CENTER FOR PREVENTION AND HEALTH PROMOTION
Oral Health Program
Kate Brown, Governor

Oregon Health Authority

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Quarterly Dental Pilot Project
Meeting: DPP 100
Meeting Minutes

Date: Monday, June 8, 2020
Time: 9:00 AM – 11:30 AM
Location: **Virtual -** OHA Public Health Division

Committee Members Present:
Rick Asai, Jennifer Clemens, Michael Costa, Bob Garcia, Jennifer Lewis-Goff, Jonathan Hall, Paula Hendrix, Leslee Huggins, Kelli Swanson Jaecks, Jill Jones, Laura McKeane, Carolyn Muckerheide

OHA Staff & **Consultants to OHA**
Kelly Hansen, Fred King, Sarah Kowalski, Rose McPharlin, Cate Wilcox

Oregon Board of Dentistry:
Daniel Blickenstaff

Project Attendees and Invited Presentors:
Donald Chi, Miranda Davis, Joan LaFrance, Jamie Meyers, Naomie Petrie, Sarah Rodgers, Gita Yitta

Signed in Public Attendees:
Doug Barrett, Vicki Faciane, Tanya Firemoon, Christina Peters, Dove Spector, 6 additional attendees on phone

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Summary of Meeting

Agenda Item: Review of Meeting Agenda and Introductions

Topic: Review of meeting agenda.

Summary of Discussion: Meetings are recorded for note taking purposes. Reviewed agenda.

Decision: No decisions made. Move to next agenda item.

Action: Meeting started.

Text in italics is intended to clarify or provide additional information not available in the meeting.

Agenda Item: Mekinak Consulting Presentation

Topic: Dental Pilot Project #100's External evaluator, Mekinak Consulting, provided an annual update of the project. Presentation by Joan LaFrance, Ed.D, Mekinak Consulting.

Summary of Discussion: Dr. LaFrance presented an "Overview of Clinic Practice with Addition of Dental Health Aide Therapists"

- Located in SW Oregon, the CTCLUSI Dental Clinic is a self-governing tribe through the federal Indian Self-Determination and Education Assistance Act.
- The Tribe contracts with the Indian Health Service (IHS) and negotiates annual funding agreements under the provisions of the Act.
- Tribal clinics do not operate for profit – they are stewards of dental care for their clients.
- The clinic operates on a "demand for care" bases.
- Use of a Dental Therapist expands access to safe and quality dental care.
- An overview of the logic model was reviewed including both short term and long-term goals.
- Preceptorship under the pilot project model reduces the dentist's production due to the direct supervision requirements.
- Review of increase in access to care, reduction of wait times due to employment and utilization of dental therapists. Wait times, in 2017, averages 10 weeks. By 2018, wait times had decreased to 6 weeks to see a dentist. Wait times fluctuated in 2019, other factors involved including staff challenges and construction/remodel of dental clinic.
- 36% reduction in dentist's production in 2019 – owing to dentist's other responsibilities.
- Dentist has been able to complete more complex procedures, specifically Level 9 procedures. [*More information on Indian Health Services and Levels is available in the endnotes.]* [i]
- Patient surveys indicate a high level of satisfaction with all the providers, including the DHATs. Dentist indicate DHAT provide value to the clinic and values the contributions therapists make to the practice. Providers

(DHATs) indicate a high level of satisfaction with their working environment.

- Clinic will be increasing community outreach. A modification request was approved from OHA. DHATs will provide outreach to visit elders and pregnant mothers in their homes.
- ***A copy of the presentation was included in materials packet disseminated to the Advisory Committee and has been included the meeting minutes.***

Decision: No decisions made.

Action: Move on to discussion with Advisory Committee and NPAIHB project staff.

Agenda Item: Questions and Answers

Topic: Discussion, questions, answers and comments with Joan LaFrance, Ed.D and members of the Advisory Committee, Northwest Portland Area Indian Health Board, Oregon Health Authority

Summary of Discussion:

Dr. Asai had several questions:

1. Questions and statements regarding the profit and status of the CTCLUSI clinic.

   Project responded with the following information:

   - CTCLUSI operates as a non-profit.
   - Indian Health Services (IHS) funds are used to cover individuals who need care outside of the CTCLUSI dental clinic under the purchased and referred care program. *[Details on the IHS purchased and referred care program can be found at https://www.ihs.gov/prc/]*
   - CTCLUSI is not a Federally Qualified Health Center (FQHC*). [Details on Federally Qualified Health Center requirements can be found at https://www.hrsa.gov/opa/eligibility-and-registration/health-centers/fqhc/index.html]*
   - Breakdown of payor mix and percentages can be found in the quarterly reports submitted by the project.

2. How will improvement in oral healthcare behaviors be measured? Decay rates, etc.

    - Project responded that it is beyond the scope of the evaluation of the pilot project to measure reduction in decay. Please see the Evaluation & Monitoring Plan for details on short-term and long-term goals. The project is looking to improve access to care, reduce wait times.

3. What is the baseline data for the community outreach measures and where can this information be located?

    - There is no baseline data for community outreach from CTCLUSI dental clinic as it was not done previously. This information is part of the data reported to OHA in the quarterly reports.

4. Please provide clarification as to what IHS procedures fall into the various levels or categories, Level 1, Level 2, etc. [*More information on Indian Health Services and Levels is available in the endnotes.]*

Ms. Jaecks asked about the hiring of a community health nurse and inquired if this was a new position at CTCLUSI.

- The community health nurse position is new to CTCLUSI. *[CTCLUSI tribal members obtain medical care from the Coquille Tribe Medical Clinic in a relationship established between the tribes. Coquille Tribal Members obtain dental care at the CTCLUSI dental clinic. More information on the Coquille Tribe and medical clinic can be found at* https://www.coquilletribe.org/*. The medical clinic has a physician and family nurse practitioner that provide medical services.]*

Dr. Davis stated that it was important to highlight the significant administrative burdens that are placed on the pilot projects. In addition, Dr. Rodgers is required to observe the preceptorship under direct supervision. A chair was also lost in 2019. Dr. Rodger's acknowledged that the preceptorship process is difficult under the current methodology. Under the burdens of the pilot project, the dentist is required to review charts, etc. in an exhaustive manner that would not normally be required of a supervising dentist, outside of the confines of a pilot project.

Agenda Item: Presentation, Dental Therapy in Alaska's YK Delta: Outcomes Data

Topic: Presentation by Donald Chi, DDS, PhD, Pediatric Dentist & Faculty University of Washington School of Dentistry.

Summary of Discussion: Dr. Chi presented "Dental Therapy in Alaska's YK Delta: Outcomes Data"

- Dr. Chi and co-authors published "Dental therapists linked to improved dental outcomes for Alaska Native communities in the Yukon-Kuskokwim Delta" in 2018, Journal of Public Health Dentistry.[ii] *[Full paper available at attachment to meeting minutes.]*
- Study objective was to evaluate community-level dental outcomes associated with DHATs.
- Methods used were a data analysis of Alaska Medicaid and EHR (electronic health) records in Alaska's YK Delta from 2006-2015.
- Independent variable was the number of DHAT treatment days in each community.
- Study used Spearman partial correlation coefficients to test the hypotheses that increased DHAT treatment days are associated with larger proportions utilizing preventive care and smaller proportions receiving extractions at the community-level.
- Study asked two primary questions: Q1: Do outcomes improve as dental therapists provide more care in communities? Q2: What is the impact of dental therapists as reported by dental providers and community members?
- Q1: Children: preventive care (exam, cleaning, or fluoride), dental emergency consultation, D-E-F-G extraction, treatment under general anesthesia
- Q1: Adults: preventive care, dental emergency consultation, extractions
- Q1 Data indicated that there was more preventive care, fewer emergency visits, fewer teeth extracted, no increase in general anesthesia
- Results: DHAT treatment days were positively associated with preventive care utilization and negatively associated with extractions for children and adults
- Q2: What is the impact of dental therapists as reported by dental providers and community members?

- Q2 methods: 16 telephone interviews with YKHC providers, 125 in-person interviews in 6 YK Delta communities, digitally recorded and transcribed, inductively coded
- Communities have benefited from restorative and preventive care provided by DT (e.g., children with no cavities), increased knowledge on oral health, evolving norms, less disease, and improved quality of life
- DT have a limited scope of practice and adults continue to have unmet needs
- multiple points of care: local communities (direct care or triage), sub-regional clinics, Bethel
- greater levels of health education, treatment, disease prevention, and quality of life, changing norms
- high levels of unmet needs among adults because of inability to access routine and non-emergency care
- DT have made important contributions to the dental care delivery system in the YK Delta
- Broad support and satisfaction with the program
- Continued need for dentists – determining optimal mix
- Future opportunities to incorporate behavioral strategies and focus on unmet needs for adults

A copy of the presentation was included in materials packet disseminated to the Advisory Committee and has been included the meeting minutes.

Agenda Item: Questions and Answers

Topic: Discussion, questions, answers and comments with Donald Chi, DDS, PhD and members of the Advisory Committee, Northwest Portland Area Indian Health Board, Oregon Health Authority

Summary of Discussion:

Dr. Asai asked how can comparisons be made between Alaska and Oregon?

- Frequent question that Dr. Chi is asked, how does Alaska compare to the other lower 48 states.

- Poor is poor
- Dietary issues, no running water in 50% of Alaska, no fluoride in water, high sugar diet
- Studies in urban areas indicate there is unmet need; pent up demand for services where there are unmet needs
- Itinerant model of dental care was not working, need consistency.
- Dental Therapist functions as a coordinator in the community, very low no-show rate. Dental Therapist is from the community.
- *Three papers published by Dr. Chi and co-authors.*

  Papers are looking at the following:

  - *Outcomes data*
  - *Community perspectives of Dental Therapists*[iii]
  - *Emergency room visits (accepted but not published, available sometime in fall 2020.)*

Ms. Jaecks asked about the treatment of periodontal disease in the adult populations.

- Periodontal disease is not addressed to the same degree as decay
- Unmet periodontal needs of the adult population remain
- Dental hygienists are located in Bethel, Alaska
- Optimal provider mix would include team – dentist, dental therapist and dental hygienist
- Goal is to first address pain and symptoms and then move on to periodontal disease and maintenance

Agenda Item: Site Visits

Topic: OHA will be conducting a virtual site visit to CTCLUSI on June 23rd and 24th.

Summary of Discussion: Site visits are part of the responsibilities of the Oregon Health Authority (OHA) and required under administrative rule.

Decision: No decisions made.

Action: Advisory Committee members have been notified and requested to

attend the site visit. Members are not required to be able to participate in all portions of the site visit. Site visits are not open to the public.

Public Comment Period: There were no public comments.

- **Next Meeting: To be determined via Doodle Poll.**
- Calibration Training: Monday, June 8, 2020, Advisory Committee members, Zoom meeting. This meeting is not open to the public.

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[i] Indian Health Services, https://www.ihs.gov/prc/eligibility/requirements-priorities-of-care/

[ii] Chi, D., Lenaker, D., Mancl, L., Dunbar, M. and Babb, M. (2018). Dental therapists linked to improved dental outcomes for Alaska Native communities in the Yukon-Kuskokwim Delta. Journal of Public Health Dentistry, 78(2), pp.175-182. Abstract available at Journal of Public Health Dentistry.

[iii] Chi, D. L., Hopkins, S., Zahlis, E., Randall, C. L., Senturia, K., Orr, E., Lenaker, D. (2019). Provider and community perspectives of dental therapists in Alaska's Yukon-Kuskokwim Delta: A qualitative programme evaluation. Community Dentistry and Oral Epidemiology, 47(6), 502-512. doi:10.1111/cdoe.12492.

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AGENDA

Dental Pilot Project #100 "Oregon Tribes Dental Health Aide Therapist Pilot Project"
Quarterly Dental Pilot Project Program Advisory Committee Meeting DPP #100
June 8th, 2020, 9:00am – 11:30am

Location: Remote meeting via Zoom.
Meeting ID: 161 8009 1097
Password: 929026
Link: https://www.zoomgov.com/j/16180091097?pwd=dmtLN0sxRDFlaEgxc2NKNkxpZXV5dz09

Call in option: 669-254-5252, Meeting ID: 161 8009 1097, Password: 929026

9:00-9:10	Official Introductions, Agenda Review	Sarah Kowalski, RDH, MS Dental Pilot Project Program Oregon Health Authority
9:10-9:40	Mekinak Consulting Presentation	Joan LaFrance, Ed.D Mekinak Consulting More information
9:40-9:50	*Questions and Answers*	Advisory Committee Northwest Portland Area Indian Health Board Oregon Health Authority Joan LaFrance, Ed.D
9:50-10:30	Presentation, Dental therapists linked to improved dental outcomes.	Donald Chi, DDS, PhD Pediatric Dentist & Faculty University of Washington School of Dentistry More information
10:30-11:00	*Questions and Answers*	Advisory Committee Donald Chi, DDS, PhD Northwest Portland Area Indian Health Board Oregon Health Authority
11:00-11:20	Follow Up Items, Future Meeting Dates, Virtual Site Visit	Sarah Kowalski, RDH, MS
11:20-11:30	Public Comment Period	Public comments are limited to 2 minutes per individual; Public comments are accepted via in-person oral testimony or submission of written comments via email to oral.health@state.or.us or US Mail.

Next Meeting: December 2020, Date to be determined

CTCLUSI Dental Clinic Baseline to 2019

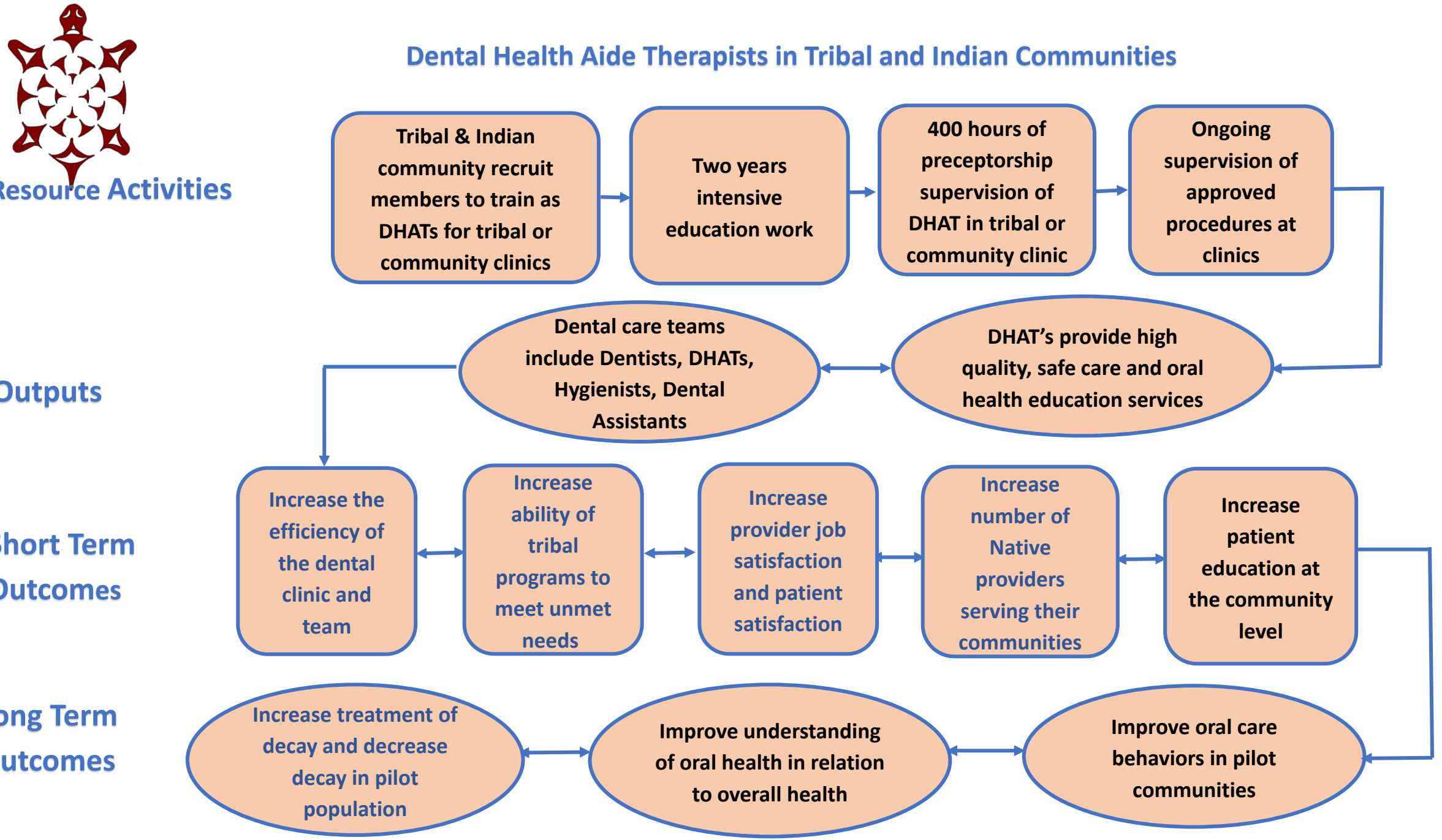
Overview of Clinic Practice with Addition of Dental Health Aide Therapists

Joan LaFrance, Mekinak Consulting

CTCLUSI Dental Clinic

- Located in SW Oregon, the CTCLUSI Dental Clinic is a self-governing tribe through the federal Indian Self-Determination and Education Assistance Act.
- The Tribe contracts with the Indian Health Service (IHS) and negotiates annual funding agreements under the provisions of the Act.
- Tribal clinics do not operate for profit – they are stewards of dental care for their clients.
- The clinic operates on a “demand for care” bases.
- Use of a Dental Therapist expands access to safe and quality dental care.

