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Supply of care by dental therapists and emergency dental consultations in Alaska native communities in the Yukon-Kuskokwim delta: a mixed methods evaluation

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Objectives: Examine the relationship between supply of care provided by dental therapists and emergency dental consultations in Alaska Native communities. ***Methods***: Explanatory sequential mixed-methods study using Alaska Medicaid and electronic health record (EHR) data from the Yukon-Kuskokwim Health Corporation (YKHC), and interview data from six Alaska Native communities. From the Medicaid data, we estimated community-level dental therapy treatment days and from the EHR data we identified emergency dental consultations. We calculated Spearman partial correlation coefficients and ran confounder-adjusted models for children and adults. Interview data collected from YKHC providers (N=16) and community members (N=125) were content analysed. The quantitative and qualitative data were integrated through connecting. Results were visualized with a joint display. ***Results***: There were significant negative correlations between dental therapy treatment days and emergency dental consultations for children (partial rank correlation = -0.48; p<0.001) and for adults (partial rank correlation = -0.18; p=0.03). Six pediatric themes emerged: child-focused health priorities; school-based dental programs; oral health education and preventive behaviors; dental care availability; healthier teeth; and satisfaction with care. There were four adult themes: satisfaction with care; adults as a lower priority; difficulties getting appointments; and limited scope of practice of dental therapy. ***Conclusions***: Alaska Native children, and to a lesser extent adults, in communities served more intensively by dental therapists have benefitted. There are high levels of unmet dental need as evidenced by high emergency dental consultation rates. Future research should identify ways to address unmet dental needs, especially for adults.

Keywords: *dental therapists, emergency dental care, Alaska Native communities, dental workforce, mixed methods research, health services research*

Introduction

Dental therapists are a relatively new workforce innovation in the U.S. (Nash and Nagel, 2005; Brickle and Self, 2017). The initial motivation for dental therapy in the U.S. was to improve access to care for underserved children (Nash, 2009), an approach mirroring systems in countries like New Zealand, where dental therapists focus on children and dentists treat adults. However, in places like rural Alaska where there are persisting dentist shortages, large proportions of children and adults have dental disease and unmet treatment needs. For instance, 87% and 91% of Alaska Native children ages 4 to 5 years and 12 to 15 years, respectively, had dental caries – compared to 35% and 51% of all U.S. children from these same age groups (Centers for Disease Control and Prevention, 2011). In terms of dental caries severity, Alaska Native children ages 4 to 5 years and 12 to 15 years had 7.3 and 5.0 decayed, missing, or filled teeth, respectively, compared to 1.6 and 1.8 for all U.S. children from the same age groups (Centers for Disease Control and Prevention, 2011). Older data for Alaska Native adults show similar disparities in dental disease (Niendorff and Jones, 2000). Thus, Alaska's dental therapy program, the first in the U.S., was designed to address oral health disparities in both children and adults in Alaska Native communities. Since the inception of Alaska's program, there are dental therapists practicing or authorized to practice in at least 11 other states (Pew, 2018).

The Yukon-Kuskokwim (YK) Delta is a region in Alaska in which dental therapists first began providing care in 2006. This first cohort of YK Delta dental therapists were trained in New Zealand. In the YK Delta, dental therapists focus on prevention and simpler dental procedures under the general supervision of dentists. Certified dental therapists work in sub-regional clinics and travel to smaller outlying communities accessible by airplane, snow machine, or boat. This differential scope of practice leaves more complex dental treatments to dentists, who work regularly in Bethel and engage in limited travel to smaller communities for care delivery (Williard, 2012).

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Studies have examined outcomes associated with dental therapy. Data from Alaska Native communities showed that treatment quality is no different when provided by dentists compared to dental therapists (Bolin, 2008; Bader *et al*., 2011). A systemic review of global dental therapy programs arrived at a similar conclusion (Phillips and Shaefer, 2013). A Cochrane review of dental auxiliaries, which included dental therapists, reported that no definitive conclusions could be drawn on the comparative effectiveness of dental auxiliaries and dentists in terms of treatment outcomes (Dyer *et al*., 2014). The five studies included in the review were at high risk of bias and had been published over 20 years ago. A recent study from Alaska's YK Delta reported improved rates of preventive care and lower extraction rates in communities served more intensively by dental therapists (Chi *et al*., 2018). Qualitative studies have reported benefits attributed to dental therapists in two different areas of Alaska (Senturia *et al*., 2018; Chi *et al*., 2019).

