Michigan
- MN Department of Health

“Stability over time was achieved in 44% of the study group.”



ORAL HEALTH STABILITY
ARTICLE

ABSTRACT
The purpose of this study was to determine whether oral health stability was achievable over time for institutionalized elderly who routinely received caregiver home care and to measure the factors associated with stability. Records of 888 dentate nursing home residents, each with a minimum of 20 months continuous care, were analyzed to determine the number of services by type for each time period between periodic examinations. Preexisting dental conditions, age, gender, functional status, prior service use, and facility characteristics were tested as explanatory variables. Oral health status was considered stable when a resident had a "good" or "excellent" finding on further treatment; otherwise it was coded as unstable. Generalized estimating equations (GEE) were used to estimate predictors of stability over time. Stability over time was achieved in 44% of the study group and negatively associated with male gender, advanced age, and more visited treatment needs. The data show that high levels of initial dental services and health stability for institutionalized elderly who routinely received comprehensive care.

KEY WORDS: aging, dentistry, long-term care, utilization, stability

What predicts oral health stability in a long-term care population?
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Division of Geriatric Dental Program, University of Michigan School of Dentistry, Ann Arbor, MI 48106-1078; *Yonkers, NY; †University of Colorado at Denver School of Dentistry, Department of Veterans Affairs, *Corresponding author: smithb@umich.edu

Introduction
Research on the oral health status of nursing home residents has been primarily cross-sectional, providing the oral care patterns of a population with competing dental health needs.¹⁻⁴ Citing the 2005 U.S. National Nursing Home Survey, reported that only 13 percent of the residents were described as having excellent or very good oral health. Cohen and Alshouse⁵ describe frail and functionally dependent elders as having significant dental needs and experiencing greater barriers to receiving dental care than independent elders. Low utilization of dental services by nursing home residents has been attributed to barriers to care, such as dental care costs and transportation to and from the dental office.⁶ Longitudinal studies describing clinically determined dental need and subsequent service utilization in nursing home residents are rare.⁷⁻¹⁰ Health services research regarding utilization and oral health outcomes in nursing home populations is also scarce and limited by small sample size.¹¹ These knowledge gaps are significant since demographic trends point to greater numbers of those aged 85 and older, the people most likely to require long-term care.¹² Furthermore, the poor dental situation has shown a decreasing proportion of admissions within each subsequent cohort of elderly,¹³ a trend that substantially increases the risk for oral disease and the need for services to meet that need.¹⁴

Planning for the service needs of an increasingly diverse and growing population of nursing home residents requires an assessment of oral health needs, utilization, and outcomes.¹⁵ To that end, this study was undertaken to establish whether the dentable outcome of oral health stability, defined as requiring only diagnostic or preventive services at periodic examination, could be achieved in nursing home residents and maintained over time in an environment free of some of the common access barriers. Since stability was used as a measure of oral health status, factors expected to be associated with oral health in general, such as age,¹⁶ functional status,¹⁷ and prior service¹⁸ were included in the analysis as potential explanatory variables. Preexisting dental conditions, specifically number of teeth present at initial examination and number of services required in the initial treatment plan, were also included as potentially predictive variables. In addition, facility factors previously identified as related to oral health status in nursing homes, such as care and proprietary status¹⁹ were also included.

Methods
Sources of data
Dental records on nursing home residents were obtained from Apple Tree Dental (ATD), a nonprofit group dental practice that provides on-site dental services in nursing home residents through the use of mobile dental offices in the

West Health Institute

Conclusions: Costs for providing comprehensive dental care in OP and LTC settings were **similar, modest, and declined over time. Care patterns shifted** over time to **increased preventive care and decreased restorative care visits.**



PLOS ONE

RESEARCH ARTICLE
Longitudinal analysis of cost and dental utilization patterns for older adults in outpatient and long-term care settings in Minnesota

Barbara J. Smith¹, Michael Hoggson¹, Brenda Pross¹, Tracy L. Fitzgibbon^{1,2*}, Mario Chaoz³, Paulden Anger⁴, Ian Pierce⁴, Gregory Norman⁴, Elizabeth Kronoff-Spancer⁴

¹ Apple Tree Dental, Minnetonka, Minnesota, United States of America, ² School of Public Health, San Diego State University, San Diego, California, United States of America, ³ West Health Institute, San Diego, California, United States of America, ⁴ University of California San Diego, San Diego, California, United States of America

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Abstract

Background
 Dental utilization patterns and costs of providing comprehensive oral healthcare for older adults in different settings have not been examined.