Dental Health Aide Therapists in Tribal and Indian Communities



Baseline and Three Years of Clinic Data

- The Baseline year is January to December 2016.
- The first dental therapist started her preceptorship on July 17, 2017 and it ended on October 18, 2018.
- The second dental therapist started her preceptorship on July 9, 2018 and ended it on February 11, 2020 (was on maternity leave in 2019).
- During the preceptorships, the dentist closely reviews major aspects of the therapists' work as it is being done.
- While supervising a preceptorship, dentist's production will decline owing to the time it takes to review the therapists' work and other responsibilities.

Baseline and Three Years of Clinic Data

- The following charts illustrate annual data for:
  - 2016 -- the baseline year when no therapist worked at the clinic
  - 2017 -- when one therapist was working for half of the year
  - 2018 – when two therapists were working for half of the year, with one working the entire year.
  - 2019 – when two therapists were working the entire year, although one was still doing her preceptorship.
- Data for the analysis was found in Dentrix reports and a scheduling log kept by the clinic's receptionist.

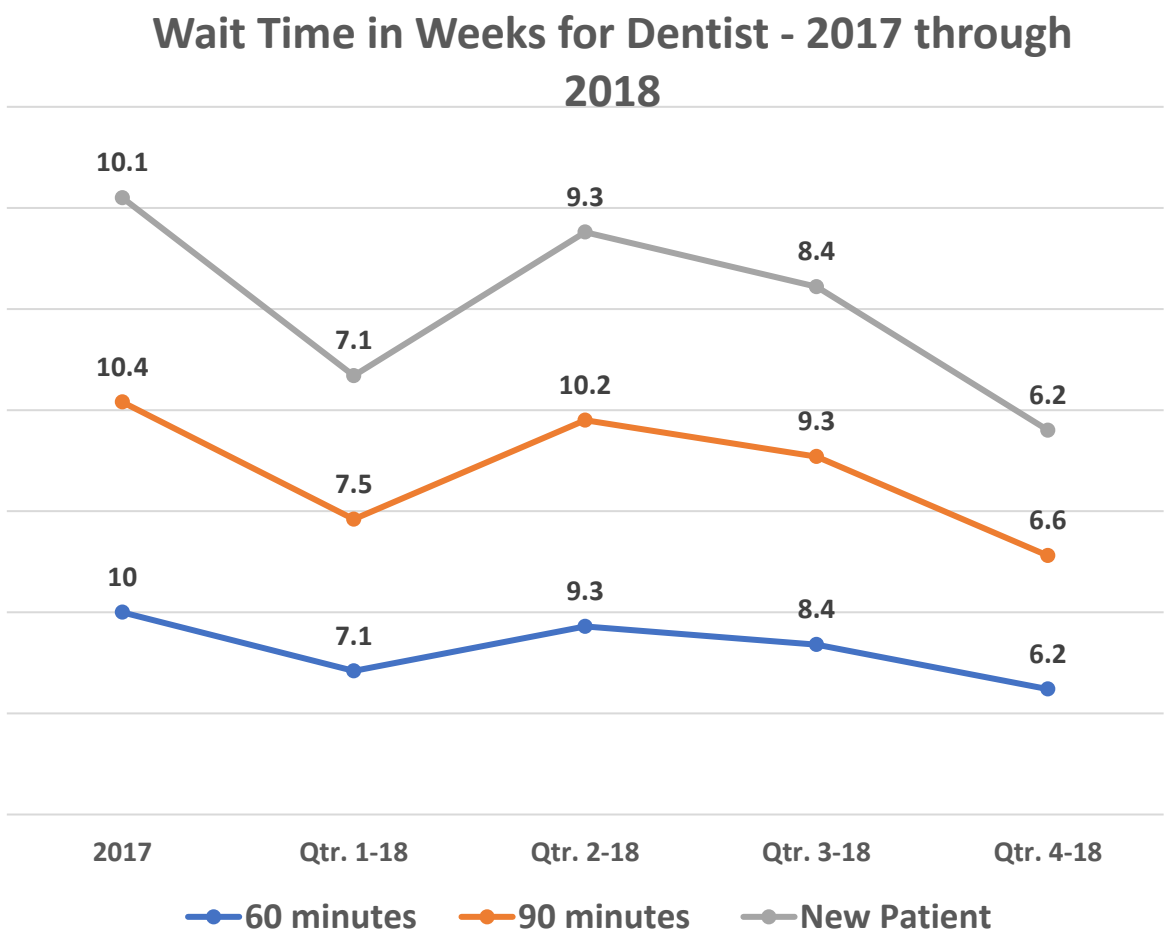
Access to Quality and Safe Care

- Access to care is influenced by several factors:
  - Number of operatories in the Clinic and available staffing
  - The “wait time” which is the time of a request for an appointment and the first available time it can be scheduled
  - The number of visits a patient can make to get care during the year
  - The production of the providers – the number of “in the mouth” dental procedures completed.
- For all of these, the CTCLUSI Clinic made significant gains in access to care.

Clinic Staffing and Expansion

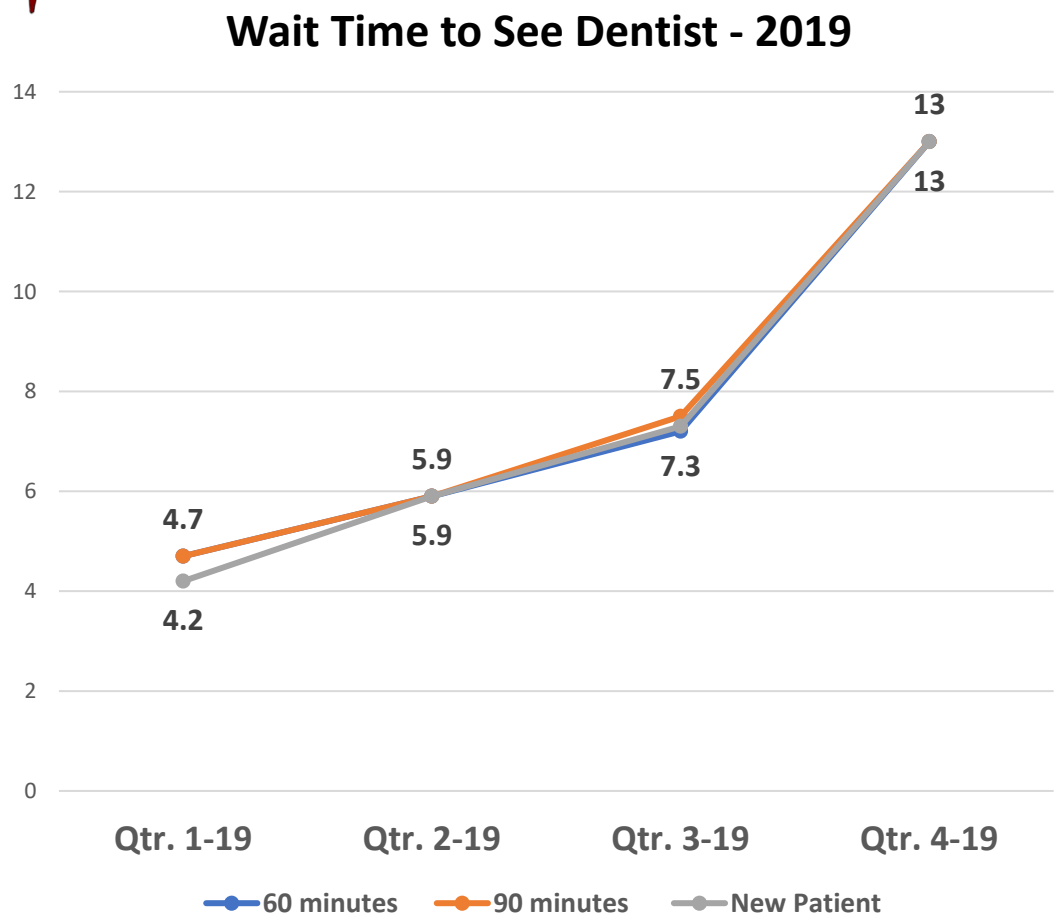
- During 2016, the clinic had 3 operatories, two for the dentist and one for the hygienist.
- During 2018, two temporary operatories were added to facilitate the addition of the dental therapists.
- The Tribe began construction to expand the clinic to 7 operatories on July 2019. The construction was completed in February 2020.
- During this time, the clinic had periodic closures, especially in late 2019.
- Over the four years there have been changes in the staffing for the hygienist and dental assistant positions and one therapist was on maternity leave.
- The time to hire new dental assistants influenced some aspects of access to care as the hiring process limited the number of patients that could be seen when the clinic was not fully staffed.

Reduction in Wait Time to See Dentist



- In 2017, average wait time to see the dentist was 10 weeks.
- By the end of 2018, the time had dropped to 6 weeks.
- The wait time to see a DHAT during this time ranged from less than a week to a week and a half.

Wait time in 2019



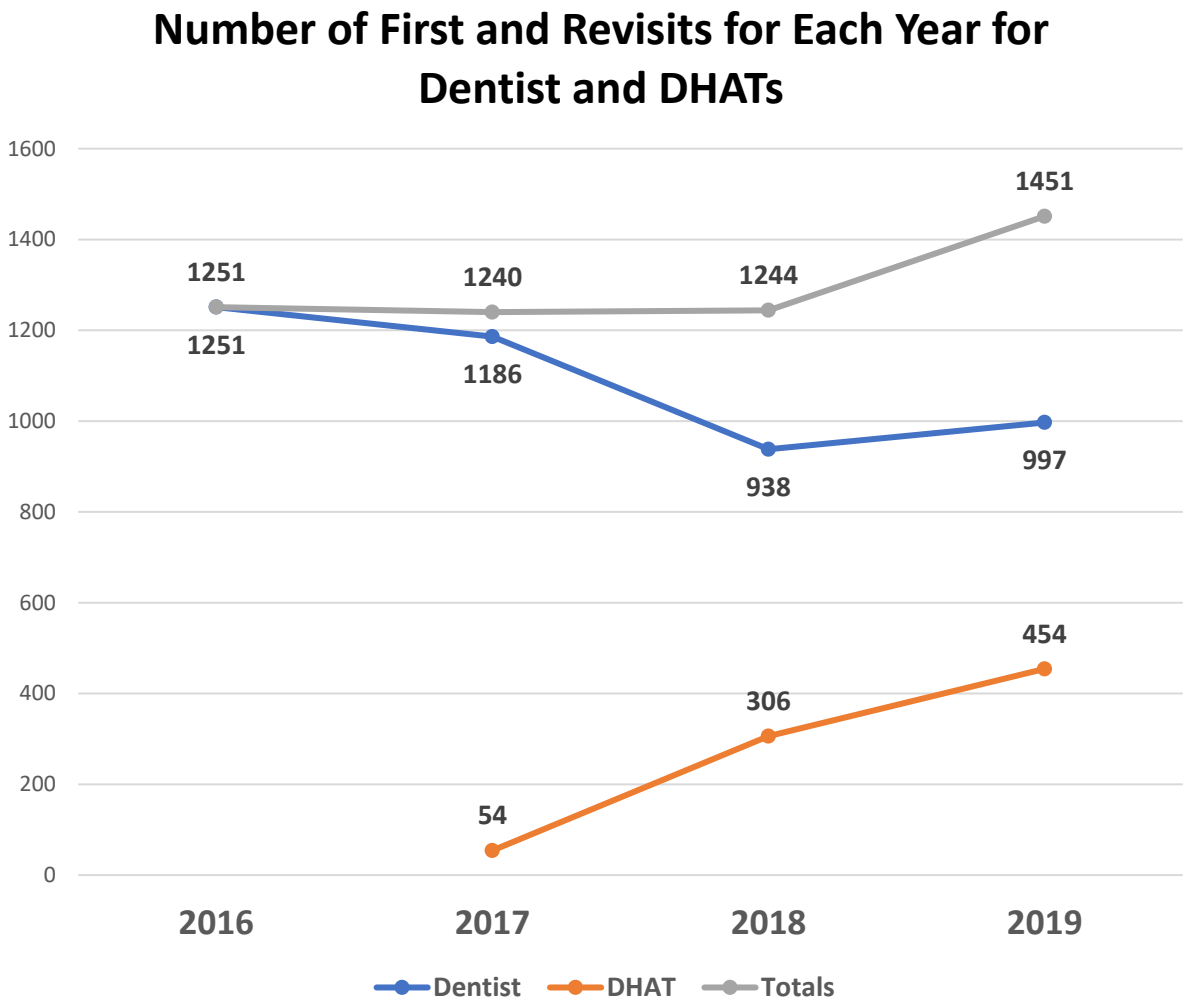
- For the first quarter in 2019, the wait time to see the dentist dropped to 4 weeks.
- However, it increases over the quarters, with a sharp uptick in the fourth quarter .
- Other responsibilities for the dentist, a DHAT maternity leave, and construction closures account for these changes.
- DHAT wait times fluctuate from less than a week to 2 weeks, with an uptick to 3 weeks owing the maternity leave.

Wait time and Access to Care

- Over the three years, patients saw a dramatic drop in the time to see the dentist.
- They were able to see a therapist within a week or two.
- The uptick in 2019 is temporary should drop in 2020.
- In interviews with a sample of patients, they noted the drop in waiting time to get into see clinic providers.