One goal of a patient-centered care delivery system is to minimize demand for emergency dental care prompted by toothaches, pain, and infection. Symptom-driven dental care is usually provided during non-clinic hours in hospital emergency departments. This form of care is costly and inefficient because it does not typically solve the underlying problem (Darling *et al*., 2016), but can be important in relieving symptoms until definitive care is available. Individuals in geographically isolated communities may not have local access to hospital care. In the YK Delta, individuals with emergency dental problems typically visit a community health aide, an indigenous primary medical care provider who is a member of the community and works in the local clinic (Golnick *et al*., 2012). The clinical responsibilities of community health aides include: collection of diagnostic data including a health history, symptoms, and intraoral photos; transmitting data to a consulting dentist in Bethel; coordinating Medicaid authorization for travel to the dental clinic in Bethel for patients with conditions deemed an emergency by a dentist; and triaging patients who cannot travel to Bethel until a dental provider is scheduled to visit the community.

In light of the potential benefits associated with dental therapists, studies to date have not examined whether the supply of care provided by dental therapists influences demand for emergency dental consultations. In this mixed-methods study, we 1) tested the hypothesis that communities with more dental therapy treatment days would have lower emergency dental consultation rates for both children and adults; and 2) conducted interviews with community members and providers to help interpret the quantitative findings. The proposed work is an important step in improving the dental care delivery system in Alaska Native communities.

Methods

Study Location

The quantitative data corresponded to individuals living in the YK Delta, an area in southwest Alaska with about 25,000 inhabitants, most of whom are of Yup'ik descent. Individuals in the YK Delta speak English and Yup'ik or Cup'ik and have a subsistence lifestyle that involves hunting, gathering, and fishing. Bethel is the largest community in the YK Delta. Nearly all health services, including dental care, in the region are provided by the Yukon-Kuskokwim Health Corporation (YKHC). A hospital and dental clinic are located in Bethel. There are also five sub-regional clinics. Most of the smaller YK Delta communities have a health clinic where primary care services are provided by community health aides. Over 80% of individuals in the YK Delta are eligible for Medicaid (Personal Communication, Lisa Wimmer, 11/21/19), which provides comprehensive dental care coverage for children. For adults, however, there was limited dental coverage through June 2019. Adult dental Medicaid benefits were eliminated completely in July 2019, but after several changes, full benefits are expected to be reinstated in January 2020.

Study Design, Data, and Integration

This was an explanatory sequential mixed-methods study. As described previously (Chi *et al*., 2018; Chi *et al*., 2019), there were three data sources: Medicaid data from the Alaska Department of Health and Human Services, electronic health record (EHR) data from the YKHC, and qualitative interview data. Medicaid and EHR data were from 2006 to 2015, corresponding to the period in which dental therapists under general supervision started providing care in the YK Delta to the year in which most recent data were available. Medicaid data were used to create the predictor variable and the EHR data were used to generate the outcome variable for the quantitative analyses (see Study Variables section).

The 48 YK Delta communities included in the Medicaid data analyses were classified as having zero, medium or high exposure to dental therapists. We identified all dental claims from the electronic health records that were submitted by a dental therapist during the study period. Each day that a dental therapist provided dental care was counted as a treatment day. These were aggregated by community and three categories were generated based on cut points in the data. Of the 48 study communities, 15 had no treatment provided by dental therapists from 2006 to 2015. There were 25 medium exposure communities (range: one to 200 dental therapy treatment days) and eight high exposure communities (201 to 1399 dental therapy treatment days). The two of the medium exposure communities had 60 to 67 dental therapy treatment days and two high exposure communities had 975 to 1249 dental therapy treatment days.

For the qualitative data, we conducted individual and group semi-structured interviews with a convenience sample of individuals recruited from two communities from each exposure level as described previously (Chi *et al*., 2019). Individuals in a zero-exposure community who moved to a community with dental therapists or saw a dental therapist in Bethel could have been exposed to a dental therapist. Additionally, we interviewed 16 former and current YKHC health providers (Chi *et al*., 2019). Thus, the quantitative and qualitative data were integrated through connecting in which a select number of communities from the quantitative analyses were part of subsequent qualitative study (Fetters *et al*., 2013).