Methods
 Retrospective longitudinal cohort data from Apple Tree Dental (ATD) were analyzed (N = 1,159 total, 503 outpatients, 656 long-term care residents) to describe oral health status at presentation, service utilization patterns, and care costs. Generalized estimating equation (GEE) repeated measures analyses identified significant contributors to service cost over the three-year study period.

Results
 Cohort mean age was 74 years (range = 55–104); the outpatient (OP) group was younger compared to the long-term care (LTC) group. Half (56%) had Medicaid, 32% had other insurance, and 22% self-paid. Most (72%) had functional dentition (20+ teeth), 15% had impaired dentition (9–19 teeth), 6% had severe tooth loss (1–8 teeth), and 7% were edentulous (OP = 2%, LTC = 11%). More in the OP group had functional dentition (83% vs. 63% LTC). The number of appointments declined from 5.0 in Year 1 (OP = 5.7, LTC = 4.4) to 3.3 in Year 3 (OP = 3.6, LTC = 3.0). The average cost to provide dental services was \$1,257/year for three years (OP = \$1,427, LTC = \$1,336), and costs declined each year, from an average of \$1,568 (OP = \$2,068, LTC = \$1,676) in Year 1 to \$1,018 (OP = \$986, LTC = \$1,037) by Year 3. Those with functional dentition at presentation were significantly less costly than those with 1–19 teeth, while edentulous patients demonstrated the highest cost and utilization. Year in treatment, insurance type, dentition type, and problem-focused/

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Data Availability Statement: Data are not to be shared publicly. The study is based on patient health record data from Apple Tree Dental (ATD). West Health Institute (WHI) purchased the dataset from ATD, and data are reviewed and can not be fully released for ethical and legal reasons and per the data sharing agreement. Interested parties may reach out to Dr. Tracy Apple, WHI Chief Medical Officer and Executive Vice President, at tracy@tracy.edu or [760-486-1000](tel:760-486-1000).

Introduction
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Methods
 Retrospective longitudinal cohort data from Apple Tree Dental (ATD) were analyzed (N = 1,159 total, 503 outpatients, 656 long-term care residents) to describe oral health status at presentation, service utilization patterns, and care costs. Generalized estimating equation (GEE) repeated measures analyses identified significant contributors to service cost over the three-year study period.

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PLOS ONE | <https://doi.org/10.1371/journal.pone.0272889> May 14, 2023 1/22

Workforce: Dental Therapy

- Case studies supported by the PEW Charitable Trust
 - An Advanced Dental Therapist in Long-Term Care (2018)
 - An Advanced Dental Therapist in Rural Minnesota (2018)
- Dental Therapy Evaluations by Center for Health Workforce Studies
 - The Contributions of Dental Therapists and Advanced Dental Therapists in the Dental Centers of Apple Tree Dental in Minnesota (2020)
 - Provider and Patient Satisfaction With the Dental Therapy Workforce at Apple Tree Dental (2022)





Data Linkages/Collaborations

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The screenshot shows the NIH National Institute of Dental and Craniofacial Research website. The header includes the NIH logo and a search bar. A navigation menu contains links for Home, Data Sources, Analytic Resources, Data Sharing, News & Events, and About Us. The breadcrumb trail reads: Home > Data Sources > Human Phenotype Data. On the left, a sidebar lists data sources: Human Phenotype Data (highlighted), Human Multi-Omic Data, Animal & Microorganism Data, Head & Neck Imaging Data, and Biospecimen Data. The main content area is titled "Apple Tree Dental Data" and contains the following text:

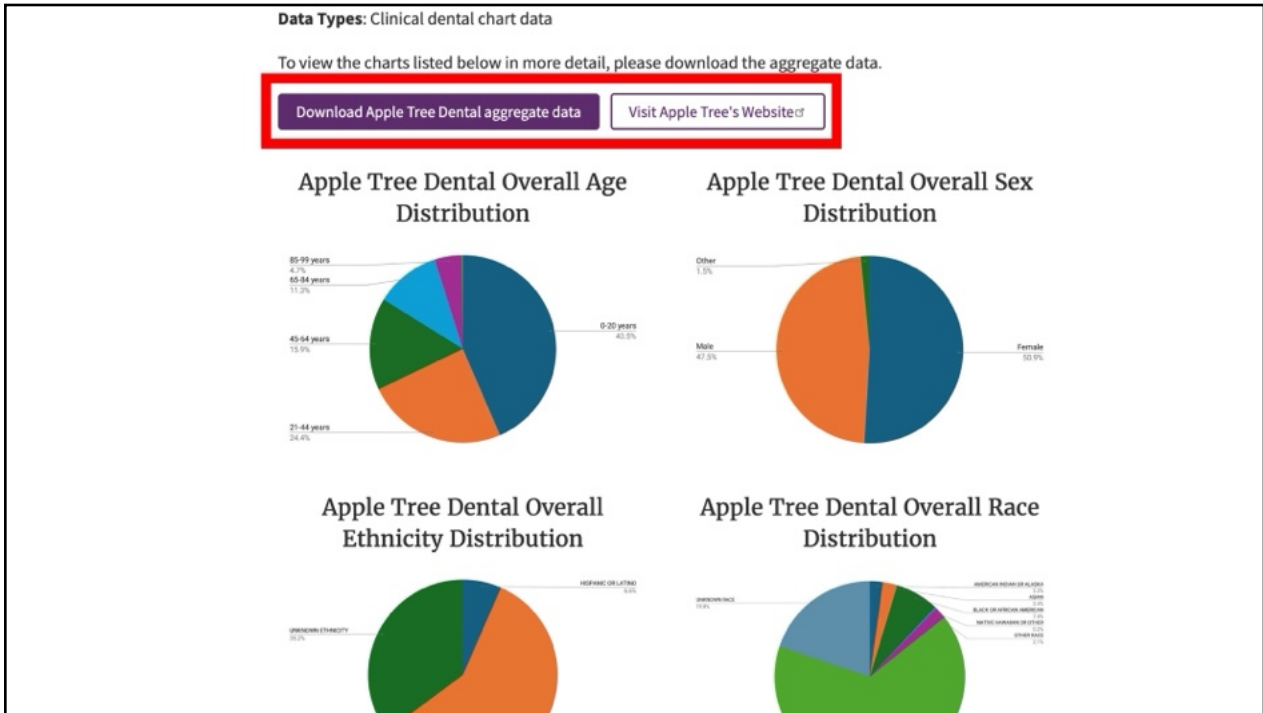
Apple Tree Dental's vision and nearly 40 years of organizational commitment have resulted in a unique longitudinal database comprising dental records for over 194,000 patients. This database includes valuable information from diverse populations, such as community-dwelling older adults, long-term care (LTC) residents, children in Head Start and school programs, adults with disabilities, and other groups facing barriers to oral health.

To support effective research collaborations, new resources have been developed to help translate this data into evidence that drives clinical and policy innovations aimed at promoting oral health equity. Past research partnerships have involved academic institutions, the Mayo Clinic's Rochester Epidemiology Project, the Center for Health Workforce Studies, West Health Institute, and CareQuest Institute for Oral Health.

Aggregate data includes overall patient population breakdown, Head Start patients, Long Term Care Patients, service statistics, and diagnoses.

Steps for Access: [Research Collaborator Inquiry Form](#)

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Mayo Clinic Rochester Epidemiology Project Collaboration

COUNTRIES IN THE REP

MINNESOTA

WISCONSIN

"The REP allows the study of health and disease across the entire community, from birth to death, and from primary to specialty care."
- Barbara Yawn, MD, REP Co-Principal Investigator 2006-2015

A Minnesota and Wisconsin Collaboration

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Utilization of the REP for OH Research

Open Access Cohort profile
BMJ Open Linking medical and dental health record data: a partnership with the Rochester Epidemiology Project

Jennifer L. St. Sauver,^{1,2} Alan B Carr,³ Barbara P Yawn,^{1,4} Brandon R Grossardt,⁵ Cynthia M Bock-Goodner,⁶ Lori L Klein,⁷ Joshua J Finkritz,⁸ Lia J Finney Rutten,^{1,2} Walter A Rocca^{1,2}

To cite: St. Sauver JL, Carr AB, Yawn BP, et al. Linking medical and dental health record data: a partnership with the Rochester Epidemiology Project. *BMJ Open* 2017;012018:doi:10.1136/bmjopen-2016-020508

Prepublication history and additional material is available. To view please visit the journal (<http://dx.doi.org/10.1136/bmjopen-2016-020508>).