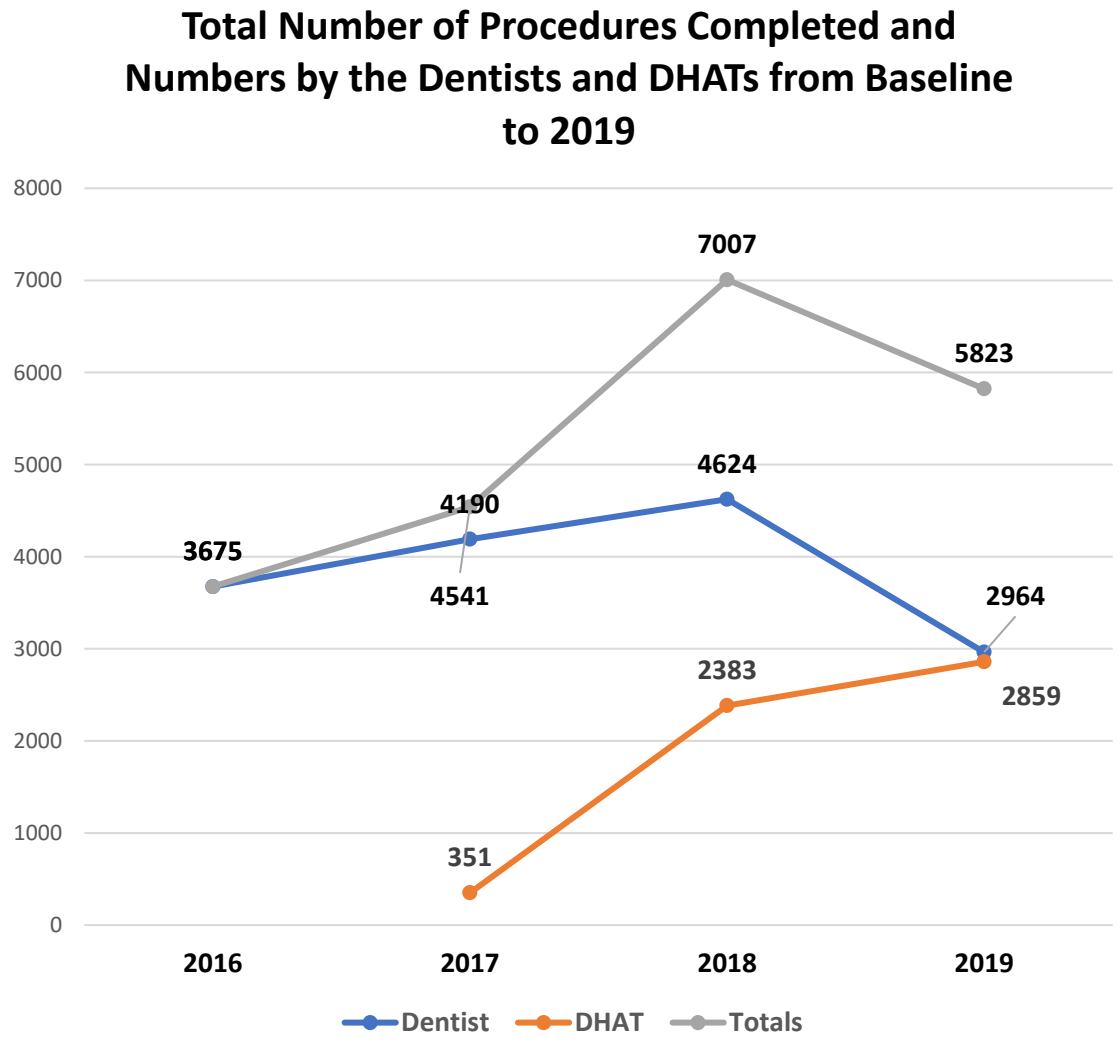
Frequency of Patient Visits and Access to Care

- The Clinic saw a modest increase in the number of patients served each year – an increase of 13% from 2016 through 2019.
- However, the patients were able to make multiple visits each year with the addition of the therapists.
- The increase in visits with DHATs from 2017 to 2018 is 467% with another 48% from 2018 to 2019.



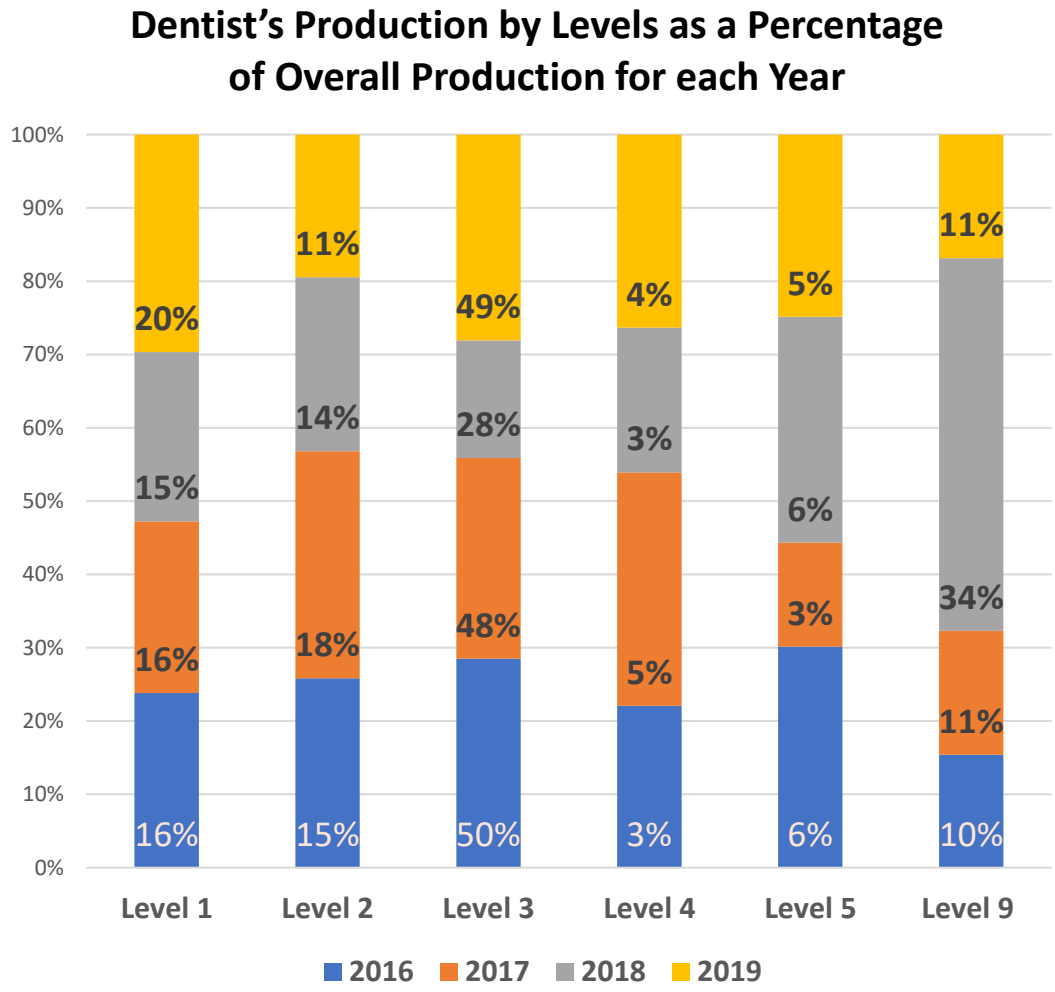
Provider Production and Access to Care

- Provider production increases from 2016 to 2019 with the addition of the therapists.
- There is a 36% reduction in the dentist's production in 2019 owing to other responsibilities.
- The DHATs' production increases each year.
- Percent change in production: 2016-17 is 24%, 2017-18 is 54% 2018-19 is -17%.

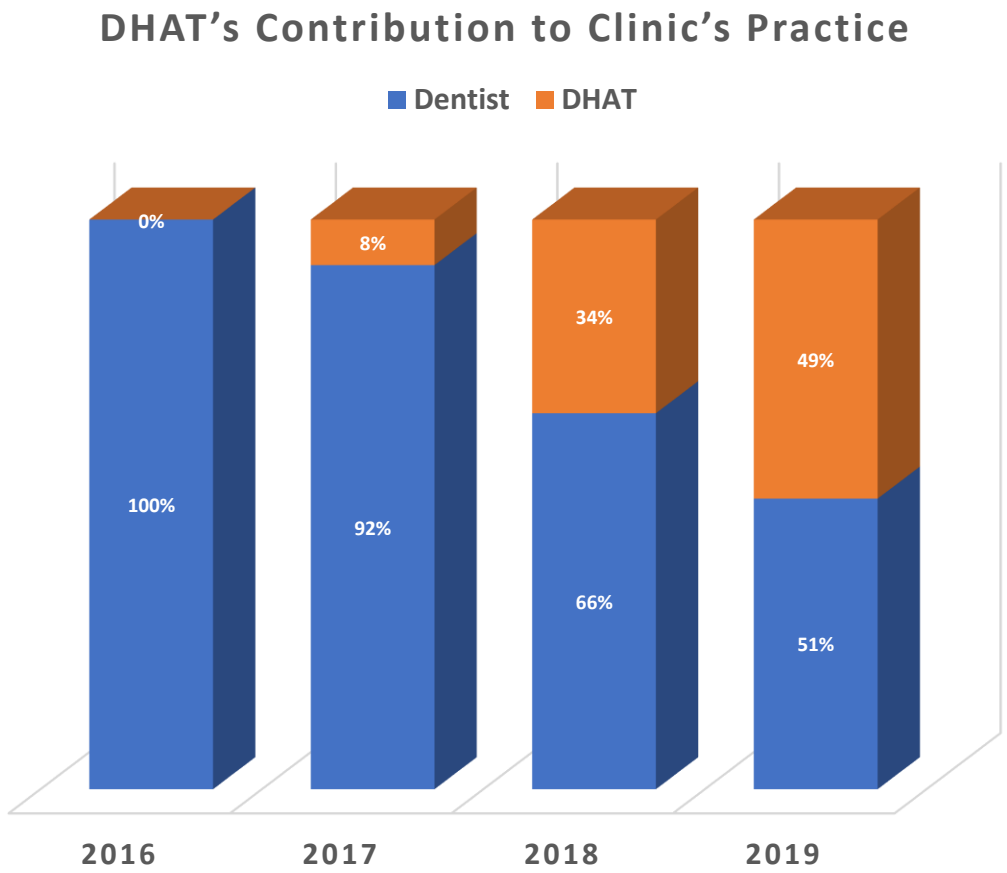


Dentist Production by Levels

- It is assumed that use of DHATs will increase the number of more complex procedures done by the dentist.
- Level 4 has increased slightly but not consistently over the years.
- Level 5 has not shown an increasing pattern.
- Level 9 has increased, especially in 2018.



Therapist Contribution to Clinic Practice



Provider and Patient Satisfaction

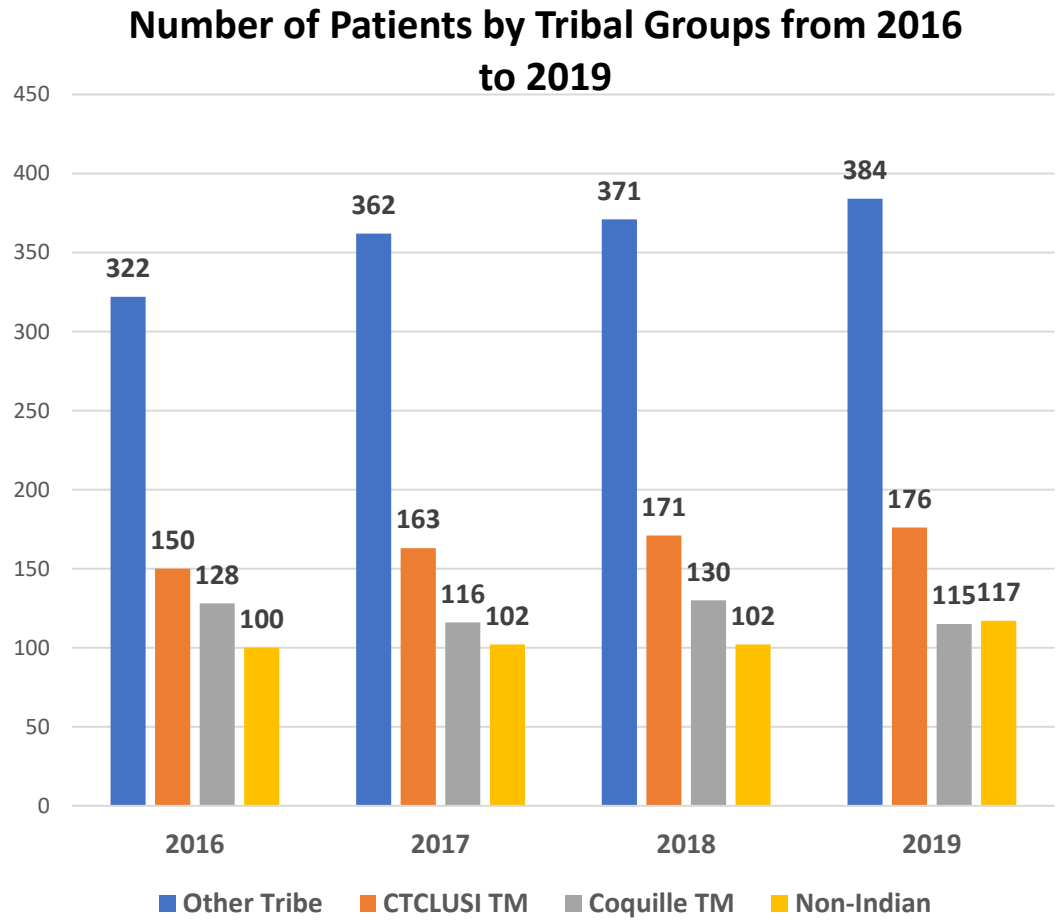
- The clinic providers report high levels of satisfaction with their working environment and teamwork.
- The clinic dentist values the contributions therapists make to the overall clinic practice.
- Surveys with a sample of patients indicate a high level of satisfaction with all the providers, including the DHATs.
- Interviews with a sample of patients support the survey findings.

Access to Quality and Safe Care

- In the pilot phase thus far, access to quality care has increased.
  - Patients do not have a long wait to see a therapist.
  - Wait time to see the dentist has dropped, except for later quarters in 2019. This should change when the dentist can increase her time with patients.
  - Patients are visiting the clinic more frequently each year.
  - Provider production has increased so patients seeing the therapists are getting more work done each year.
  - Patients are very satisfied with the care they receive.
- The clinic will be increasing community outreach to visit elders and pregnant mothers in their homes.

Patient Demographics

- The Clinic served:
  - 2016 – 700
  - 2017 – 743
  - 2018 – 774
  - 2019 – 792
- Most of their patients are members of other tribes followed by CTCLUSI tribal members.
- The age range of the patients is similar across the years.



Thumps Up!

Dental Therapy in Alaska's YK Delta: Outcomes Data

Donald L. Chi, DDS, PhD
University of Washington
@donaldLchi

Oregon Health Authority Dental Pilot Advisory Committee Meeting
June 2020

background

Dental therapists in the YK Delta since 2005

Practice under general supervision

Studies demonstrate quality of care and safety

No studies on outcomes

design and questions

mixed methods design

Q1: Do outcomes improve as dental therapists provide more care in communities?

Q2: What is the impact of dental therapists as reported by dental providers and community members?