We created semi-structured interview scripts for providers and community members based on Grembowski's program evaluation model (2016). The interview script for providers consisted of 13 open-ended questions about the care they provided in the YK Delta, any perceived concerns about the dental therapy program, personal observations of the program as it operated in YK Delta communities, and recommendations for improvement. The script for community members was reworded to focus on patient experiences as recipients of care provided by a dental therapist, a caregiver of a child who received care from a dental therapist, or a relative of a care recipient.

All interviews were conducted by five members of the research team with interviewing experience. Provider interviews were completed by phone and community interviews were conducted locally in private areas. All interviews were digitally recorded. Interview data were collected until no new themes emerged. The study was approved by the YKHC Human Studies Committee, the Tribal Councils in each community in which interviews were conducted, the University of Washington Institutional Review Board, and the University of Alaska Fairbanks Institutional Review Board.

Study Variables

For community-level quantitative analyses, the predictor variable was the annual total number of dental therapy treatment days (Chi *et al*., 2018). The outcome variable was the proportion of individuals each year having a consultation for an emergency dental problem, also measured at the community-level. The denominators for the outcome variable comprised individuals with at least one YKHC dental claim in the calendar year. Most consultations were initiated through contact with a community health aide, but some individuals accessed consultations by seeing a dental therapist or dentist. We identified the following EHR dental emergency consultation codes: D9310 (diagnostic dental consultation with a community health aide) or PEF (general dental consultation). D9310 is a standard American Dental Association code. PEF is a tracking code used within YKHC. Emergency dental consultation codes were historically underutilized (2006 to 2010) because of limited telehealth resources. Consistent use of these codes started in 2011. Accordingly, we restricted the quantitative analysis to data from 2011 to 2015. Models were run separately for adults ages 18 years and older and for children under age 18 years because the dental needs of the two groups are different. There were two community-level confounders that we established *a priori* based on previous work: the number of days on which a dentist provided treatment and the proportion of individuals living below poverty in 1999 (Chi *et al*., 2018).

Data Management and Analyses

For the quantitative data, we calculated the overall proportion of children and adults with an emergency dental consultation in the 48 communities for each year and for the study period (2011 to 2015). We also reported calculated community-level proportions, presented as medians and interquartile ranges. We then generated unadjusted and confounder-adjusted Spearman partial correlation coefficients to evaluate the association between dental therapy treatment days and emergency dental consultations. The analyses were aggregated by year for each community (48 communities over five years, N=240). Generalized estimating equations were used to account for clustering by community because of multiple observation years (Hardin and Hilbe, 2012). We assumed observations from different communities to be independent. We generated smoothed lines using a LOWESS (Locally Weighted Scatterplot Smoothing) tool of scatterplots between the predictor and outcome variables. SAS version 9.4 was used for the analyses.

One member of the research team with 30 years of qualitative research experience coded the transcribed and verified interview data. All interview responses were unitized by noun and verb, and each unit was coded. In content analysis, open coding was used to categorize each unit and the units of analysis were labeled with emic words drawn from the participants' own words (Krippendorf, 1980). No qualitative data software was used. Categories were drawn into broader themes inductively by the research team. Themes were generated separately for children and adults. The quantitative and qualitative data were visualized with a joint display (Fetters *et al*., 2013).

Results

Quantitative Results

From 2011 to 2015, 10.4% of children and 5.4% of adults had an emergency dental consultation (Table 1). However, the annual community-level range was highly variable, from 0% to 100% for children and 0% to 60% for adults, with a number of communities having no emergency dental consultations. From 2011 to 2015, the median (interquartile range) percentage of children and adults with an emergency dental consultation was 15.4% (7% to 29%) and 18.2% (8% to 28%), respectively (Table 1).

After adjusting for confounders, there was a significant negative correlation between dental therapy treatment days and emergency dental consultations for children (partial rank correlation= -0.48; $p<0.001$) and adults (partial rank correlation= -0.18; $p=0.03$) for years 2011 to 2015 (Figure 1). The unadjusted correlations were nearly identical (-0.47 for children and -0.18 for adults).