Received 4 May 2016
 Revised 18 December 2016
 Accepted 21 February 2017



ABSTRACT
Purpose: The purpose of this project was to expand the Rochester Epidemiology Project (REP) medical records linkage infrastructure to include data from oral healthcare providers. The goal of this linkage is to facilitate research studies exploring the role of oral health in overall health and quality of life.

Participants: Eight dental practices joined the REP between 2011 and 2015. The REP study team has linked oral healthcare information with medical record information from local healthcare providers for 31 750 participants who have resided in Olmsted County, Minnesota, Overall, 17 718 (54%) participants are women, 14 318 (45%) are 40 years of age or older and 25 295 (80%) are white.

Findings to date: A first study using this new information was recently completed. This resource was used to determine whether the 2007 guidelines from the American Heart Association affected prescription rates of antibiotics to patients with moderate-risk cardiac conditions prior to dental procedures. The REP infrastructure was used to identify a series of patients diagnosed with moderate-risk cardiac conditions by the local healthcare providers (n=121), and to abstract antibiotic prescriptions from dental records both pre-2007 and post-2007. Antibiotic prescriptions prior to dental procedures declined from 62% to 7% following this change in guidelines.

Future plans: Dental data from participating practitioners will be updated on an annual basis, and new dental data will be used to augment medical records. In addition, we will continue to invite new dental practices to participate in the REP. Finally, we will continue to use this research infrastructure to investigate associations between oral and medical health, and will present findings at conferences and in the scientific literature.

Strengths and limitations of this study

- The Rochester Epidemiology Project has linked oral health data from community dental practitioners to electronic health record data from medical providers. This linkage provides a unique opportunity to study associations between oral health and overall health and quality of life.
- This study includes linked data for 31 750 participants of all ages and both sexes who have resided in Olmsted County, Minnesota. The sample size makes it possible to study a wide range of oral health questions and outcomes.
- The study does not include all dental practices in Olmsted County, and data are less complete for some segments of the population.

or result from other medical conditions.^{1,2} Oral health problems may lead to a systemic proinflammatory state that could contribute to the development of certain medical conditions. For example, persons with chronic periodontitis are at a significantly increased risk of developing cardiovascular diseases compared to persons without this condition,³ and poor periodontal health may worsen diabetes.⁴ In addition, the systemic deregulation of inflammatory responses can cause the concomitant development of oral health problems and other medical conditions. For example, patients with rheumatoid arthritis or dermatomyositis are at high risk of also having oral diseases due to the underlying inflammatory aetiologies of these conditions.⁵ Conversely, medications used for several chronic condi-



HHS Public Access

Author manuscript
 Mayo Clin Proc. Author manuscript; available in PMC 2018 November 10.

Impact of the American Heart Association's 2007 Guidelines on the Practice of Dental Prophylaxis for the Prevention of Infective Endocarditis in Olmsted County, Minnesota

Daniel C. DeSimone, MD¹, Abdeighani El Rafei, MD¹, Douglas W. Challener, MD², Alan B. Carr, DMD³, James A. Kelly, DDS³, Walter A. Rocca, MD, MPH^{4,5}, Jennifer L. St. Sauver, PhD⁴, Cynthia M. Bock-Goodner, BA⁶, Brian D. Lahr, MS⁷, James M. Steckelberg, MD¹, Walter R. Wilson, MD¹, and Larry M. Baddour, MD^{1,8}

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⁶Department of Information Technology, Department of Health Sciences Research

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https://www.rochesterproject.org/portal/

MayoOutlook

REP Data Exploration Portal Home Explore Documentation My Account

Characteristic A selection 5-year 1-year
 Diagnosis Defined Characteristics
 [15] - Diabetes
DHS diagnosis coding -- Dept. Health and Human Services Chronic Conditions [List of codes]

Characteristic B selection 5-year 1-year
 Procedures and Services
 [0029] - Oral and Dental Services
CCS procedures & services coding -- (3rd Ed) Operations on the nose, mouth, and pharynx [List of codes]

Prevalence Geography Trends

Diabetes

Oral and Dental Services

Diabetes & Oral and Dental Services

Observed to expected ratio (OER)