Q1 methods

Data from 2006 to 2015

YKHC dental EHR, N=28,191

Medicaid data, N=22,351

Community-level study

Predictor: # of treatment days (continuous variable)

Spearman partial correlation coefficients

Q1 outcomes

Children

preventive care (exam, cleaning, or fluoride)

dental emergency consultation

D-E-F-G extraction

treatment under general anesthesia

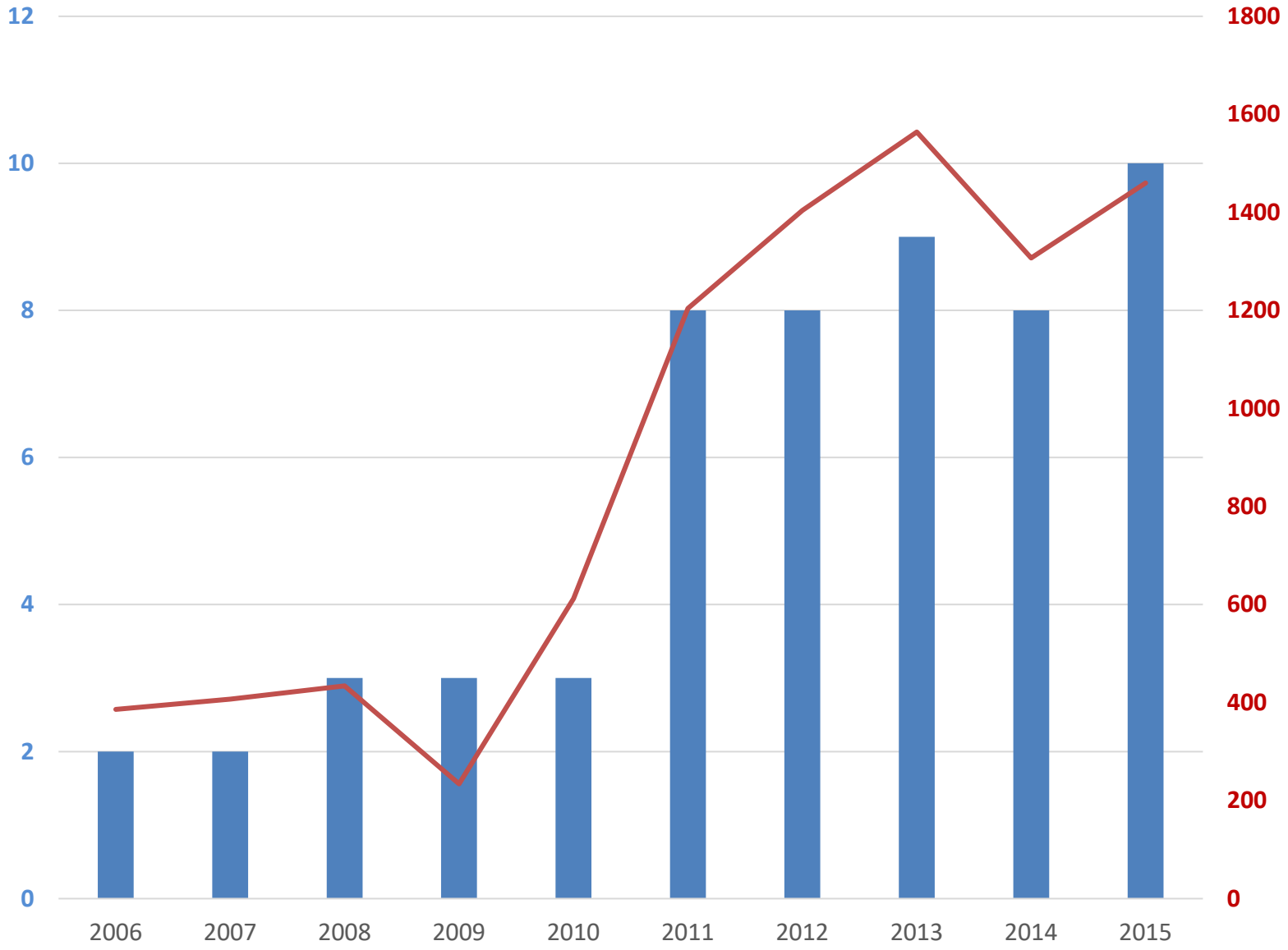
Adults

preventive care

dental emergency consultation

extraction

of DTs and treatment days



use

Outcome	10-year mean (EHR)	10-year mean (Medicaid)
Child preventive care	31.8%	15.4%
Child emergency consult	10.4%*	--
D-E-F-G extraction	14.0%	3.1%
General anesthesia	5.7%	5.4%
Adult preventive care	18.7%	3.8%
Adult emergency consult	5.4%*	--
Adult extraction	32.9%	7.8%

* 5-year mean

Spearman partial correlation coefficients*

Outcome	Coefficient (EHR)	P-value	Coefficient (Medicaid)	P-value
Child preventive care	**+0.26**	<.0001	**+0.23**	<.001
Child emergency consult	**-0.48**	<.0001	**--**	--
D-E-F-G extraction	**-0.28**	<.0001	**-0.17**	0.03
General anesthesia	**-0.27**	<.0001	+0.05	0.45
Adult preventive care	**+0.30**	<.0001	**+0.20**	<.001
Adult emergency consult	**-0.18**	<.0001	**--**	--
Adult extraction	**-0.46**	<.0001	**-0.16**	0.02

*adjusted for dentist treatment days and baseline poverty

Q1 bottom line

More preventive care

Fewer emergency visits

Fewer teeth extracted

No increase in general anesthesia

Q2 methods

16 telephone interviews with YKHC providers

125 in-person interviews in 6 YK Delta communities

digitally recorded and transcribed, inductively coded

results

providers

communities have benefited from restorative and preventive care provided by DT (e.g., children with no cavities)

increased knowledge on oral health, evolving norms, less disease, and improved quality of life

DT have a limited scope of practice

adults continue to have unmet needs

results

community members

multiple points of care: local communities (direct care or triage), sub-regional clinics, Bethel

greater levels of health education, treatment, disease prevention, and quality of life

changing norms

high levels of unmet needs among adults because of inability to access routine and non-emergency care

conclusions and next steps

DT have made important contributions to the dental care delivery system in the YK Delta

Broad support and satisfaction with the program

Continued need for dentists – determining optimal mix

Future opportunities to incorporate behavioral strategies and focus on unmet needs for adults

Quyana

Study was funded in part by the Pew Charitable Trusts, the Kellogg Foundation, and the Rasmuson Foundation

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Dental therapists linked to improved dental outcomes for Alaska Native communities in the Yukon-Kuskokwim Delta

Donald L. Chi, DDS, PhD[1]; Dane Lenaker, DMD, MPH[2]; Lloyd Mancl, PhD[1]; Matthew Dunbar, PhD[3]; Michael Babb, MA[3]

1 School of Dentistry, University of Washington, Seattle, WA, USA
2 Southeast Alaska Regional Health Consortium, Sitka, AK, USA
3 Center for Studies in Demography and Ecology, University of Washington, Seattle, WA, USA

Keywords
Dental Health Aide Therapists; Alaska Native oral health disparities; dental utilization; access to dental care; dental workforce.

Correspondence
Donald L. Chi, School of Dentistry, University of Washington, Seattle, WA 98195-7475, USA. Tel.: 206 616-4332; Fax: 206 685-4258; e-mail: dchi@uw.edu. Dane Lenaker is with the Southeast Alaska Regional Health Consortium. Lloyd Mancl is with the School of Dentistry, University of Washington. Matthew Dunbar and Michael Babb are with the Center for Studies in Demography and Ecology, University of Washington.

Received: 10/15/2017; accepted: 12/15/2017.

doi: 10.1111/jphd.12263

Journal of Public Health Dentistry **00** (2018) 00–00

Abstract

Objectives: Dental Health Aide Therapists (DHATs) have been part of the dental workforce in Alaska's Yukon-Kuskokwim (YK) Delta since 2006. They are trained to provide preventive and restorative care such as filling and extractions. In this study, we evaluated community-level dental outcomes associated with DHATs.
Methods: This was a secondary data analysis of Alaska Medicaid and electronic health record data for individuals in Alaska's YK Delta (2006-2015). The independent variable was the number of DHAT treatment days in each community. Child outcomes were preventive care, extractions, and general anesthesia. Adult outcomes were preventive care and extractions. We estimated Spearman partial correlation coefficients to test our hypotheses that increased DHAT treatment days would be associated with larger proportions utilizing preventive care and smaller proportions receiving extractions at the community-level.
Results: DHAT treatment days were positively associated with preventive care utilization and negatively associated with extractions for children and adults ($P < 0.0001$). DHAT treatment days were not associated with increased dental treatment under general anesthesia for children.
Conclusions: Dental therapists are associated with more preventive care and fewer extractions. State-level policies should consider dental therapists as part of a comprehensive solution to meet the dental care needs of individuals in underserved communities and help achieve health equity and social justice.

Introduction

Poor oral health is common in Alaska Native communities (1-3). Untreated tooth decay leads to pain, difficulties eating and sleeping, systemic diseases, hospitalization, and, in rare cases, death (4,5). Other consequences include school absences, poor grades, low self-esteem, and employment problems (6-8). There are persisting oral health inequalities in Alaska Native communities (9,10).

Tooth decay is a multifactorial disease linked to a high sugar diet, inadequate fluoride, and poor access to dental care (11). Sugar-sweetened beverages comprise a large portion of modern Alaska Native diets and have fueled the tooth decay epidemic (12,13). In addition, piped-in water is not universal in Alaska Native communities, making water fluoridation costly (14). Further complicating local fluoride acceptance is the only documented death linked to water fluoridation in Hooper Bay, Alaska (15). Finally, Alaska Native communities are remote, making it difficult to provide a regular, local source of dental care. Seeking care involves traveling long distances, usually by airplane. As a result, most individuals are unable to receive preventive care or needed restorative treatment.

To begin addressing dentist shortages, the Alaska Native Tribal Health Consortium trained Dental Health Aide Therapists (DHATs) for deployment in areas like Alaska's Yukon-Kuskokwim (YK) Delta. The DHAT program is based on a model in place for decades in New Zealand and more than 50 other countries (16,17). The first DHATs began providing dental care in the YK Delta in 2006. DHATs are recruited

from local communities and are trained to provide preventive care as well as restorative care for primary teeth (e.g., fillings, crowns, pulp therapy, extractions) and permanent teeth (e.g., simple fillings and extractions) under general supervision in local communities by dentists located in the hub city of Bethel (18). Dental therapists currently provide care in Alaska, Minnesota, and parts of Washington state and Oregon (19). Vermont and Maine have authorized the practice of dental therapy, and other states are considering similar legislation (19).

Studies have documented initial outcomes associated with the DHAT program in the YK Delta. DHATs provide care that is similar to care provided by dentists in terms of clinical quality (20,21). Residents of YK Delta communities served by DHATs have reported shorter wait times for dental appointments and satisfaction with the care provided by DHATs (22). No studies to date have documented longer-term outcomes associated with this innovative workforce program.

Persisting oral health inequalities in underserved communities underscore the importance of research aimed at advancing social justice (23). Dental therapists are part of an upstream approach that could help to address oral health inequalities by diversifying the dental workforce, removing barriers to care, and closing the health gap between individuals in resource-rich and resource-poor communities.

The goal of this study was to evaluate YK Delta's DHAT program. The main research question was whether DHATs are associated with improved oral health outcomes since 2006. We hypothesized that a larger number of DHAT treatment days would be associated with dental utilization patterns consistent with improved oral health over time (e.g., more preventive care, fewer extractions, less general anesthesia). This is based on two premises: 1) indigenous communities have low rates of preventive care utilization and high rates of extractions and treatment under general anesthesia; and 2) dental therapists have the potential to influence these trends. The long-term goals of this research are to provide policymakers with information on existing dental therapy programs and to develop strategies to optimize the DHAT program.

Methods

Study location

This study focused on communities served by the Yukon-Kuskokwim Health Corporation (YKHC). Prior to 2006, patients traveled from remote communities to Bethel to obtain dental care. Dentists traveled to communities on an annual basis. DHATs work in decentralized Sub-Regional Clinics and travel to remote communities to provide care.

Study design and data sources

This was a retrospective observational study (calendar years 2006–2015), corresponding to the 10-year period in which DHATs started providing care under general supervision in the YK Delta to when the most recent data were available. The study was approved by the YKHC Human Studies Committee and the University of Washington Institutional Review Board.

There were two data sources. The first was Medicaid data provided by the Alaska Department of Health and Human Services. These consisted of data on 1) monthly enrollment (e.g., name, age, sex, address) and 2) dental claims, indicating all procedures for which a claim was submitted by a dental provider and corresponding dates of services. The second was electronic health record (EHR) data provided by the YKHC dental clinic. These data consist of diagnosis and treatment data for all YKHC patients who received any dental care during the study period.

Classifying individuals into communities

We classified individuals into a mutually exclusive YK Delta community for each study month. Of the 322,578 individuals in the Medicaid dataset, 22,645 lived in the YK Delta at some point during the 10-year study period. We used monthly address data to geocode these individuals using the Google Maps Geocoding API. There were 22,353 individuals with a geocodable address. Our geocoding algorithm accounted for individuals who moved within the YK Delta and YK Delta residents who lived outside of the YK Delta for at least 1 month during the study period. We reconciled address data for 1,034 individuals with overlapping dates of residence (e.g., an individual listed as living in a community May 1, 2007 to September 9, 2009 and July 1, 2008 to October 31, 2010). Twenty-seven individuals were excluded because of missing or invalid dates of residence.

The resulting Medicaid dataset contained 22,326 unique individuals who lived in the YK Delta for at least 1 month during the study period. The resulting EHR dataset contained 28,821 unique individuals who utilized dental care through a YKHC dental clinic at least once during the study period, all of whom were geocoded into a YK Delta community.

Predictor variable

The main community-level predictor variable was the total number of days in which a community had $\geq$1 DHATs providing care (DHAT treatment days). This continuous variable was created from the EHR data. We identified all dental claims in the EHR dataset with a valid Current Dental Terminology (CDT) code submitted by a DHAT during the study period. For each day on which a DHAT provided dental care, the location of service (as indicated in the EHR) was noted and counted as one DHAT treatment day.

Outcome variables

There were three child and two adult outcomes, each measured at the community-level using both the Medicaid and EHR data.

Child outcomes

a) Proportion of children <18 years utilizing preventive care, defined as an exam (D0120/D0145/D0150), cleaning (D1110/D1120), fluoride (D1203/D1204/D1206/D1208), or cleaning and fluoride (D1201/D1205). b) Proportion of children <3 years who had their four front teeth (D-E-F-G) extracted (D7111/D7140). c) Proportion of children <6 years who received ≥5 stainless steel crowns on a single day, a proxy measure of general anesthesia (D2930).

Adult outcomes

d) Proportion of adults ≥18 years utilizing preventive care, defined as an exam (D0120/D0150), cleaning (D1110), fluoride (D1204/D1206), or cleaning and fluoride (D1205). e) Proportion of adults ≥18 years with any tooth extraction (D7111/D7140).

The two datasets had different denominators. For the Medicaid data, the yearly denominators consisted of individuals classified into a community and enrolled in Medicaid for ≥1 month during the calendar year. For the EHR data, the yearly denominators consisted of individuals who were classified into a community and had at least one dental claim in the calendar year.

Confounders

We identified two potential confounders. The first was dentist treatment days, which is the total number of days in which communities had one or more dentists providing treatment. We identified all EHR dental claims submitted by a dentist and estimated the total number of treatment days provided by a dentist in each community. The second was baseline poverty, which accounted for potential differences in resources and social conditions. Because there was no standardized community-level poverty measure, we adopted a proxy measure from the US Census Bureau indicating the proportion of all individuals living below poverty in 1999 in each community (potential range: 0 to 100).

Analyses

The analyses were restricted to dental services provided within YK Delta communities. Location of service was unavailable in the Medicaid data. Therefore, we used the EHR data to determine the location of service for each Medicaid dental service. We matched on name, sex, and date of birth. After excluding claims without a match, there were 13,810 unique individuals in the final analytic population for the Medicaid data. The EHR claims data included information on location of service. After removing claims associated with locations of service outside of the YK Delta, there were 28,191 unique individuals in the final analytic population for the EHR data.

We used Spearman partial correlation coefficients for the confounder analyses (24). Spearman partial correlation coefficients were used to evaluate our study hypotheses ($\alpha = 0.05$), adjusting for dentist treatment days and baseline poverty. We adjusted for dentist treatment days to control for background differences in dental care due to dentists and as a surrogate measure for other potential secular trends in the availability of dental care. The analyses were aggregated by year for each community (48 communities × 10 years, $n = 480$), and generalized estimating equations were used to account for clustering within village due to multiple observation years (25). Observations from different villages were assumed to be independent. Three communities with small populations were excluded. We used SAS version 9.4 for the statistical analyses (SAS Institute, Inc., Cary, NC, USA).

Results

Study communities

There were 48 study communities. Sixteen communities had no dental services provided by a DHAT. The mean proportion of individuals at the community-level in 1999 that were below poverty was 28 percent (range: 10.7 to 64.5 percent).

Predictor variable

The predictor variable was the number of DHAT treatment days. In 2006, there were two practicing DHATs in the YK Delta. The number of DHATs increased to 10 by 2015. In the 10-year period, there were a total of 9,012 DHAT treatment days.