Community and Participant Demographics

For the qualitative analyses, we interviewed 16 providers (nine dentists, three dental hygienists, three dental therapists, and one physician assistant). Of the 125 community member interviews, most identified as Yup'ik (98.4%), 69% were female, and the mean age was 41.1±15.9 years (range: 18 to 77 years).

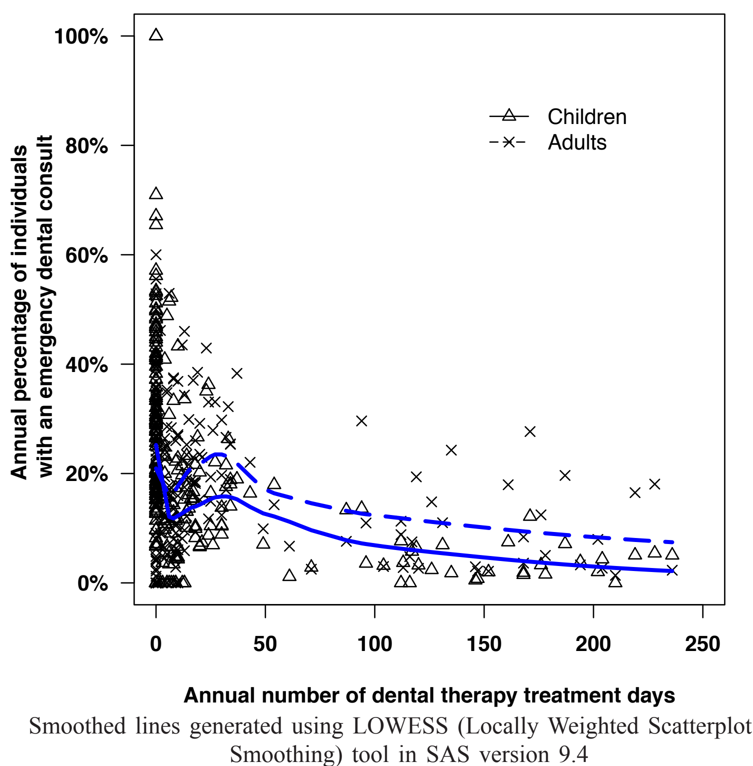
Child Qualitative Findings

There were six themes related to emergency dental consultations for children:

- Child-Focused Health Priorities
- School-Based Dental Programs
- Oral Health Education and Preventive Behaviors
- Dental Care Availability
- Healthier Teeth
- Satisfaction with Dental Care

Table 1. Emergency dental consultations for children and adults in Alaska's Yukon-Kuskokwim Delta, 2011 to 2015.

	Year					
	2011	*2012*	*2013*	*2014*	*2015*	*2011-2015*
Children						
Overall (%)	10	10.6	9.7	11.1	10.5	10.4
Total number of living in all communities (N)	11,240	11,243	11,106	10,811	10,235	54,635
Median %	15.3	16.6	15.9	14.8	12.3	15.4
Interquartile median range (%)	4 to 25	7 to 31	7 to 28	6 to 33	4 to 31	7 to 29
Median range (%)	0 to 52	0 to 100	0 to 100	0 to 57	0 to 51	0 to 100
Adults						
Overall (%)	4.8	6.0	6.5	5.0	4.7	5.4
Total number of living in all communities (N)	15,645	16,218	16,758	17,341	17,954	83,916
Median (%)	13.2	17.6	24.6	17.6	14.8	18.2
Interquartile median range (%)	5 to 24	11 to 26	17 to 33	8 to 29	6 to 30	8 to 28
Median range (%)	0 to 42	0 to 53	0 to 60	0 to 53	0 to 45	0 to 60



Smoothed lines generated using LOWESS (Locally Weighted Scatterplot Smoothing) tool in SAS version 9.4

Figure 1. Scatterplot of annual number of dental therapy treatment days and annual percentage of children and adults with an emergency dental consultation

Child-Focused Health Priorities

Six providers believed children were the primary focus of care provided by dental therapists in the YK Delta. A dentist shared that "we've made it a goal at YKHC [to] improve the…oral health of our children. So we've been doing a big push to get in more zero- to nine-year-olds [to see a dental provider]…I would say because of that [dental therapists] here are seeing more children." This was consistent with a statement by a dental therapist who believed that focusing on children was "our corporate goal." Community members' impressions were in line with providers' views. A 42-year-old female from a medium-exposure community said that "I always feel like [dental therapists] are for kids…[Dental therapists] are always busy and…the kids are always getting seen first before the adults."