Age Group	Men	Women	Total
0-20 y	1.37	1.70	1.53*
21-39 y	2.26*	1.99*	2.09*
40-64 y	1.50*	1.81*	1.63*
65-79 y	1.49*	1.51*	1.50*
≥ 80 y	1.43*	1.54*	1.48*
All Ages	1.53*	1.70*	1.61*

* OER statistically different from 1.0

Data Exploration Portal



MAYO CLINIC
HEALTH SYSTEM

TARGETING THE SUBGINGIVAL MICROBIOME TO LOWER INSULIN RESISTANCE AND GLUCOSE AMONG PEOPLE WITH PREDIABETES

ELIGIBILITY, INTERVENTION, ENROLLMENT



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Disability Led Social Accountable Care Organization (ACO)

- Altair was founded in 2013 as a non-profit collaborative of leading disability services providers
- Today, it is a collaboration of 16 providers teaming up to provide value-based care
- It's members serve more than 45,000 Minnesotans
- Altair members serve 75% of Minnesotans receiving a Residential Service

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Mission and Values

Mission

To bring the collective resources of our members to create quality innovative solutions and service delivery models promoting desired outcomes for people served by Altair's members

Values

1. Person-centered
2. Continuum of care/life-time focused
3. Collaboration
4. Innovation
5. Sustainability

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Altair's Members



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Total Costs of Care



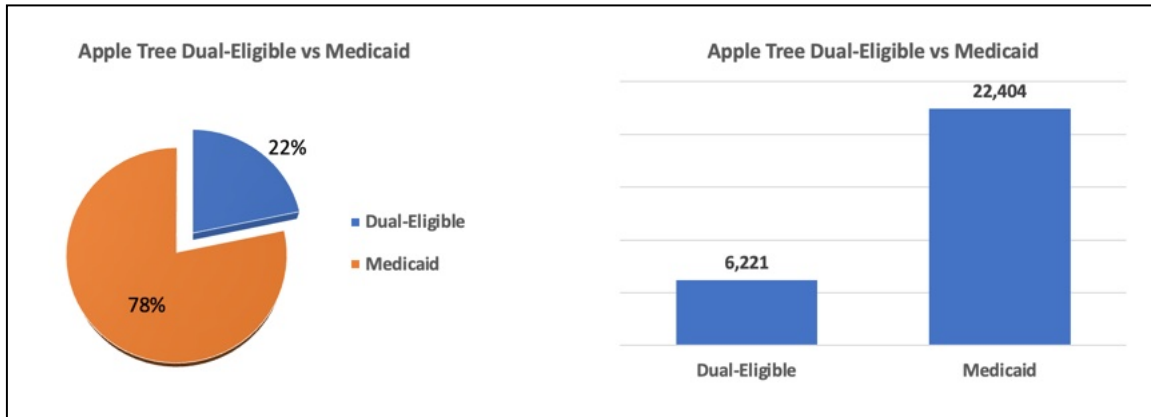
- Altair partners with Minnesota’s Medicaid and with CMS nationally to obtain all the Medicaid and Medicare claims data for 45,000+ people served by Altair’s members.
- This makes it possible to measure the total costs of care
- Altair can measure the impacts of interventions on both cost and quality across the whole system.
- In partnerships with major health plans, this data is being used to develop alternative payment and value-based care models
- With Apple Tree...this now includes Dental services!

Value-Based Care



- Altair is rolling out demonstration projects and large scale programs
- Altair’s data-informed, value-based designs will provide cost-effective solutions that improve people’s lives