Child outcomes

Mean preventive utilization for children was 15.4 percent in the Medicaid data and 31.8 percent in the EHR data (Table 1). Over the 10 years, the proportion of children who received preventive care increased fivefold in the Medicaid data (7.4 to 35.6 percent) and doubled in the EHR data (30.5 to 57.8 percent). The mean proportion of D-E-F-G extractions for children was 3.1 percent in the Medicaid data and 14 percent in the EHR data. The proportion of D-E-F-G extractions increased in Medicaid data (1.9 to 16.3 percent) and decreased in the EHR data (19.2 to 12.1 percent). The mean proportion of children utilizing dental care under general anesthesia was 5.4 percent in the Medicaid data and 5.7 percent in the EHR data. The proportion of children undergoing

Table 1 Dental Utilization for Individuals in Alaska's Yukon-Kuskokwim Delta by Year (2006 to 2015)

	Year (%)										All years (%)
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Child preventive dental care, Medicaid data	7.4	9.0	10.7	8.7	13.4	13.3	17.7	21.1	30.4	35.6	15.4
Child preventive dental care, EHR data	30.5	24.2	30.4	29.5	35.4	27.4	35.4	42.2	52.7	57.8	31.8
Child D-E-G-F extraction, Medicaid data*	1.9	3.2	2.3	2.7	2.9	3.4	3.4	5.4	8.0	16.3	3.1
Child D-E-G-F extraction, EHR data	19.2	20.1	20.6	26.4	13.1	9.7	9.1	12.5	14.4	12.1	14.0
Child general anesthesia, Medicaid data†	1.6	2.4	2.1	2.0	4.0	5.5	6.4	7.4	13.7	15.8	5.4
Child general anesthesia, EHR data	7.3	7.8	7.6	7.7	8.1	5.9	5.6	5.9	6.3	4.8	5.7
Adult preventive dental care, Medicaid data	1.1	2.6	2.6	2.5	3.0	4.3	4.3	5.6	8.5	6.4	3.8
Adult preventive dental care, EHR data	24.0	19.8	15.7	16.7	24.4	22.8	20.7	28.9	36.9	35.3	18.7
Adult extraction, Medicaid data	6.6	8.9	7.3	6.6	8.1	6.9	7.8	7.6	10.7	10.3	7.8
Adult extraction, EHR data	34.5	32.7	33.2	33.7	31.9	29.2	27.5	29.1	31.0	30.9	32.9

*There were no tooth numbers available in the Medicaid data. Therefore, this measure was defined as four extractions on the same day.
†There were no tooth numbers available in the Medicaid data. Therefore, this measure was defined as five or more stainless steel crowns on the same day.

general anesthesia increased in the Medicaid data (1.6 to 15.8 percent) and decreased in the EHR data (7.3 to 4.8 percent).

Adult outcomes

Mean preventive dental care utilization for adults was 3.8 percent in the Medicaid data and 18.7 percent in the EHR data (Table 1). Adult preventive care utilization in the Medicaid data started at 1.1 percent (2006), peaked to 8.5 percent (2014), and decreased to 6.4 percent (2015). For the EHR data, preventive utilization fluctuated during the 10-year study period, starting at 24 percent (2006) and ending at 35.3 percent (2015). The mean proportion of adults with extractions was 7.8 percent in the Medicaid data and 32.9 percent in the EHR data. Adult extractions fluctuated in both datasets, increasing from 6.6 to 10.3 percent in the Medicaid data and decreasing from 34.5 to 30.9 percent in the EHR data.

Confounder analyses

Dentist treatment days were positively associated with the predictor ($\rho = 0.31$; $P < 0.0001$) and significantly associated with most outcomes (Table 2). Baseline poverty was not associated with the predictor ($\rho = -0.12$; $P = 0.53$) but significantly associated with most outcomes (Table 2).

Main statistical analyses

Across the 10-year study period in both EHR and Medicaid datasets, increased DHAT treatment days were positively associated with child and adult preventive care, and negatively associated with extractions for children and adults (Table 3). From the EHR data, DHAT treatment days were negatively associated with treatment under general anesthesia for children, but this association was not statistically significant in the Medicaid data.

Discussion

This is first known study to evaluate long-term outcomes associated with DHATs. The main finding is that increased DHAT treatment days were positively associated with preventive care utilization and negatively associated with extractions. These trends suggest that dental outcomes have improved in Alaska's YK Delta with the introduction of

Table 2 Spearman Correlation Coefficients for Model Confounders

	Spearman correlation coefficients *P*-values				
	Child preventive dental care	Child D-E-F-G extraction	Child general anesthesia	Adult preventive dental care	Adult extraction
Dentist treatment days	0.33	0.21	0.16	0.31	0.02
(Medicaid data)	<0.0001	<0.001	0.01	<0.001	0.78
Dentist treatment days	0.25	0.13	0.17	0.26	−0.22
(EHR data)	<0.001	0.09	0.03	<0.001	<0.01
Baseline poverty	−0.12	−0.16	−0.18	−0.10	−0.001
(Medicaid data)	<0.001	<0.01	<0.0001	0.01	0.53
Baseline poverty	−0.15	−0.18	−0.16	−0.20	0.001
(EHR data)	<0.001	<0.01	<0.01	<0.001	0.91

Table 3 Spearman Partial Correlation Coefficients Between DHAT Treatment Days (Continuous Variable) and Each Outcome During 10-Year Study Period Based on Medicaid and EHR Data

	Spearman partial correlation coefficients* *P*-values				
DHAT treatment days	Child preventive dental care	Child D-E-F-G extraction	Child general anesthesia	Adult preventive dental care	Adult extraction
Medicaid data	0.23	−0.17	0.05	0.20	−0.16
	<0.0001	0.03	0.45	<0.001	0.02
EHR data	0.26	−0.28	−0.27	0.30	−0.46
	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

*Adjusted for dentist treatment days and baseline poverty.

dental therapists. These results are consistent with a study reporting positive associations between pediatric dentist density and preventive dental care use for children in Medicaid (26).

There are a number of potential explanations. The most plausible mechanism underlying increased preventive care utilization is improved local access to providers, which may have also increased patient demand for care. This is consistent with previous work indicating reduced patient-reported wait times for dental appointments in YK communities (22). Fewer extractions could indicate improvements in oral health behaviors and beliefs, as well as earlier restorative intervention before the need for extractions. These mechanisms could be assessed in the future by further examining restorative claims data and conducting interviews in communities, and comparing oral health behaviors and beliefs across communities that vary on DHAT treatment days. Similar interviews could be conducted with DHATs and dentists to measure provider perceptions of how patient attitudes, beliefs, and behaviors regarding oral health have changed over time.

We had inconsistent findings regarding general anesthesia for children. DHAT treatment days were negatively associated with general anesthesia in the EHR data but not significant in the Medicaid data. There are two possible explanations for this discrepancy. First, population characteristics differed across the two datasets. The EHR data consisted of individuals who utilized dental care, whereas the Medicaid data included all enrollees regardless of utilization of dental care. Second, the Medicaid-based outcome could be misspecified due to lack of tooth-level data. There was a near doubling in the proportion of children in the Medicaid data receiving dental care under general anesthesia between 2013 and 2014, which was not observed in the EHR data. A conservative conclusion is that increased DHAT treatment days were not associated with increased proportions of children receiving dental care under general anesthesia. Future research should continue to examine the associations between DHAT treatment days and child general anesthesia.

Improvements in dental utilization were particularly noticeable in communities where DHATs had the greatest presence. In post-hoc subgroup analyses, we identified communities in which DHATs did not provide any dental treatment ($N = 16$) and communities in which the DHAT treatment day to population ratio was >75th percentile ($N = 7$). Across both datasets, communities with the highest DHAT treatment days exhibited consistently greater

Table 4 Percentage Point Differences in Outcomes Between Communities with No DHAT Treatment Days and the Highest Number of DHAT Treatment Days

	No DHAT treatment day communities $N = 16$ (%)	Highest DHAT treatment day communities $N = 7$ (%)	Percentage point difference between highest and no DHAT treatment day communities (%)
Medicaid data			
Child preventive dental care	15.5	24.8	9.3
Child D-E-F-G extraction	7.3	1.9	−5.4
Child general anesthesia	7.9	5.5	−2.4
Adult preventive dental care	3.2	5.6	2.4
Adult extraction	9.6	7.1	−2.5
EHR data			
Child preventive dental care	30.5	46.9	16.4
Child D-E-F-G extraction	22.6	7.4	−15.2
Child general anesthesia	8.5	5.4	−3.1
Adult preventive dental care	15.3	27.1	11.8
Adult extraction	40.5	27.0	−13.5

proportions of individuals utilizing preventive care and lower proportions utilizing invasive dental treatment (Table 4). Differences were similar in the EHR data although the magnitudes were larger. These findings suggest that clinically meaningful improvements in dental use can be achieved by incorporating DHATs into the care delivery system. Potential challenges to maintaining a cadre of active DHATs include difficulties with recruitment, preventing provider burn out, and managing provider preferences for communities that may not be the areas of greatest need – all of which are similar difficulties in retaining dentists in underserved areas (27-29). These issues should be explored through research involving current and former DHATs so that recruitment and retention strategies can be improved.

DHATs appear to have an impact on the dental care delivery system. Over the 10-year period, 13 DHATs provided 9,012 treatment days in the YK Delta, compared to 23,368 days of treatment provided by 41 full-time dentists and 14 per diem dentists. The mean number of treatment days provided by each DHAT was slightly higher than dentists, but the number of patients treated and the complexity of care are likely to be different.

One goal of the DHAT program is to address pent up demand for emergency and routine dental care needs, which should level off over time. As this happens, one would expect DHATs to spend more of their time on prevention efforts that go beyond the clinic setting. This could come in the form of community- and home-based behavioral and social interventions aimed at reducing sugared sweetened beverages and improving toothbrushing with fluoridated toothpastes. Evidence-based preventive efforts could be incorporated into the scope of dental therapy practice, which might be particularly effective in indigenous communities because of cultural concordance between DHATs and community members.

Future research should assess how community-level dental care needs change as dental therapists are integrated into the local delivery care system, and characterize the proper balance for DHATs between restorative and preventive activities based on changing community needs. The ultimate goal is to ensure that dental therapy programs do not simply replicate the existing dental care delivery system that focuses primarily on clinic-based treatment and that dental therapists and dentist are providing care that optimizes health outcomes at the lowest cost possible.

Policymakers considering dental therapy legislation are increasingly interested in outcomes data. One example is cost effectiveness. A recent simulation study from the United Kingdom found that mid-level dental providers working in a public dental care delivery system can be a dominant strategy over dentists (i.e., improved outcomes at a lower cost) (30). These findings may be applicable to the YK communities. Additional cost-effectiveness analyses would help to provide answers applicable to the US context.

Our study findings support dental therapists as part of an upstream approach to help address oral health inequalities and achieve social justice (23). Dental therapists in the YK Delta have diversified the dental workforce, created opportunities for community members to serve as healers, and removed cultural barriers to care – important steps in achieving health equity and social justice within indigenous communities.

The main study strength is that we had two longitudinal data sources. However, there are at least six limitations. First, this was an observational study. All findings are associations. Causal inferences can only be drawn from randomized clinical trials, but such trials are unlikely because of cost. In addition, there are ethical considerations in withholding care that has been shown to be safe and effective. Second, there is the potential for selection bias. We attempted to address this problem by adjusting for confounders. However, baseline poverty in 1999 may not accurately measure differences in resources across communities, particularly because the study period began in 2006. Future work should continue to refine the models by identifying and operationalizing additional covariates.

Third, there were differences between the two datasets. Utilization trends were consistent, but Medicaid proportions were generally lower than EHR proportions (Table 1). One reason is that the annual Medicaid denominators included all enrollees regardless of utilization. When we restricted the Medicaid analyses to those who utilized care, the proportions between the two datasets converged. For instance, Medicaid preventive care use in 2015 increased to 65.5 percent for children and 35.6 percent for adults.

Fourth, there was a relatively low match for location of service in the Medicaid data, which raises potential concerns regarding generalizability. We compared demographic and utilization differences between the 13,810 retained and 8,516 excluded Medicaid enrollees. There were no differences in sex or age distribution between retained and excluded enrollees. Proportions of retained children and adults who utilized preventive care utilization were higher, whereas there were no consistent differences in D-E-F-G extractions, dental treatment under general anesthesia, or adult extractions. These findings make it difficult to draw definitive conclusions regarding the degree of systematic bias represented in the retained Medicaid enrollees. Future studies should develop methods to increase the proportion of matches between individuals in Medicaid and EHR data as well as ways to impute location of service for Medicaid enrollees when matching is not possible.

Fifth, our study focused on utilization. We did not assess other outcomes like unmet dental care needs, disease prevented, or quality-of-life. Future studies should be conducted to evaluate ways dental therapists can help improve patient-centered outcomes. In addition, qualitative work within communities of varying degrees of DHAT treatment days could

reveal other important differences associated with care provided by DHATs.

Sixth, dental care is not a panacea. Preventive care utilization was generally low even in recent years. This underscores the importance of targeting behaviors relevant in oral health such as limiting sugar intake and optimizing fluoride exposure. Future work should examine how preventive behaviors and norms within Alaska Native communities are influenced by the presence of DHATs. There is a need for evidence-based strategies that can be incorporated into the Alaska Native dental care delivery system to help providers like DHATs promote patient-level behavior change. This is especially relevant in the YK Delta in which DHATs maintain familial ties, share a common history, and understand the strengths and challenges as experienced by local populations. The eventual goal would be to harness the dental care delivery system as a way to improve oral health behaviors among individuals and norms within families and communities.

Conclusions

Our results provide evidence of positive benefits associated with dental therapists within underserved communities. These promising findings are relevant to policymakers in states with active or pending dental therapy legislation, which is a step toward meeting the dental care needs of vulnerable populations and achieving oral health equity and social justice.

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ORIGINAL ARTICLE

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Provider and community perspectives of dental therapists in Alaska's Yukon-Kuskokwim Delta: A qualitative programme evaluation

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Abstract

Objectives: Dental therapists deliver preventive and basic restorative care and have been practicing since 2006 in Alaska's Yukon-Kuskokwim (YK) Delta. In this qualitative programme evaluation, we documented health providers' and community members' experiences with dental therapy. The goal of the evaluation was to develop a conceptual model of dental care delivery in Alaska Native Communities centred on dental therapists.

Methods: We developed semi-structured interview scripts and used snowball sampling to recruit 16 health providers with experience providing care in the YK Delta and 125 community members from six YK Delta Communities in 2017 and 2018. The six communities were a stratified convenience sample based on community-level exposure to dental therapists (high, medium and no exposure). Interview data were digitally recorded, transcribed, verified for accuracy and coded inductively into conceptual domains using content analytic methods.

Results: Providers believed individuals living in the YK Delta have benefited from clinic-based restorative care and community-based education provided by dental therapists. The restricted scope of dental therapy practice limits the complexity of care that may be offered to patients. However, community members expressed high satisfaction with the quality of care provided by dental therapists. Community members noted more widespread knowledge and evolving norms about oral health and believed dental therapists are helping to prevent disease and improve quality of life. Participants believed access to dental care for children has improved over the years, but felt that many adults in the YK Delta continue to have unmet needs. A potential barrier to sustained programme effectiveness is low retention of dental therapists in the region, driven primarily by reports that dental therapists feel overworked, stressed and geographically isolated.

Conclusions: Dental therapists have contributed to the dental care delivery system in Alaska's YK Delta. Future opportunities remain within the system to address the needs of adults, develop strategies to retain dental therapists in the region and incorporate evidence-based, prevention-oriented strategies to improve oral health behaviours and reduce oral diseases.