School-Based Dental Programs

Two of the three participating dental therapists discussed their role in implementing community-based programs, especially in schools. One noted that "we [dental therapists] do a lot more community outreach around the schools [than dentists]." Another dental therapist "implemented a school brushing program during my trips out to the villages…At every weekly trip, I would visit the Head Start [schools] and I would provide toothbrushes… For every consent that we had we would also do povidone iodine treatments, and then oral health education." A current dentist reported that dental therapists "go into the schools quite a bit and do different programs there. One [dental therapist]…started a No Cavity Club. And, so I feel like…everybody is excited to be a part of it and people are really motivated." A former dentist noted

that "it was easier for [dental therapists] to get into the schools [be]cause they were living…in the community." A 52-year-old grandmother in a high-exposure community said that her "grandson goes…for his fluoride and tooth checkups for school…Every three months [dental therapists] do check-ups [at school]."

Oral Health Education and Preventive Behaviors

Parents reported that dental therapists provide oral health education to children and families. A 42-year-old female from a medium-exposure community admitted that her young nephew now tells her "that little bugs are gonna come in my mouth" when she skips brushing. A 52-year-old female from a high-exposure community explained that "[dental therapists are] good because…they educate young parents to do preventative [sic] stuff for their kids." A 27-year-old mother from a zero-exposure community explained that dental therapists "made me realize I have to take care of my kid's teeth." Multiple parents explained how dental therapists taught them about the importance of removing plaque from the teeth, brushing twice daily, and avoiding sweets.

Dental Care Availability

Participants discussed ways that the availability of care had improved for children, starting in utero. One dentist observed a new emphasis on "treating pregnant moms and trying to get them in good dental condition" since dental therapists started providing care. A dental therapist discussed having "a roster of every single zero to five-year-old. I made a recommendation for the [clinic] registration staff to tie all the [medical] well child visits to a dental visit…So for every well child visit, they would also schedule a dental appointment."

A number of parents, especially those from high-exposure communities, spoke about the availability of care locally. A 76-year-old male in a high-exposure community said that before dental therapists "children had to go to Bethel whenever they had toothache. Their parents would take them there. And now they don't send them away, but work on them [locally]." A 23-year-old mother in a high-exposure community said that she gets her "baby's teeth checked [by a dental therapist]. It was good." A 51-year-old grandmother in a high-exposure community said that her 7-year-old granddaughter went to see a dental therapist "every 6 months and every 3 months for fluoride treatments" from the time her first tooth erupted. In addition to preventive care, parents talked about the availability of restorative treatment for children. A 43-year-old mother of four children in a high-exposure community described a situation in which her daughter chipped a tooth. She described her daughter being able to be "seen the next day [by a local dental therapist] as a walk-in [patient] and they got her taken care of. I was really happy about that".

Healthier Teeth

Providers and community members talked about perceptions that fewer children have tooth decay after dental therapists began providing care in the YK Delta. A dental therapist recalled seeing "kids who've been cavity free…since they were babies…I started a No Cavity Club. We started off from zero [children on the list]…[Later] we had fifteen middle school-aged children on our no cavity list." A 51-year-old female in a high-exposure community spoke about her daughter and mentioned that "to this day she doesn't have cavities or fillings." She also observed "a whole lot less referrals to [the] OR [operating room] for children." A 47-year-old teacher from the same community recalled seeing "students going to their appointments for dental or their follow-ups and I don't hear [about] a lot of toothache problems from students." A 60-year-old teacher in another high-exposure community noticed "a few kids who actually come into my classroom. These are five- and six-year-olds with front teeth rather than all their front teeth being gone."

