

Self-reported Dental Health of Hmong Adults and Children in a Thai Village: a Descriptive Cohort Study

By

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Abstract

Objectives: Describe Hmong adults and children's dental status in one Thailand village. *Methods:* Population-based cross-sectional study to evaluate adults' and children's dental status, demographics, and behaviors. Quantitative analysis of survey by descriptive, bivariate and multivariate statistics. Qualitative description of open-ended questions and reflection of participant observations. *Results:* 37.8% of village adults and 52.2% of village children participated. Of 232 adults, 57.8% had fair/poor self-reported dental status—related to female gender, low formal education, earning occupations and fair/poor self-reported physical health ($p<0.05$). Toothbrushing daily or less had a non-significant trend for fair/poor dental status. Of 155 children, 58.9% had poor/fair dental status—related to less toothbrushing ($p<0.05$), poor physical health ($p<0.001$) and paradoxically, consuming less sweets per day ($p<0.05$). Logistic regressions revealed education for adults and physical health for children were the most important factors for dental health. Qualitative reflection placed the results in historical socio-cultural-economic contexts. *Conclusion:* These baseline observational results highlight the need for additional dental health education and services.

Key Words: Hmong, self-reported dental health, cross-sectional survey, Thailand,

Introduction

The World Health Organization emphasizes the dangers of poor dental health and stresses the need for optimal dental health, given its importance in nutrition, non-communicable diseases and overall well-being (WHO 2022a). Many global communities have poor dental health status, generally caused by behavioral factors (sugar, alcohol and tobacco use), lack of strong preventive factors (fluoride and personal dental hygiene) and limited dental community health services. (WHO 2022a).

Hmong communities living around the world may have poor dental health, but few studies have explored their dental health. The Hmong are an ethnic minority who originated in China, settled into Southeast Asia in the 1800s, and then were resettled in Western countries as refugees from Laos, starting in the mid-1970s (Vang and Flores 1999). There are only two published research studies about Hmong dental health, both from the United States. A convenience sample of 118 Hmong adults at two Wisconsin community events revealed 49% had poor self-reported dental health, 20% did not brush their teeth at least twice a day, and 47.8% had not received preventive dental care (Okunseri et al. 2008). An evaluation of 100 Hmong adult patients presenting for the first time at a dental clinic revealed that 93% had some form of periodontal disease and 66% did not return for routine care (Her 2014).

The World Dental Federation (FDI) characterizes Thailand's dental health program as exemplary in support of their Vision 2030, given its primary public healthcare system that includes dental services and its universal health coverage (known in Thailand as Universal Coverage Scheme (UCS) for medical and dental care (FDI 2023). Thailand's Bureau of Dental Health has a Strategic Plan for Oral Health (2023-2037) that promotes dental health literacy and dental services for children, adults and the elderly (Bureau of Dental Health 2023). Despite these strengths, challenges remain, according to the most recently available Thai national statistics in 2021, with 44.7% prevalence rates of caries in deciduous teeth, 27.0% in children's permanent teeth, 19.1% of severe periodontal disease in adults >15 years of age and 6.6% edentulousness in adults 20+ years old (WHO 2022b). There is no available Thai government data about dental health of minority communities in Thailand and there have been no published research reports about dental health for Hmong in Thailand.

This brief report focuses on the dental data from an epidemiological cross-sectional study in one Hmong village in Northern Thailand. The primary objective of this sub-analysis was to describe self-reported dental health (SRDH) of Hmong adults and parent-reported dental health (PRDH) of Hmong children in the village. The second objective was to identify connections between SRDH or PRDH and factors related to dental status for adults and children. These results could identify unmet dental needs and factors that could be addressed in future interventions.

Methods

Setting

We conducted an epidemiological population-level cross-sectional study using community-based participatory action research (Israel et al.1998) processes in 2014 in one White Hmong village in Chiang Mai province in Northern Thailand to evaluate multiple aspects of villagers' health. The principal investigator and author (KACP) had conducted ethnographic qualitative and quantitative research related to socio-cultural and economic influences on health in this village intermittently since 1989 (Culhane-Pera 2009; Culhane-Pera et al. 2014, 2015a and 2015b). The village was in a rural mountainous setting, about one hour from an urban center with 122 households and 903 residents, including 613 adults (≥ 15 years of age) and 295 children. The village had non-fluoridated water from a mountain stream, electricity, and water-seal toilets. It had a pre-school and a primary school but not a secondary school, so students moved to the city for 3-6 years of secondary education. Most villagers were farmers; some were merchants selling goods to locals and tourists; others were non-wage earners. Villagers had access to the medical and dental care in the Thai public health system that started in 1977-78 and the Thai Universal Coverage Scheme (UCS or "30 baht scheme") in 2002 (Tangcharoensathien

et al. 2020), which allowed them to receive free medical and dental care services within the public health care system. The public health system included a primary health center of about a one hour drive; one community health worker (CHW) for every ten households; and referral outpatient and inpatient services at the provincial hospital about 1.5 hours away. In 2014, villagers could receive dental care at the provincial referral hospital, but not yet at their primary health center.