1 | INTRODUCTION

Dental caries is a significant public health problem in Alaska Native Communities.[1] The unique historical and physical contexts of Alaska Native Communities exacerbate the problem.[2] For example, US settler colonial practices introduced sugar into indigenous communities,[3] and sugar-sweetened foods and beverages are now among the most commonly consumed items in Alaska Native Communities.[4] Furthermore, Alaska Native Communities are small, geographically isolated and situated on permafrost, making the cost of piped fluoridated water prohibitive.[5] Complicating local acceptance of water fluoridation is the only documented death due to insufficient monitoring of water fluoridation, which occurred in the 1990s in an Alaska Native Community.[6] Dentist shortages and geographic isolation make it difficult for those living in Alaska Native Communities to have a regular and local source of dental care.[1]

To address barriers to dental care, the Alaska Native Tribal Health Consortium started the first US-based dental therapy education programme. The dental therapy model has been in place in New Zealand and other countries for nearly 100 years.[7] In Alaska's Yukon-Kuskokwim (YK) Delta dental therapists are recruited from local communities with the goal of having licensed indigenous providers return to their communities as dental providers. After 2 years of schooling and clinical preceptorships, dental therapists can provide preventive and basic restorative care (eg, restorations, pulpotomies, stainless steel crowns, extractions) in sub-regional or local clinics under general supervision by dentists.[8]

Studies show the dental therapy programme in Alaska is effective. Dental care provided by dental therapists is comparable in quality to care provided by dentists.[9,10] In addition, YK Delta residents served by dental therapists have reported shorter wait times and high satisfaction with the care provided by dental therapists.[11] A recent study assessing long-term outcomes associated with dental therapists in the YK Delta found that children and adults living in communities served more intensively by dental therapists were significantly more likely to utilize preventive care and less likely to have teeth extracted.[12] Another study assessing the dental therapy programme in Southeast Alaska showed benefits associated with the programme, in terms of meeting the treatment needs of children and being accepted as local dental care providers.[13]

The objective of this study was to evaluate perceptions of the dental therapy programme in Alaska's YK Delta by interviewing health providers and community members. The goals were to (a) develop a preliminary conceptual model of dental care delivery in the YK Delta with an emphasis on the role of dental therapists and (b) make recommendations on ways local health administrators and educators can help to strengthen the dental therapy programme.

2 | METHODS

2.1 | Study location

This study focused on communities in the Bethel Service Area of the YK Delta. The Yukon-Kuskokwim Health Corporation (YKHC) serves about 25 000 people from 58 federally recognized tribes.[14] The YKHC is one of 12 Tribal Health Organizations (THOs) that currently employ dental therapists in Alaska. Individuals in the YK Delta have a subsistence lifestyle and rely on seasonal hunting, fishing and berry picking. The Yup'ik and Cup'ik languages are still extensively used. The region is also the poorest economically in the state with almost 27% of the population under the Federal Poverty Level.

Most individuals in the YK Delta are eligible for Medicaid. Children in Medicaid have access to comprehensive dental services, including examinations, cleanings, fillings, emergency care and general anaesthesia. Before dental therapists began providing care, most patients travelled from remote communities in the YK Delta region to the dental clinic in Bethel because care was only intermittently available from visiting dentists. Since 2006, dental therapists have been providing care within decentralized sub-regional clinics and

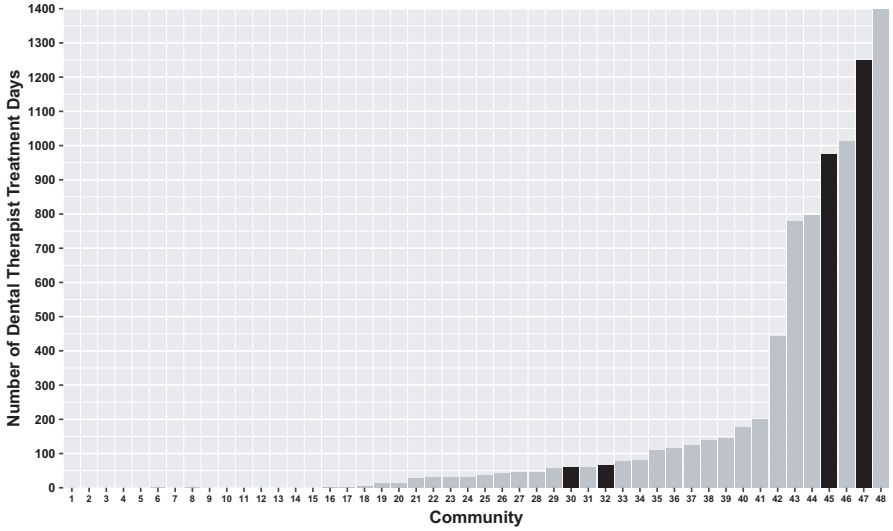

FIGURE 1 Number of dental therapist treatment days by community in Alaska's Yukon-Kuskokwim Delta with Study Communities indicated by Black Bars (2005-2015)

travelling to remote communities to provide care. However, dentists continue to travel to YK Delta Communities to address unmet needs.

2.2 | Study design and time period

This was a qualitative study utilizing semi-structured interviews. We conducted provider interviews by telephone and community member interviews in person from September 2017 to April 2018.

2.3 | Study communities

In a previous study, we estimated the total number of dental therapist treatment days aggregated over a 10-year period (2006-2015) for 48 YK Delta Communities[12] (Figure 1). Communities were classified as no exposure, medium exposure or high exposure to dental therapists. Excluding Bethel, we selected a stratified convenience sample of two YK Delta Communities from each exposure level for this study. The goal of this sampling strategy was to hear from community members with a range of experiences. The no exposure communities had zero dental therapist treatment days. The medium exposure communities had 60-67 dental therapist treatment days (mostly from 2013 to 2015) on which dental therapists visited the communities. The two high exposure communities had 975-1249 treatment days with dental therapists who lived and worked in the communities.

2.4 | Participant recruitment

We interviewed two groups of individuals: (a) providers with experience delivering dental or medical care in the YK Delta and (b) community members living in one of the six YK Delta study communities. Dental care providers were identified from Electronic Health Record data from the YKHC dental clinic. Using snowball techniques, we asked providers to recommend other providers for the study. Adult community members ages 18 years and older from the six communities were recruited from clinic waiting rooms and washeterias as well as by VHF radio, posting flyer in public places, Facebook postings and word of mouth. The sample was expanded using snowball sampling. We conducted group interviews when multiple community members were available. The study was approved by the University of Washington IRB, the University of Alaska Fairbanks IRB, the YKHC Human Studies Committee and the local Tribal Councils in each of the six study communities.

2.5 | Interview scripts

We developed semi-structured interview scripts, one for providers and one for community members, based on a health programme evaluation model presented by Grembowski.[15] The provider script included 13 open-ended questions about the participant's experiences providing care in the YK Delta, initial concerns about dental therapy, observations before and after dental therapists began providing care, scope and quality of care provided by dental therapists, patient satisfaction and impact of care, and barriers to recruitment and retention of dental therapists in practice. The community member script included similar questions reworded to focus on patient experiences as a (a) recipient of care from a dental therapist; (b) caregiver of a child recipient; or (c) family member of a recipient.

2.6 | Study procedures

Consent was obtained by a member of the research team, either in verbally or in writing. Community members completed a five-item demographic questionnaire. Each interview was conducted in a closed area to ensure privacy and lasted 15-60 minutes. After the interviews, providers received two continuing dental education credits from the University of Washington. Community members received a $25 gift card as a thank you for participating in the study.

2.7 | Data management and analyses

All interviews were audio recorded, transcribed verbatim and verified for accuracy. Responses provided in Yup'ik were translated into English by a native Yup'ik-speaking member of the research team. One member of the research team coded the interview data inductively. A multi-phased process based on content analytic methods was used to analyse the interview data.[16-20] All responses relevant to the question were unitized by noun and verb phrases. Compound sentences were analysed separately and coded. Each unit of analysis was coded. Open coding was used to analyse, compare and categorize each unit.[20] The units of analysis were organized according to the manifest meaning of the words.[16] The categories were labelled with emic words drawn from the participants' own words. Data from these categories were analysed by the larger research team to organize the data into domains, which were merged to develop a preliminary conceptual model of oral healthcare service delivery in the YK Delta with an emphasis on the role of dental therapists.

3 | RESULTS

3.1 | Participant demographic characteristics

We interviewed 16 individual providers, 56% of whom were female. There were nine dentists, three dental therapists, three dental hygienists and one physician assistant. We interviewed 125 community members, 39 of whom were from communities with no exposure to dental therapists, 48 from medium exposure and 38 from high exposure communities. Of the 125 community member interviews, 115 were individual interviews. We held two small group interviews with N = 3 and N = 7 participants. Most interviews were conducted in English (83.2%), 13.6% were conducted in mixed Yup'ik and English, and 3.2% were conducted in Yup'ik only. Almost all participating community members self-identified as Yup'ik (98.4%) and 1.9% identified as Cup'ik. In terms of language preference, 30.4% preferred Yup'ik, 29.6% preferred English, and 40% had equal preference for Yup'ik and English. Women represented 68.8% of the participating

community members, the mean age was 41.1 ± 15.9 years (range: 18-77 years), and the mean number of children under age 18 years living in the participant's home was 2.3 ± 1.9 (range: 0-8).

3.2 | Provider data

Provider data were summarized into four domains.

3.2.1 | Oral health and access to care before dental therapists

Providers believed individuals in the YK Delta had relatively little knowledge or awareness about oral health, what caused dental diseases, and ways to prevent tooth decay—before dental therapists were introduced. Most local community members had irregular or limited access to dental care unless they were able to travel from their community to Bethel or a dentist visited their community. One provider observed a historical perspective:

> …lack of education on the importance of teeth and… how to take care of teeth. It was kind of a mentality…Well, my parents have no teeth. My grandparents have no teeth. So, I-know-I'm-gonna-have-no-teeth type of thing.

3.2.2 | Oral health and access to care after dental therapists

After the dental therapy programme started, providers observed improvements in oral health in the communities in which dental therapists provided care. There were fewer patients with 'large cavities' and some children with no cavities, which was rare before dental therapists. Reduced disease prevalence and severity were especially noticeable among individuals living in communities where dental therapists provided care. Access to dental care improved for both children and adults, although the focus was for dental therapists to care for children. One dentist who travelled frequently to YK communities noticed

> …that the care I was providing when I'd go out on a village trip changed. We have lists now of services that are out of [a dental therapist's] scope which is something that is really cool because…most of our patients before [dental therapists]…needed fillings and extractions. Now when I go out to a community with a [dental therapist], you know they've got the [less complicated] fillings and extractions under control. And there are patients that need crowns and bridges, dentures, higher level services that wouldn't have been in the realm of what we were doing before because I would have had to do [the less complicated] fillings [and] extractions.

Other perceived benefits associated with dental therapists included improvements in prevention-oriented educational efforts in schools. Another outcome was the creation of a local screening and triage system in communities with a dental therapist. However, as was the case before the dental therapy programme, patients with complex dental needs would frequently need to be referred to a dentist in Bethel.

3.2.3 | Scope of practice and dental care workforce

Dental therapists provide preventive care, most types of treatment for primary teeth, and fillings and extractions for adults. The scope of dental therapy focuses primarily on dental care for children and excludes complex treatment for adults like large fillings requiring pins or posts, root canals on permanent teeth, surgical tooth extractions and dentures. A number of providers noted that dental therapists are 'not allowed to do any…complex dentistry', limiting the type of patients that can be treated by dental therapists. For this reason, providers believed dentists will continue to be an important part of the YK Delta's dental care delivery system.

3.2.4 | Overall impressions and future challenges

Providers believed local community members are satisfied with the quality of care provided by dental therapists. However, providers reported that patient satisfaction with dental therapists vary based on the personality, chairside manners and perceived clinical skills of individual dental therapists. Some providers surmised that communities have accepted dental therapists because of the benefits of having a Yup'ik provider who understands the historical and sociocultural context in which care is being provided. Additionally, providers noted the added benefit of local employment and career opportunities for individuals interested in becoming a dental therapist.

There were also challenges noted. Providers perceived a shortage of dental therapists and dentists that make it difficult to meet local demands for care. Providers noted concerns expressed by some community members about being treated by a new or inexperienced dental therapist. In addition, providers talked about difficulties retaining dental therapists. Perceived barriers to long-term retention include dental therapists not being able to work in their home community, feeling isolated, lack of social support, having a heavy travel schedule and the absence of childcare. One provider, who expressed concerns that dental therapists generally were not assigned to work in their home communities, shared her observations

> …to stay in a community, you have to have…good social support. For a lot of people, why would you… [work and live in] some village you're not familiar with? Because I would think that in the Yup'ik mind, family is more important than career.

3.3 | Community member data

Community member data were summarized into five domains.

3.3.1 | Oral health behaviours

Community members from all three community types were aware of behaviours that help to prevent tooth decay: limiting sugary foods and beverages (diet) and brushing and flossing (hygiene). Palliative care was also believed to be important in addressing immediate dental problems. One individual living in a community with a local dental therapist stated, '[The dental therapists] do an exam. They find the problem. And they take care of it through antibiotics or pain medicine'. There were also a number of participants who talked about remedies such as over-the-counter analgesics and cold packs. A 32-year-old man from a community with medium dental therapist exposure said

> I used to take Tylenol and chew on it and leave it …where…[the]…toothache is. And it used to help me a lot. Just…chew on it and let [the] Tylenol soak [in] to [the] toothache.

A 49-year-old female caregiver also from a medium dental therapist community recalls telling her daughter, 'Um, [use] dental floss and let it bleed. So the abscess will go [away]. And it works'.

3.3.2 | Recurring cycle of dental need

Community members talked about different types of dental needs, ranging from cleanings and checkups to more complex treatment to alleviate pain and restore function. Individuals in all communities expressed persisting unmet needs, but there were more frequent references to unmet dental need from individuals living in communities with no dental therapists. For example, a 46-year-old woman from a community with no dental therapists said that she would get her teeth checked at the Bethel dental clinic 'every 2 years, maybe. Or something like that. When I have a toothache, I go in'. Similarly, a 40-year-old female from a community with no dental therapist said 'the only time I ever get into dental is only when I have a toothache' and talked about the need for routine examinations and cleaning:

> I wish that us adults too would get the same dental services as children. Like for exams or cleanings other than just having to go only when we have a toothache or a swollen face from having a toothache for so long.

Other community members talked about the need for nonurgent routine dental care to get chipped teeth fixed and fillings, root canals or braces to straighten teeth. However, getting an appointment for routine and specialty care at the YKHC dental clinic in Bethel was a noted difficulty. The previously quoted 46-year-old woman shared an incident involving a member of her community

> And, here's the kid. He's going like this is broken [pointing to tooth]. He's got caps on his front teeth [be] cause he fell when he was in high school and they broke and the caps need to be redone… And then [the dental clinic receptionist] will say, 'Well are you in pain?' 'Well, no', I said, 'But, he's going to be!' But, they don't see it as an emergency so they won't see him.

3.3.3 | Points of dental care access and dental providers

Interviewees from all communities believed dental care access for children in the YK Delta is good, especially because air travel to Bethel is covered by Medicaid. However, community members stated that care for adults is restricted mostly to emergency treatment, for which travel to Bethel is paid by Medicaid. Reasons why adult dental care is limited to emergency treatment include an annual dollar cap for nonemergency routine care enforced by Medicaid, costs of travelling to Bethel for dental care and limited dental appointment availability for adults.

Individuals in need of dental care have several potential access points from a variety of providers, including YKHC dentists in Bethel, local dental therapists in the sub-regional clinics and travelling dentists or dental therapists in smaller communities. Individuals with a dental emergency who live in Bethel or in a community with a sub-regional dental clinic staffed by a dental therapist have the option of dropping in as a walk-in patient. In addition, for individuals with resources to pay for care out-of-pocket, comprehensive dental care is available from general dentists and specialists outside the YKHC system in Anchorage and other parts of Alaska.

For individuals in communities with no local dental provider, the initial access point is the community medical health aide who screens patients, collects information on symptoms, takes intraoral photographs and/or refers patients to an on-call dentist in Bethel via teledentistry. Based on the severity of need, the on-call dentist may approve a dental appointment in Bethel or a sub-regional clinic. Visiting dentists and dental therapists may also provide care in communities with no local providers. However, as a 32-year-old woman in a community with no dental therapists noted 'here in the village I notice [dental providers] come around quite rarely'. When visiting providers are in town, announcements are usually made on the VHF radio, but these announcements are easy to miss. Treatment is provided on a first-come-first-served basis, with priority given to children. As a result, not all individuals in need are able to receive dental care, especially adults. A 25-year-old man who lived in a community with no dental therapists, but appeared to know about dental therapists, explained

> I always feel like [dental therapists] are for kids. And, you know, mostly for the kids, the children at school. They're always busy and we'd have to wait…Only during the end, when they're almost done…they'll

> have some space for other people that are wanting to get seen.