Satisfaction with Care

Interviewees reported general satisfaction with dental therapists from both caregivers and children. A dental hygienist believed the "connection with the patient was often much more immediate [when a provider is able to speak Yup'ik]…It may have enhanced their connection, you know, especially with kids. I think that having a [dental therapist] that looks like them is a real advantage in working with the children." A 34-year-old mother from zero-exposure community described her child's experience with dental therapists trainees in Bethel. The mother noticed the dental therapists were "Yup'ik…They can speak Yup'ik. And since my kids are mostly Yup'ik-speaking, [my children] are so comfortable…[and] cooperative when they get their teeth checked and worked on." A 51-year-old female from a high-exposure community was "extremely satisfied with the way [the dental therapist has] taken care of my children and grandchildren."

Adult Qualitative Findings

Four themes were related to dental emergency consultations for adults. Because findings from the first three adult themes were similar to child themes, these findings were collapsed.

- Satisfaction with Care
- Adults as a Lower Priority
- Difficulties Getting Appointments
- Limited Scope of Practice of Dental Therapy

Satisfaction with Care, Adults as a Lower Priority, and Difficulties Getting Appointments

Individuals living in high-exposure communities underscored the convenience and satisfaction of having a dental therapist available locally. A 65-year-old female said dental therapists are "right here in town…Whoever wants to see them." While satisfied with the availability of dental therapists locally, many providers and community members believed children were the primary focus of dental therapy, leaving adults as a lower priority. Participants in medium- and zero-exposure communities described difficulties accessing dental care, particularly when their only option is to travel to Bethel. A 55-year-old female from a zero-exposure community described her experiences trying to get a dental appointment. The receptionist at the YKHC dental clinic in Bethel "would say *Call back Monday morning at 8AM*. And if we do they'll say it's already overbooked. *Call next week*. [They]

keep doing that. It sounds like there's so many people waiting already that you can't even get in line." Getting follow-up dental appointments could be equally difficult. After seeing a dentist in Bethel, a 53-year-old male from a zero-exposure community was advised to make an appointment for an examination. "When I went out, I tried to make an appointment. And the receptionist told me to call back tomorrow. Then I call back tomorrow, and she said *Call back tomorrow*". They keep doing that. A year. And so I gave up on that."

Limited Scope of Practice of Dental Therapy

Participants in medium-exposure communities described how the limited scope of practice of dental therapists was unhelpful at times. A 25-year-old male said, "Well, I came here [to the clinic] one time I had some cavities. I [also] had a wisdom tooth, but [the dental therapist] couldn't do much because…they said that they needed a professional dentist to be doing extractions and other stuff. They couldn't really help me." Problems related to limited scope of practice also occurred when individuals were referred for treatment that could not be provided by a dental therapist. An individual in a medium-exposure community recalled being referred to a sub-regional clinic for care: "So when I went [there], [a dental therapist] did the exam. But they couldn't…take care of that tooth that was having the problem…So I had to go to Bethel to see the dentist." A 58-year-old female from a medium-exposure community recalled a dental therapist saying, "*Oh you have rotten teeth? You need to go into Bethel*. Why can't they just send us to Bethel to be seen instead of going through [a sub-regional clinic]? And then what a waste for Medicaid recipients because they are seen like how many times a year for dental? And if they over exceed [Medicaid's annual dental spending maximum] then they can't [be seen] until the next year. [Also] they refer us to Bethel but we have to convince them [to help us] make an appointment."

Integrated Mixed Methods Findings

The quantitative data indicate that individuals from communities served more intensively by dental therapists had fewer emergency dental consultations than individuals in communities with fewer dental therapy treatment days. While the qualitative interview data were generally consistent with the quantitative findings, data indicated persisting unmet dental care needs for adults – a finding that was not apparent from the quantitative data alone (Table 2).

Discussion

This mixed methods study is one of the first to examine the association between dental therapy treatment availability and emergency dental consultations for Alaska Native communities. There were two sets of findings, one for children and a second for adults.