Community-based Participatory Action Research

With support from the village leadership and director of the local primary health center (PHC), we partnered with five trained village community health workers (CHW) to design the full study in 2013, collect the data in 2014, and share the descriptive results with the villagers in 2015. We wrote the questionnaires in the Thai language (with English translations) and trained the CHWs to conduct the study, in a mixture of Thai and White Hmong languages. Our academic partners included the Department of Family Medicine (KACP, AA), Department of Community Medicine, and Department of Physical Therapy at Chiang Mai University CMU. Our public health partner was the director of their local PHC (NT). We received Institutional Review Board permission from College of Associated Medical Sciences, Chiang Mai University and Chiang Mai Provincial Public Health Department. To conduct analysis in 2024, we expanded the partnership to include a Hmong American dentist (SL) and a pre-dental student (KT).

Cross-sectional study

As a population-based descriptive study, we invited all villagers to participate. The research trained CHWs went to each household to invite all adults and their children to join, speaking in White Hmong or Thai language as villagers preferred. Interested adults and parents completed an informed consent process and signed a consent form. The CHWs interviewed

consenting adults and parents to complete a questionnaire about general characteristics: age, gender, education, occupation, habits; dental health behaviors: toothbrushing, flossing, dental visits; and dental health: self-report dental health (SRDH) and parent-reported dental health (PRDH) as well as physical health: self-reported physical health (SRPH) or parent-reported physical health (PRPH). We adopted questions from the Thailand National Health Examination Survey IV and previous questionnaires used in the village (Culhane-Pera 2009; Kunstadter et al. 2000) to inquire about demographics and habits (diet, tobacco, alcohol and drugs); most questions were closed-ended with “other” options and a few questions were open-ended. We used the standard SRDH and PRDH question: “How would you rate your/ your child’s dental health/physical health?” with a 1-5 smiling face scale of very poor, poor, fair, good and very good. SRDH has been used in global studies as a simple, effective and efficient way to obtain patient-centered information about dental status (Atala-Acevedo 2023), including Thailand (Sermsuti-anuwat et al. 2022), with some correlation with dentists’ objective evaluations (Meyers-Wright et al. 2018) and people’s lifestyles (Liu 2014). Similarly, PRDH has been used as a simple measure to gain insight into parent’s perceptions of children’s dental health status (U.S. National Survey of Children’s Health, cited in Mandal et al. 2013).

Analysis

Using Stata 16.1 to analyze the quantitative survey items, we calculated univariate descriptive statistics for all variables reporting means, standard deviations and minimum-maximum ranges, frequencies and percentages; missing data were acknowledged in the percentages. We created binary measures of the dependent variables (very poor/ poor and fair were combined into poor; good and very good were combined into good for both SRDH or PRDH). We grouped independent variable responses into two categories as possible based on

distribution of responses. Using Pearson's chi-squared test with a significant level of 0.05, we analyzed the bivariate relationships between the dependent variable and each independent variable. Independent variables included demographic characteristics, SRPH/ PRPH, habits, and dental hygiene behaviors. For a subset of children whose mothers were also participants, we explored mothers' characteristics as independent variables. Once we had identified the significant bivariate variables, we evaluated them with logistic regression models to identify the most important characteristics related to dental health for adults and children using a backward stepwise approach. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines in describing this study (von Elm et al. 2008).

For the open-ended questions, we qualitatively identified the main categories to describe their answers. To place these results into socio-cultural-economic context, the principal investigator (PI) reflected on her participant observation experiences related to dental health in the village, including discussions with the five research CHWs while collecting data and after presenting results to the villagers at a community event in 2015.

Results

In the full epidemiological study, 70/122 households (57.4%) had at least one participant, including 281/613 (45.8%) adults and 162/295 children (54.9%). For this dental analysis, 232 adults (37.8%) and 154 (52.2%) children met the inclusion/ exclusion criteria of having completed the dental history questions and not being edentulous.

Dental health

Dental health for 232 adults as evaluated by SRDH and 154 children as evaluated by PRDH (Table 1). Most adults (57.8%) had poor/fair dental health and some adults (19.8%) had some dentures. When asked why they rated their dental health as poor or very poor, people

described the condition of their teeth as having dental caries, broken teeth, missing teeth, and gum pain. They did not report underlying reasons for poor dental health. About a third (34.5%) with poor dental health had never seen a dentist. When asked why these people had not seen a dentist, they reported 3 main reasons: cost, time, limited government dental services, and futility. By futility, they meant there was no need, as dentists would only extract painful or broken teeth rather than save the tooth, and eventually the dental pain would subside and the teeth would break and fall out on their own. When asked about treatments for poor dental health, only extraction was mentioned. Most children (58.9%) had fair/poor dental health, with dental caries and broken teeth. When asked why their children had poor or very poor dental health, parents described the teeth's poor condition, not the underlying reasons contributing to poor dental health. Half of the children (51.7%) had never seen a dentist, while the other half (42%) had seen a dentist once or twice a year.