Community members with access to dental therapists appreciated having local providers. Benefits included having a provider who can speak Yup'ik and understand the local context. However, some community members were hesitant about dental therapists, especially in regard to perceptions about receiving treatment from a relatively inexperienced provider compared with a dentist. A 68-year-old woman stated

> …cause the young people [dental therapists] they're still learning…I know they were bragged about but…a *dentist-dentist* has more experience than [a dental therapist].

A dental therapist recalled that

> when I started working for YKHC at the clinic…I had kind of a baby face. So a lot of times our patients and their parents…would ask, 'How old are you?' [be] cause I looked so young.

In the past, primary dental health aides (PDHAs) provided school-based education and clinic-based preventive care in the communities. PDHAs are different from dental therapists and focus exclusively on prevention. A 34-year-old woman living in a community with no dental therapist recalled

> We used to have one [primary dental health aide] here. It was nice when we had one, nine years ago.

However, PHDAs stopped providing care, and community members did not know why.

3.3.4 | Outcomes

Community members described four outcomes associated with having any type of dental provider. The first is an increased presence of community-based prevention, which includes school-based outreach and the provision of hygiene supplies like toothbrushes, toothpaste and floss. A 47-year-old woman from a community with high exposure to dental therapists said that one of the benefits of dental therapists is that they will 'ask you: Do you need a brush or the toothpaste? And they'll let us know how important it is for us to… take care of our teeth and brush them daily'. A 34-year-old mother of five children stated that

> [dental therapists] took some hours off to go to the school. I remember…my kids came home really excited [and said] They checked my teeth! I have no cavities!

However, several participants from all community types noted the irregularity of school-based preventive dental services and believed services needed to be available through schools consistently.

The second outcome is treatment in the form of emergency, palliative, restorative and preventive care provided in a clinic setting. While community members were satisfied with preventive care provided by dental therapists, many preferred their care to be provided by a dentist when more complex treatment was needed, like crowns and root canals. A number of community members expressed frustration with the requirement to see a dental therapist before being referred to a dentist in Bethel, which was viewed as an unnecessary waste of time and money. A 42-year-old woman from a community with medium exposure to dental therapists explained

> …one time I went [to see a dental therapist]. I wanted [a] filling done in my teeth…And, this one tooth of mine…would bleed and stinky blood would come out…And [the dental therapist] told me to make an appointment [with a dentist]. And I have been trying to do that but…trying to make an appointment in Bethel is really hard. I prefer maybe, I would kind of prefer at the time, the dentist comes here, so, he can, like, if there's a problem, pull the teeth off right away and fix it.

The third outcome is disease prevention. An 18-year-old man from a community with high exposure to dental therapists explained that before a dental therapist started providing care locally 'my teeth hurt almost every day. I had cavities – a lot of cavities before the dental program started here', indicating that dental therapists had a role in preventing dental disease. A 68-year-old man in a high dental therapist community believed that dental therapists provided 'more information to the people' and that people in this community are 'more aware of… what causes cavities…and how to prevent them'. A 26-year-old woman in a medium dental therapist community believed dental therapists were 'concerned about the health of the teeth, you know, preventive care. They educate people on…how important…taking care of your mouth is'. A 51-year-old mother in a high dental therapist community described the experiences of her 7-year-old daughter

> …from the time she had her first tooth come out, we went to the dental therapist every 6 months and every 3 months for fluoride treatments. And to this day she doesn't have cavities or fillings.

The fourth outcome is improved quality of life, subjectively reported as less dental pain and fewer toothaches, retaining natural teeth, the ability to smile and chew foods, and positive dental care experiences. A 20-year-old man in a medium dental therapist community recalled that dental therapists

> …actually listen when I felt sharp pain. [Be]cause that one time when I was being seen to pull out my teeth over in, I believe in Bethel…there was…[a dentist] that had way more experience. And he told me to raise my hand whenever I felt that sharp pain. I raised my hand, he didn't do nothing. He just kept pulling and pulling. And I was just in pain, constantly in pain. Kept raising my hand. He didn't do nothing. But [the dental therapists]…every time I raised my hand for pain, they just stopped right away. And then they ask if they want to numb it a little more, and I said, *Yes*, and they do it right away.

A 54-year-old man in a high dental therapist community explained that dentists 'will just take care of your teeth and sometimes let you be on their way. But with a [dental therapist] they take care of your teeth, clean it up and all that, and explain what we need to do in the near future to get a healthier life'. The individual also noticed that people in his community are 'smiling a lot more' since dental therapists started providing care locally. A 60-year-old female teacher in a high dental therapist community has noticed 'a few [5- and 6-year-olds] who actually come into my classroom…with front teeth rather than all their front teeth being gone'.

3.3.5 | Determinants of oral health behaviours

Dental care provided by dental therapists can promote oral health behaviours when accompanied by material resources like toothbrushes, toothpaste and floss. Seeing a dental therapist can also help to increase awareness about oral health, transmit knowledge and convey a sense of self-reliance. A 68-year-old woman in a high dental therapist community stated that 'kids are more aware of… their dental hygiene and stuff like that…They know a lot more which is amazing.' She added that people in her community 'are more aware of…what causes cavities and…how to prevent them' as a result of the care provided by dental therapists. A 42-year-old woman in a medium exposure community said that her little brothers and nephews 'tell me that little bugs are gonna come in my mouth' when she does not brush her teeth. A 63-year-old man from a medium exposure community shared that dental therapists 'remind us that we are responsible for our health [and] oral care'. Conversely, the lack of care can reinforce existing community norms about oral health. For instance, a 20-year-old woman from a community with no dental therapists believed 'a lot of people are losing their teeth. It's just a normal thing'. This participant described similar norms about primary teeth among parents in her community: 'I don't really think that parents really care…about…baby teeth [be]cause…they all know that another set's gonna come in some time'.

3.4 | Conceptual model

Based on the provider and community member data, we developed a preliminary conceptual model of oral health service delivery for individuals in the YK Delta (Figure 2). The model has five interrelated components.

The first is oral health behaviours, which are routines or palliative remedies that help prevent tooth decay or oral disease symptoms. These behaviours collectively influence the point at which an individual recognizes a need for dental care. For instance, caregivers who are vigilant about minimizing sugar intake and promoting hygiene in their children and adults who manage dental disease symptoms with over-the-counter pain medications may not recognize an immediate need for dental care, especially if they live in a community without a dental care provider.

The second component includes dental need. Acute needs arise when dental symptoms are no longer manageable with palliative remedies. Individuals may also recognize a need for preventive care to avoid future problems. However, recognizing need may not always

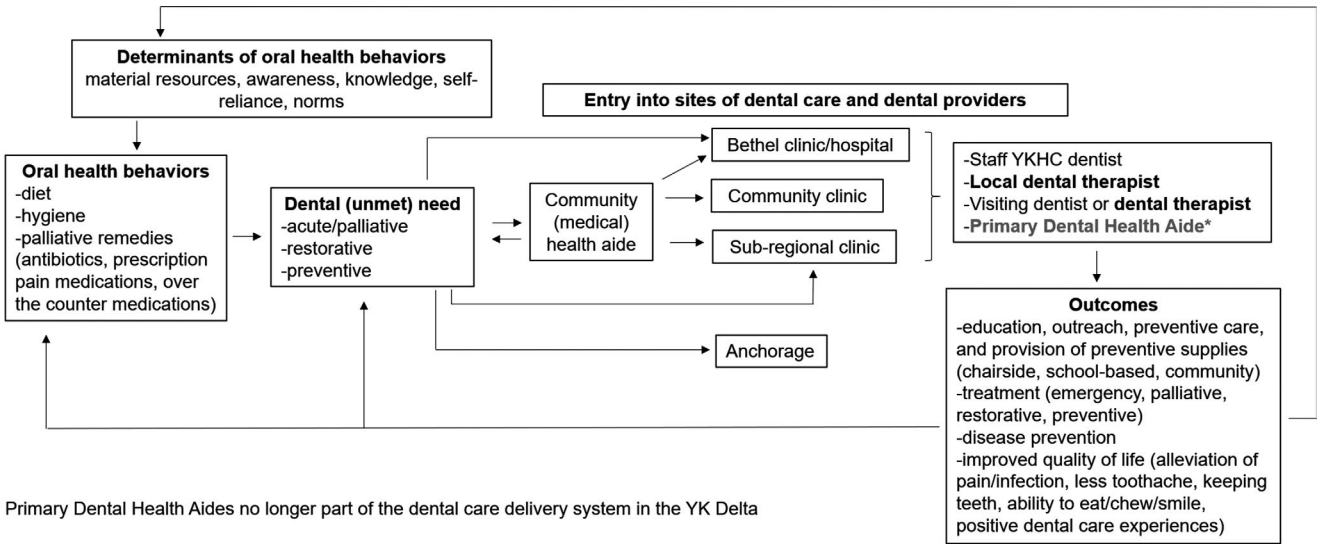

FIGURE 2 Preliminary conceptual model of oral health service delivery in Alaska's Yukon-Kuskokwim Delta

lead to entry into the dental care system, in which case the demand for care may remain dormant. Regardless of whether a dental therapist provides care locally, adults from all communities discussed the recurring cycle of need in which an individual remains outside the care delivery system with unmet dental care needs.

The third component is entry into the dental care system where providers are located. Most individuals in the YK Delta initiate dental care by contacting a local community medical health aide, who collects pertinent clinical information and works with the on-call dentist in Bethel to assess where within the YK Delta the patient should be seen (eg, Bethel, sub-regional clinic, community clinic) and by whom. Dental care for children is prioritized, by both the dental care system and by Medicaid, which covers travel from local communities to either sub-regional clinics or Bethel. For Medicaid-enrolled adults, travel is limited to emergency care (eg, tooth abscess, facial swelling). To access nonemergent care, adults often times solicit resources from family and friends to cover air travel, at which point an adult may present to the Bethel dental clinic for diagnosis and possible treatment. As a result, many adults in need who attempt to seek care by contacting the community health aide may not be able to access care, leaving them with unmet need.

The fourth model component is outcomes, including treatment such as chairside and community-based preventive care and restorative care, as well as disease prevention and quality of life. These outcomes, in turn, can lead to recognition of dental need as well as changes in oral health behaviours.

The fifth model component is comprised of the determinants of oral health behaviours. These determinants include material resources as well as oral health-related awareness, knowledge, self-reliance and norms.

4 | DISCUSSION

In this qualitative study, we examined the dental therapy programme in Alaska's YK Delta with an emphasis on documenting provider and community member perspectives. Our findings indicate dental therapists have been successfully incorporated into the local dental care delivery system in the YK Delta. Interviewees believed individuals living in communities served by dental therapists have improved access to community-based preventive programmes and dental care. There may also be additional benefits in terms of reduced rates of dental disease and self-reported improvements in quality of life. These improvements are encouraging, particularly when considering the relatively short duration of Alaska's dental therapy programme and the small number of dental therapists in practice.[12] The current findings are consistent with a recent qualitative assessment of the dental therapy programme in southeast Alaska.[13] There are two additional findings with implications for future planning of dental care service delivery in the YK Delta.

The first is that there appear to be persisting dental care needs for adults in the YK Delta, regardless of whether there are dental therapists providing care locally. A contributing factor is the relatively few number of days on which dental therapists provide care within communities, which limits the availability of care even when there is some access to providers. Furthermore, while dental therapists provide palliative care, like temporary fillings to relieve pain and/or restore short-term function, many adults require complex restorative procedures like dentures, crowns and root canals that are beyond the scope of dental therapy. In this context, community members may not fully appreciate palliative care, which is not definitive treatment. As such, dissatisfaction with palliative care provided by a dental therapist may not always be a reflection of care quality but rather indicative of an understaffed system. In addition, adult Medicaid dental benefits in Alaska are not comprehensive. Insurance-related barriers are likely to get worse with the recent elimination of all dental benefits for adults in Medicaid except for emergency services. Finally, children are frequently prioritized for dental appointments over adults, driven by the philosophy that scarce resources within indigenous communities be devoted to children[21] and the YKHC's belief that treating children has the potential to prevent dental problems in the long term as these children become adults. Most dental therapy programmes around the world focus on providing care to children rather than adults.[22] Some proponents have argued that the focus of dental therapy should be exclusively on paediatric dental care.[23] However, based on local needs, preferences and resources, communities may need to be the final arbiters in setting the appropriate scope of dental therapy practice. This approach is consistent with the US context in which dental practice-related legislation is enacted at the state-level.

Collectively, it appears the YKHC dental care system requires the hiring of additional dental therapists as well as dentists to be optimally staffed and to meet the dental care needs of community members. Future studies should be conducted to examine productivity levels of dental providers with the goal of estimating optimal provider- and skill-mix between dental therapists, dentists and hygienists that would meet the dental care needs of YK Delta Communities.[24] Advanced simulation methods could be employed to understand the applicability of data from the YK Delta to underserved areas outside of Alaska, which would be relevant to state-level policymakers interested in how dental therapists can address local needs. This is especially relevant in the current environment in which multiple states have active dental therapy legislation.

The second finding is the continued need for preventive care and prevention-oriented programmes. A previous evaluation of outcomes associated with dental therapists in the YK Delta reported increased levels of preventive care for children and adults.[12] While this is encouraging, community members in our current study reported continued preventive care needs for adults, especially examinations and cleanings. Future efforts could increase the availability of preventive care for adults, which would also have the benefit of reinforcing the importance of prevention in the absence of symptoms.

According to some interviewees, school-based prevention programmes are not being delivered consistently. Part of the reason for this may be the discontinuation of primary dental health aides, trained providers who worked alongside dental therapists in some

communities to run school- and clinic-based preventive programmes. Primary dental health aides started providing care in 2002 but were eliminated from the YK Delta dental workforce in 2014 because of cuts from the federal budget sequestration of 2013. The value of lay health workers in community-based dental programmes has been demonstrated in previous studies.[25] Another potential explanation is that dental therapists may spend more clinical time providing restorative care, especially as their skills and speed improve, leaving less time for community-based prevention. A focus on providing restorative care could lead to burnout, which is common in dentistry, and may explain relatively low retention of dental therapists in the YK Delta.[26] Allowing dental therapists to implement prevention programmes may help to address community-based prevention goals and give dental therapists a more balanced set of professional responsibilities. Researchers should examine how dental therapist practice patterns change over time, strategies to address how prevention gaps can be filled and ways to retain dental therapists in practice.

Most community-based preventive programmes focus on health education, which is important but could be strengthened by incorporating evidence-based behaviour change strategies. Such strategies could be implemented by lay providers from the community such as primary dental health aides. For instance, there are a number of programmes currently under evaluation that seek to improve dietary behaviours linked to chronic oral diseases in Alaska Native children.[27,28]

In terms of ways to improve the dental therapy programme, there are two additional recommendations. The first recommendation is to formalize the way in which dental therapists are introduced to communities. Most community members do not understand the differences between dentists and dental therapists, which can become frustrating or confusing for patients seeking treatment. Formal community-level provider introductions that focus on delineating the scope of practice of dental therapists compared with dentists could help to ensure realistic expectations from patients and communities.

The second recommendation is to find ways to recruit and retain dental therapists. Fifteen-year retention rates are about 50% for dental therapists in the YKHC compared with 68% for dental therapists practicing in other areas of Alaska (Dr Mary Williard, unpublished data, personal communication, 3 April 2019). Past research shows that there were no more than 10 practicing dental therapists in the YK Delta at any given time.[12] A study from Australia examined reasons why dental therapists left the workforce[29] and the reasons provided aligned with findings from the current investigation. For instance, placement away from home communities is a barrier to recruitment and retention. The overall needs of the healthcare system may not make it possible to honour geographic placement preferences. Strengthening ties between dental therapists and other indigenous providers, like community health aides, could build local provider support systems and improve retention. Additional support services could include limits on work-related travel and offering childcare. Efforts to attract individuals into the dental therapy educational programme could focus on middle and high school students. A vocational track within high schools may help identify interested applicants and fast-track education in the basic sciences.