We found a significant negative correlation for children between dental therapy treatment availability and emergency dental consultations. Potential explanations include child-focused health goals set by the YKHC, school-based dental programs that focus on prevention and treatment, increased dental care availability in local communities, and improved oral health. There are at least three considerations in regard to addressing the dental care needs of children in the YK Delta. First, some level of emergency dental consultations may persist in even an optimal dental care delivery system for problems like orofacial trauma, fractured teeth, and acute infections. However, sustained attention is needed to ensure that the dental care needs of children in all Alaska Native communities are being met, especially in zero- and medium-exposure communities. Previous work showed that children living in communities served more intensively by dental therapists received more preventive care and had fewer teeth extracted (Chi *et al.*, 2018). While these findings are encouraging, the fact that emergency dental consultations did not decrease during the study period is an indication that some Alaska Native children continue to have unmet treatment needs. Most priorities in the YK Delta appeared to center on young children. A particularly vulnerable pediatric subgroup may be adolescents, many of whom have permanent teeth and may present with complex dental care needs similar to adult needs. However, when we examined emergency consultation rates by age, there was no apparent heterogeneity within the pediatric population. For example, the correlation coefficient was -0.36 for children under age 3 years, -0.43 for children ages 3 to 5 years, -0.45 for children ages 6 to 12 years, and -0.40 for children ages 13 to 17 years. Future efforts could focus on children in communities without dental therapists, many of whom may need to wait until a provider visits the community or to travel to a sub-regional clinical or Bethel to access dental care. There is a need to evaluate differential unmet dental care needs within the pediatric population and ensure that dental care is available for all children and adolescents.

Second, there is value in redoubling preventive care efforts to reduce tooth decay rates and help communities reach a maintenance phase, which would reduce the portion of dental care resources devoted to treatment. Preventive care includes traditional treatment like topical fluoride varnish, povidone iodine, and sealants as well as newer approaches like silver diamine fluoride. Third, there is a need for community-based prevention programs to support and reinforce behaviors like reducing sugar intake and twice daily brushing with fluoridated toothpaste.

For adults, there was also a significant negative association between dental therapy treatment days and emergency dental consultations. This finding was consistent with our original hypothesis that an increased supply of care provided by dental therapists would be associated with lower emergency dental consultation rates. Our qualitative data found that adults were generally satisfied with the quality of care provided by dental therapists. However, community members also expressed frustration that dental therapists could not provide all types of dental care, which would frequently necessitate visits to a dentist in Bethel. Unless treatment was considered an emergency by a dentist, adults would often need to pay for their own travel expenses to Bethel because of limited Medicaid travel coverage. Collectively, these findings suggest that even though communities served

Table 2. Integrated results regarding supply of care by dental therapists and emergency dental consultations

Children		
Quantitative Findings	*Qualitative Findings*	*Integration*
A significant negative relationship between dental therapy treatment days and emergency dental consultations	Child-Focused Health Priorities We've made it a goal at YKHC [to] improve the…oral health of our children. --Dentist School-Based Dental Programs I would visit the school…at every weekly trip, I would visit the Head Start [schools] and I would provide toothbrushes…we would also do povidone iodine treatments, and then oral health education. --Dental therapist Oral Health Education and Preventive Behaviors [dental therapists are] good because…they educate young parents to do preventative [sic] stuff for their kids. --52-year-old female from a high-exposure community Dental Care Availability [My seven-year-old granddaughter] went to the dental therapist every six months and every three months for fluoride treatments. --51-year-old grandmother from a high-exposure community Healthier Teeth [I've seen] kids who've been cavity free…since they were babies… I started a No Cavity Club. We started off from zero [children on the list]…[Later] we had fifteen middle school-aged children on our no cavity list. --Dental therapist Satisfaction with Dental Care I am extremely satisfied with the way [the dental therapist has] taken care of my children and grandchildren. --51-year-old female from a high-exposure community	A focus on child oral health, preventive programs, improved preventive behaviors and availability of care, healthier teeth, and satisfaction with care have contributed to a dental care delivery system in which demand for emergency dental consultations has decreased for children in communities served more intensively by dental therapists. Dental needs for children are largely being met in communities served by dental therapists, though overall rates for emergency dental consultations are high.
Adults		
Quantitative Findings	*Qualitative Findings*	*Integration*
A significant negative relationship between dental therapy treatment days and emergency dental consultations	Satisfaction with Dental Care I like having [dental therapists] here. We don't have to leave the village when we have problems. --77-year-old female from a high-exposure community Adults as a Lower Priority It was hard making an appointment…because [dental therapists] gotta go and they see the students first. --42-year-old female from a medium-exposure community Difficulties Getting Appointments [The receptionist at the YKHC dental clinic in Bethel] would say Call back Monday morning at 8AM. And if we do they'll say it's already overbooked. Call next week. [They] keep doing that. It sounds like there's so many people waiting already that you can't even get in line. --55-year-old female from a zero-exposure community Limited Scope of Practice of Dental Therapy Well, I came here [to the clinic] one time I had some cavities. I [also] had a wisdom tooth, but [the dental therapist] couldn't do much because…they said that they needed a professional dentist to be doing extractions and other stuff. They couldn't really help me… so I didn't have much of an experience with the one I [saw]. --25-year-old male from a medium-exposure community	The demand for emergency dental consultations has decreased for adults in communities served more intensively by dental therapists. However, the decrease is not as large as the one observed for children. Adults are a lower priority compared to children which makes it difficult for adults to get dental appointments. Adults are aware that dental therapists have a limited scoped of practice, but are generally are generally satisfied with the care provided by dental therapists. Adults continue to have unmet dental care needs.