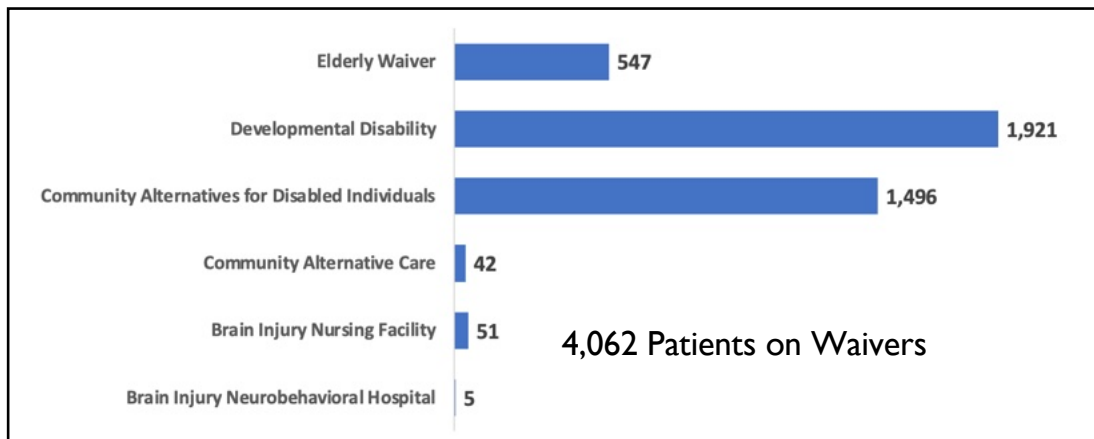
Medicare and Medicaid



- People with disabilities are one of the most costly populations to serve
- They are where medical, behavioral and dental services intersect most

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Patients on Disability and Elderly Waivers



Medicaid and Medicare Patients Served in 2024

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HEALTH DATA EXCHANGE

Improving oral health with **integrated data, powerful insights, and seamless collaboration.**