TABLE 1 Barriers to and facilitators of oral health and dental care access in Alaska's Yukon-Kuskokwim (YK) Delta

Broad barriers	Broad facilitators
• Lack of resources to care for teeth • Not having money for dental care • Travel-related challenges, including money to travel and inclement weather • Difficulties getting dental appointments • No local dental provider • Poor oral health and oral hygiene as the norm	• Not having to travel (reduced time and financial burden) and not having to wait for care • Having local access to a clinic with a dental provider • Having a source of oral hygiene supplies • Having insurance, Medicaid or financial resources
Barriers specific to dental therapists in the YK Delta	**Facilitators specific to dental therapists in the YK Delta**
• Dental therapist shortage; difficulty identifying individuals interested in becoming a dental therapist • Intensive travel schedule of dental therapists • Young age of dental therapists that lead to perceptions that dental therapists are inexperienced • Limited scope of practice of dental therapists compared to dentists and lack of community clarity on scope of practice • Needs of dental therapists in terms of postgraduation support to enhance retention and prevent burnout	• Local availability of dental therapists and individuals interested in becoming a dental therapist • Acceptance of dental therapists by communities • Dental therapists integrated into structure of the community • Linguistic and cultural concordance with members of local communities • Dental therapist placement in home community • Having a local source of community-based health education provided by dental therapists • Focus on prevention by dental therapists • Access to a dental therapist in one's own community or a sub-regional clinic • Dental therapists spending more time with patients than dentists • Dental therapists treating both children and adults and helping to triage emergencies • Previous experience with dental therapists, especially those that are positive • Dental therapists give dentists time to focus on more complex restorative cases

The study data were used to develop a preliminary conceptual model of oral health service delivery in the YK Delta (Figure 1). A number of existing models describe factors that predict use of health care services,[30-32] the most relevant of which is Andersen and Aday's behavioural model. The model developed in the current study shares elements with Andersen's most recent version, including an emphasis on the recursive aspects of health service use, particularly in terms of how health outcomes can influence subsequent use of care.[30] However, our model emphasizes unmet need rather than predisposing or enabling factors, the latter of which are nearly uniform in the YK Delta population. Furthermore, our model provides additional specification of who is providing services and where services are provided—key aspects in how dental care services are organized. The preliminary model presented can be used to identify specific areas within the dental care delivery system, particularly related to personnel and location of services that can be targeted to improve health outcomes.

Based on our conceptual model, we identified barriers to and facilitators of oral health and dental care services reported by interviewees (Table 1). Some barriers and facilitators are relevant to multiple aspects of the model (referred to as broad), and others are specific to dental therapists. These barriers and facilitators provide additional points of potential intervention when planning for future delivery of dental care services in the YK Delta.

There were three main study limitations. First, we interviewed a small sample of providers and community members. We had lower-than-expected participation from providers, especially dental therapists. These providers had a range of exposure to dental therapists. Some were employed in the YK Delta prior to dental therapists joining YKHC, while others joined later and did not have personal experiences working alongside dental therapists. Community members were recruited from only six YK Delta Communities. One of our original goals was to identify potential differences across communities based on dental therapy treatment days (high, medium and no exposure), which is why we focused on selecting two communities of each type. However, the small number of communities precluded such comparisons. Community members who agreed to be interviewed included individuals who had seen dental therapists themselves, those whose family members had seen dental therapists and some who had little or no knowledge of dental therapist activities in their communities and could only report general impressions from having resided in their communities over time. Furthermore, interview depth was limited by participants' knowledge about dental therapists and cultural communication styles which resulted in some interviews being brief. Additionally, the findings are generalizable to only the YK Delta and may not be applicable to other regions of Alaska. Future studies should recruit participants from a larger number of YK Delta Communities to assess the extent to which our findings are more widely generalizable and compare across systems to elucidate similarities and differences in how dental therapists contribute to dental care delivery systems.

Second, there is the possibility of misclassification bias. For instance, many community members were not able to differentiate dental therapists from other dental care providers in the YK Delta, including dentists and primary dental health aides. In addition, there was lag time between the years in which communities were classified into dental therapy treatment categories and when interviews took place. The lag means individuals from communities with no dental therapy treatment days may have subsequently been exposed to dental therapists. Participants could also have had exposure to dental therapists in Bethel.

Third, the conceptual model of oral health, assumes directionality and causality. Conceptual models are important because they can help programme planners identify parts of a dental care delivery system that can be improved. However, our proposed model is preliminary and based on cross-sectional narrative data collected through interviews. Additional research is needed to validate and refine the model.

In conclusion, dental therapists have made important contributions to the dental care delivery system in Alaska's YK Delta. Future opportunities remain within the local system to address the needs of adults, incorporate evidence-based, prevention-oriented strategies to improve oral health behaviours and reduce disease levels, and develop strategies to retain dental therapists in practice.

AUTHOR CONTRIBUTIONS

DLC led the study, designed the study, developed the data collection and analytic plan, helped interpret the findings, and took the lead in drafting the first version and writing the final version of the manuscript. SH helped to collect data, interpret findings and write the manuscript. EZ took the lead in coding the data and helped to interpret findings and write the manuscript. CLR and KS helped collect data and assisted with interpreting study findings and writing the manuscript. EO helped collect data, translate interviews, and write the final manuscript. LM helped develop the study plan and write the final manuscript. DL helped interpret findings and write the final manuscript.

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Schedule of Dental Services (Levels of Care)

The Schedule of Dental Services was developed by the Indian Health Service (IHS) Division of Oral Health to assist community dental programs in managing their resources effectively to provide access to care in a "demand care" setting. The schedule categorizes *all* types of dental services into *Levels of Care,* a priority-based listing that is outlined below and described on the following pages.

Services that alleviate pain or prevent disease are given a higher priority than those intended to prevent or contain disease, or correct damage caused by disease. Thus, emergency care has the highest priority (Level I), while providing access to complex rehabilitative care (Level V) is given the lowest priority for expending the available resources.

- Level I Emergency Oral Health Services
- Level II Preventive Oral Health Services
- Level III Basic Oral Health Services
- Level IV Basic Rehabilitation Oral Health Services
- Level V Complex Rehabilitation Oral Health Services
- Level IX Exclusions

The majority of treatment needs in American Indian/Alaska Native (AI/AN) communities falls within the first three levels, sometimes called "basic care," which comprise the most cost-effective services to provide on a community-wide basis. As additional funds become available for dental care, the schedule can be used to expand access to care beyond basic services in an orderly, equitable, and cost-effective manner.

The schedule forms a consistent structure for program planning as well as for the treatment planning of individual patients. However, it is intended to be a flexible tool which can be adapted to the situation of each community and of dental patients. Factors such as the availability of alternate resources, community water fluoridation, patient age, and the prognosis for success, as well as other conditions, each play a role in determining how the schedule should be applied to individuals and target groups. *The general principle for implementing the schedule is always to use the available resources for providing the greatest health benefit to the greatest number of people for the longest time possible.*

Over the past decade, the Schedule of Dental Services has proven its value to IHS, Tribal, and Urban (I/T/U) dental programs in many ways. The following list summarizes some of the common uses:

- Provides consistent structure for program/provider performance evaluations (in-house and Joint Commission on Accreditation of Healthcare Organizations [JCAHO]).

- Provides a way to document dental program activity and adequacy of funding during Tribal self-determination contracts and self-governance compact negotiations.
- Provides a framework for contracting a scope of work and standards of care with private care providers. These contracts may be administered by local authorities or indirectly through outside agencies (Delta Dental, Blue Cross/Blue Shield, etc.).
- Provides a basis for planning dental facility expansion and manpower enhancements to improve access to care, using anticipated care utilization rates and population growth estimates.
- Provides a way to demonstrate and compare the dental needs and relative level of access to care among AI/AN communities of all sizes and backgrounds (for annual budget preparations to the U.S. Congress and other potential funding sources).

Description of the IHS Schedule of Dental Services Levels of Care Structure

Level I: Emergency Oral Health Services

Emergency dental services are those necessary for the relief of *acute* conditions. Emergency dental care services include all necessary laboratory and preoperative work including examination, radiographs, and appropriate anesthesia. Emergency dental services shall include but not be limited to the following:

- Control of oral and maxillofacial bleeding in any condition when loss of blood will jeopardize the patient's well being. Treatment may consist of any professionally accepted procedure deemed necessary.
- Relief of life-threatening respiratory difficulty and improvement of the airway (respiratory system) from any oral or maxillofacial dental condition. Treatment may consist of any professionally accepted procedure deemed necessary.
- Relief of severe pain accompanying any oral or maxillofacial dental conditions affecting the nervous system, limited to immediate palliative treatment, but including extractions where professionally indicated.
- Immediate and palliative procedures that include but are not limited to: (1) fractures, subluxations and avulsions of teeth, (2) fractures of jaw and other facial bones (reduction and fixation only), (3) temporomandibular joint subluxations, (4) soft tissue injuries, (5) broken dentures, and (6) chipped tooth.
- Initial treatment for acute infections.

Procedures that are frequently reported in this category of care are listed below:

- Emergency oral examination (limited to problem area)

- One or more periapical radiographs associated with the problem
- Simple tooth extractions
- Temporary or sedative restorations
- Palliative procedures
- Prescription medications for pain and infection
- Endodontic access preparations
- Draining of oral abscesses
- Denture repairs and other urgent repairs

Level II: Preventive Oral Health Services

The listed services are those which prevent the onset of the dental disease process. Some of the services provided to individuals are modified by IHS definitions, exclusions, limitations, and processing policies. Please refer to the appropriate sections for further descriptions of exclusions, limitations, and processing policies.

The preventive oral health services most frequently provided are:

- Adult prophylaxis with or w/o topical fluoride
- Child prophylaxis with or w/o topical fluoride
- Sealants by tooth or quadrant
- Preventive (self-care) training
- Periodontal recall procedures
- Athletic mouthguards
- Water fluoridation activities
- Group education
- Tracking of number of children receiving supplemental fluorides per month

Level III: Basic Oral Health Services

Basic dental care includes those services provided early in the disease process and which limit the disease from progressing further. They include most diagnostic procedures, simple restoration of diseased teeth, early treatment of periodontal disease, and many surgical procedures needed to remove or treat oral pathology.

The Level III procedures commonly reported include the following:

- Initial or periodic oral exam
- Bitewing and panoramic radiographs

- Diagnostic casts
- Space maintainers
- Amalgam restorations (1,2,3-surface)
- Composite restorations (1,2,3-surface)
- Stainless steel crowns (primary teeth only)
- Therapeutic pulpotomy (primary teeth only)
- Anterior endodontics (one canal)
- Periodontal scaling/root planing
- Biopsy, excision of lesion

Level IV: Basic Rehabilitative Oral Health Services

Basic rehabilitation services are those necessary to contain the disease process after it is established or improve the form and/or restore the function of the oral structures. The word "function" as used here includes some psychosocial considerations as well as the mastication of food. These services are more difficult to provide since the disease process is well established. The investment of resources will have a good cost-effectiveness because the procedures are directed at containment or basic rehabilitation. They include but are not limited to complex restorative procedures (onlays, cores, and crowns), the majority of endodontic procedures, most advanced periodontal procedures, prosthodontic appliances that restore function, pre-prosthetic surgery, and most interceptive or limited orthodontic procedures.

The following Level IV services are those most frequently utilized:

- Complex amalgams (4 or more surfaces)
- Cast onlays or crowns with or w/o porcelain
- Post and core restoration
- Crown buildups
- Acid etch retainers (Maryland Bridge)
- Bicuspid endodontics (two canals)
- Apicoectomy/retrograde filling
- Gingivoplasty
- Limited/interceptive orthodontics

Level V: Complex Rehabilitative Oral Health Services

The complex rehabilitation services listed in Level V are those that require significant time, special skill or cost to provide. Certain patients will require referral to dental care providers skilled in providing the specific procedure and/or which have limited their

practice to that specific specialty area. Generally the patient must present special circumstances that would warrant the added time and transportation associated with specialty referral. Level V services may not improve the overall prognosis for most patients so patient selection is of critical importance when considering the provision of these services.

The Level V services most frequently provided are:

- Molar endodontics (3 or more canals)
- Periodontal surgery (mucogingival and osseous)
- Complete and partial dentures
- Denture rebase (laboratory)
- Fixed bridgework (retainers and pontics)
- Implants
- Surgical extractions (impactions)
- Analgesia (e.g., nitrous oxide)
- Cephalometric or TMJ radiographs
- Occlusal adjustment (complete)
- Periodontal surgery
- Overdentures
- Consultation for specialty services
- Precision attachment prosthetics
- Comprehensive orthodontics (Class I, II, or III)
- Surgical extractions (bony impactions) and unusual or complex oral surgery
- Maxillo-facial prosthetics
- Intravenous (IV) sedation, general anesthesia

Level IX: Exclusions

These services have been determined to be of limited benefit in the treatment of oral disease or maintenance or oral health. These services have a variable rate of success, are difficult to monitor from an appropriateness or effectiveness standpoint, are not universally defined or accepted as the preferred method of treatment. Some of the services listed under exclusions require heroic effort and therefore are questionable from a cost benefit standpoint. Other services use material which is obsolete or of disputable effectiveness. In other cases the services are considered part of treatment and do not warrant a separate fee or value. In certain other cases the IHS simply will not pay for the service.

The following procedures are examples of exclusions which are frequently reported:

- Removable unilateral space maintainers
- Silicate restorations
- Gold foil restorations
- Cast inlay
- Porcelain inlays or crowns
- Full resin or resin/metal crowns
- Direct pulp caps
- Unilateral cast partials
- Chairside denture relines
- Pulpotomy in permanent tooth
- Tooth transplantation
- Removable appliance therapy
- Behavior management
- Broken appointments

Limitations

Provisions have been added to the IHS Schedule of Dental Services to limit the frequency of certain procedures provided to individual patients. The limitations are similar to those accepted in contracts managed by most third party payers and therefore should be acceptable to most practicing dentists. The limitations are to be used in conjunction with applicable modifiers for specific services to assure that care is provided with optimal effectiveness.

The following table lists dental services which are subject to the specific limitations given:

Procedure	Limitation
Initial oral exam	Once per patient
Periodic oral exam	Once per 6-month period
Full mouth radiographs	Once during 3-year period
Supplemental bitewings	Once per 6-month period
Prophylaxis	Once per 6 months, includes education
Topical fluoride	Selected patients with high caries activity
Crowns	Only when a less complex restoration is not possible (supported by x-rays)
Class II posterior composites	By report only
Periodontics	Limitations on type and frequency of services vary with disease severity

Procedure	Limitation
Prosthodontics	No replacement within 5 years
	Chrome/acrylic material of choice

Treatment Modifiers

To further enhance the appropriateness and effectiveness of oral health care for Native Americans, the Schedule of Dental Services contains modifiers that practitioners must consider before planning treatment. These modifiers are based upon differences between the needs and circumstances of individual patients. Factors such as the patient's age, their health behavior or motivation, existing medical conditions, as well as other factors, may dictate the priority and extent of dental care that can be provided.

Following is a list of modifiers that may affect the provision of higher levels of care:

- Age of patient
- Arch integrity
  - Strategic importance of teeth involved in treatment
- Patient's health behavior or motivation
  - Compliance
  - Willingness to receive treatment
  - Dependability (history of keeping or breaking appointments)
- Oral hygiene and periodontal status
  - Activity of destructive disease
- Caries activity
  - Recurrent caries
  - Smooth-surface lesions
  - Root-surface lesions
  - Pit and fissure lesions
- Medical conditions
  - Diabetes
  - Other systemic conditions which may affect the patient's ability to receive or respond to dental therapy
- Access to care
  - Distance from clinic
  - Availability of skilled provider
  - Backlog of demand for lower levels of care