more intensively by dental therapists have exhibited fewer adult emergency dental consultations, adults continue to have high levels of dental treatment needs that are not met locally by dental therapists and traveling dentists, which in the long-term may lead to increased costs for the Medicaid program in Alaska as has been shown in other settings (Sun *et al*., 2015).

There are two strategies that should be considered for YK Delta adults. First, communities could benefit from using with adults the same formalized local triaging system recommended for young children, in which teams of dentists travel to communities to extract non-restorable teeth and stabilize existing dental disease with silver diamine fluoride (Milgrom and Chi, 2011). This process would quickly reduce emergency dental care

needs. As part of this triaging system, adults would be classified as needing care provided by a dentist or a dental therapist – who would then travel to communities over time to provide needed restorative care. Once emergent needs are addressed, adults could receive regular preventive care from dental therapists. Local efforts involving use of silver diamine fluoride started in 2019 and may help to change the level of adult emergency dental needs. Second, adults could also benefit from the same community-based preventive programs that are typically designed for children. Programs could be implemented within homes and community centers to address suboptimal oral health behaviors.

In terms of policy implications, a significant barrier to addressing the dental care needs of adults is limited Medicaid dental coverage. Historically, the Alaska Medicaid dental program restricted expenditures by instituting annual dollar limits for adults. In an era of dental coverage instability, YKHC policy planners may need to allocate resources to adults with the goal of reducing pain and infection through low-cost approaches, including extractions and silver diamine fluoride to control disease. While this approach is not ideal, it may be a short-term solution until resources are available to offer adults comprehensive care, which includes fillings and dentures.

There were four main study limitations. First, we conducted interviews with individuals in a convenience sample of six YK Delta communities. Although we selected communities based on previous exposure to dental therapists measured using claims data from 2006 to 2015, it was apparent during interviews that some participants from zero-exposure communities had been exposed to dental therapists through sub-regional clinics or the dental clinic in Bethel. Furthermore, even though exposure level is included with the quotes presented in the results section, the small number of communities in which we conducted interviews precludes definitive conclusions from the qualitative data by level of dental therapist exposure. Second, the interview script did not include specific questions on emergency consultations. However, many interviewees spoke about unmet need and the steps that could be taken to address problems within the existing dental care delivery system. Third, emergency dental consultations are initiated by patients and may not indicate true emergent need. It is also possible that individuals with unmet dental needs did not seek an emergency consultation. While previous work has shown high concordance between provider- and self-assessed oral health (Blizniuk *et al*., 2017), the YKHC threshold for conditions that constitute a dental emergency may be relatively high because of the large numbers of patients in need, limited resources to meet these needs, and the financial impact that travel authorizations have on the state Medicaid budget. Fourth, one confounding variable (community-level poverty rate) was measured in 1999, which preceded our study period. Annual community-level poverty rates may have changed from year to year.

Conclusion

Alaska Native children and adults living in communities served more intensively by dental therapists have benefitted as demonstrated by lower rates of emergency dental consultations. However, the electronic health record data indicate that overall emergency dental consultation rates remain high for both children and adults. Our interview data support the quantitative findings by showing that Alaska Native adults continue to have unmet dental care needs. Future research should identify ways to reduce emergency dental consultation rates, especially for adults.

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