dataexchange.carequest.org



Available Data Sets in the Health Data Exchange



Dental

- Dental Claims
- State Medicaid Dental Coverage



Medical

- Integrated Claims Processing and Enrollment Analytics

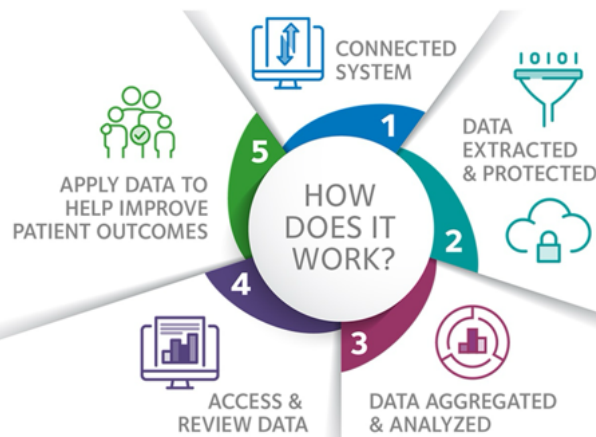


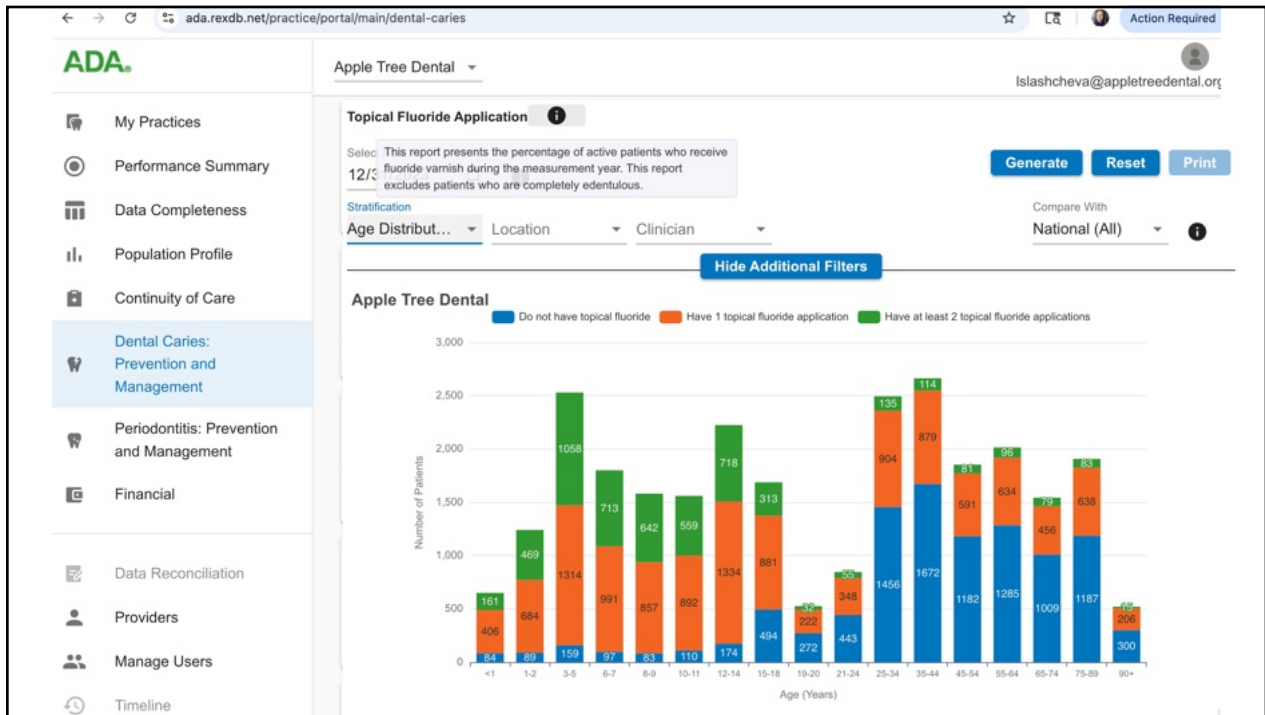
Social

- Social Determinants & Equity Insights Survey
- State of Oral Health Equity in America Survey
- State Oral Health Dashboard
- Veteran Oral Health Data Dashboard
- Health Professional Shortage Areas

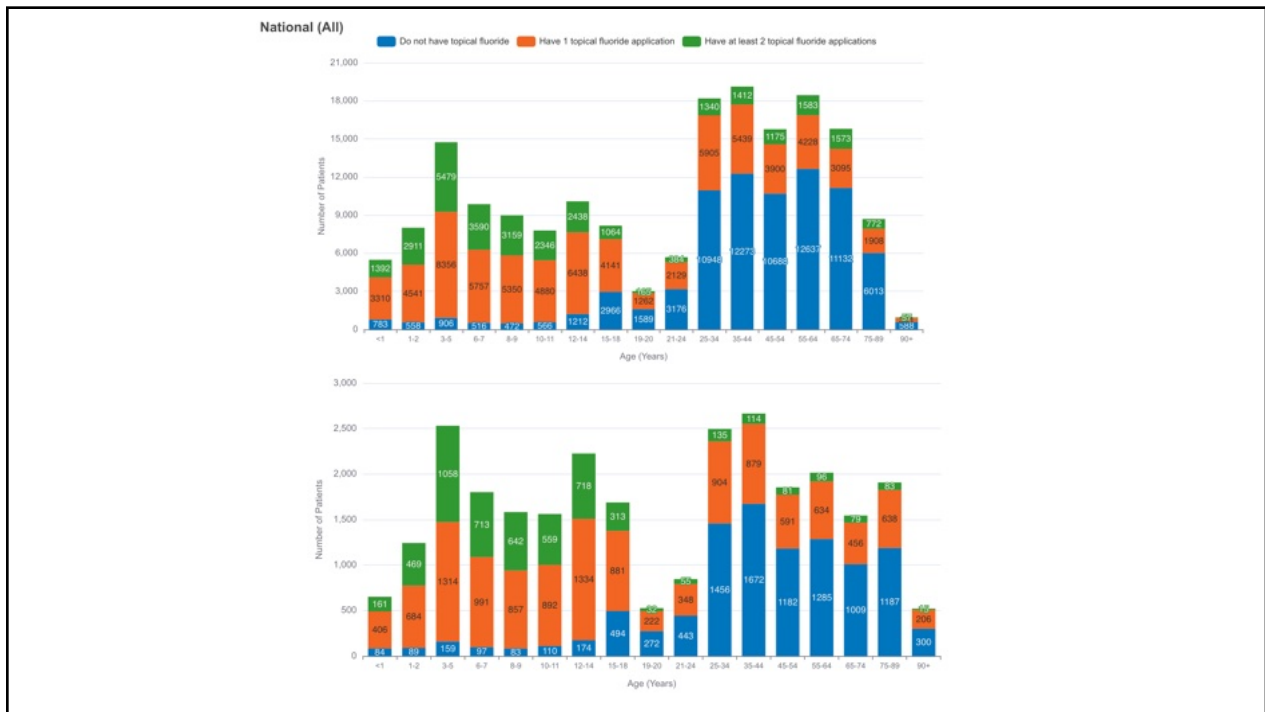
ADA Data Experience and Research Exchange

ADA Dental Experience and Research Exchange*





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ADA Why Join Education Advocacy Publications Resources

Research Dental Quality Alliance Health Policy Institute Science at the ADA **DERE**

The ADA Dental Experience and Research Exchange (DERE)®

DERE® is the first dental data registry open to all practice types.

[Learn more](#)

ADA Dental Experience and Research Exchange®

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Thank You!

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 Access • Compassion • Excellence

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