Table 1. Adults' and Children's Dental Health Status

	Adults	Children
	Self-reported Dental Health SRDH n= 232	Parent-Reported Dental Health PRDH n=151
Categorical responses, n (%)		
Very poor	-	1 (0.7)
Poor	29 (12.5)	24 (15.8)
Fair	105 (45.3)	64 (42.1)
Good	89 (38.4)	60 (39.5)
Very good	9 (3.9)	2 (1.3)
Condensed responses, n (%)		
Fair (Very poor/ Poor/ Fair)	134 (57.8)	89 (58.9)
Good (Good/ Very good)	98 (42.2)	62 (41.1)

Adults

Adult participants (Table 2) were mostly women (58%), with a range of ages (15-81 years-old), with a range of formal education (from none to primary, secondary and above); and most (79%) had money-earning occupations such as farming and marketing and few (21%) had non-wage earning occupations, such as housewife, childcare provider and student. Also, all had Thai universal health coverage and most (89%) spoke Thai (data not shown). Table 2 displays results of bivariate analyses between the dependent variable SRDH (poor/fair vs good/very good) and independent factors that could have influenced SDRH. Poorer dental health was related to female gender ($p=0.025$); low formal education ($p<0.001$); and having an occupation that did not earn money ($p=0.005$). Self-reported physical health (SRPH) was significantly correlated with SRDH; those with fair/poor oral health reported fair/poor physical health ($p=0.045$). Toothbrushing daily or less and eating sweets had non-statistically significant trends. Table 3 displays results of multivariable logistic regression analyses. Considering sex, education and occupation, education persisted as having a significant association ($p=0.035$).

Most participants reported low to moderate consumption of energy drinks, drugs, sweets, and sugar-sweetened beverages, and reported moderate to high use of cooking with sugar; there were no differences between those with and without good SRDH (Table 2). When asked about changes in sugar consumption (cooking with sugar, eating sweets, eating snacks, and drinking sweetened drinks) over the past 10 years, approximately half of participants reported no change. Among those who indicated a change, the majority reported an increase in sugar intake, especially sweets and sweetened beverages, citing factors such as enjoyable taste, availability, and affordability, while a minority reported a decrease in sugar consumption due to having diseases, or concerns for developing diseases, or cost considerations.

Table 2. Adults' Characteristics and Self-Reported Dental Health (SRDH)

Characteristics	Frequencies n (%)	SRDH and Characteristics		
		Fair/Poor 134 (57.8%)	Good/Very good 98 (42.2%)	P- value
Adult demographic factors, n= 232				
Age, mean (mid to max range)	37.52 (15-81)			
Age, in years, n (%)				
<= 35	111 (47.8)	62 (46.3)	49 (50.0)	0.574
> 35	121 (52.2)	72 (53.7)	49 (50.0)	
Sex, n (%)				
Male	97 (41.8)	48 (35.8)	49 (50.0)	0.025
Female	135 (58.2)	86 (64.2)	49 (50.0)	
Education, n (%)				
None and Primary	139 (59.9)	92 (68.7)	47 (48.0)	0.001
Secondary and above	93 (40.1)	42 (31.3)	51 (52.0)	
Occupation*, n (%)				
Not earning money	30 (12.9)	10 (8.2)	20 (21.7)	0.005
Earning money	184 (79.3)	112 (91.8)	72 (78.3)	
Adult behaviors				
Toothbrushing, times/day*, n (%)				
None, < daily, once daily	103 (44.4)	66 (50.4)	37 (38.5)	0.077
> Once daily	124 (53.4)	65 (49.6)	59 (61.5)	
Tooth flossing, times/day*, n (%)				
None	197 (84.9)	110 (89.4)	87 (92.6)	0.431
< Daily, once, >once	20 (8.6)	13 (10.6)	7 (7.4)	
Tobacco*, n (%)				
Never used	191 (82.3)	112 (84.2)	18 (18.6)	0.581
Smoke now/Smoked prior	39 (16.8)	21 (15.8)	79 (81.4)	
Alcohol*, n (%)				
Never used	153 (66.0)	93 (70.5)	60 (61.2)	0.142
Drink now/Drank prior	77 (33.2)	39 (29.5)	38 (38.8)	
Energy drinks*, n (%)				
Never used	169 (72.8)	96 (73.6)	73 (75.3)	0.809
Use now/ Used prior	58 (25.0)	34 (26.2)	24 (24.7)	
Drugs*, n (%)				
Never used	223 (96.12)	129 (97.0)	94 (95.9)	0.659
Use now/ Used prior	8 (3.5)	4 (3.1)	4 (4.1)	
Cooking with sugar*, n (%)				
Low	26 (11.2)	14 (10.9)	12 (13.6)	0.826

Moderate and High	190 (81.9)	114 (89.1)	76 (83.4)	
Eating sweets*, n (%)				
Low and Moderate	165 (71.1)	91 (72.2)	74 (81.3)	0.121
High	52 (22.4)	35 (27.8)	17 (18.7)	
Sugar sweetened beverages*, n (%)				
Low and Moderate	209 (90.1)	124 (96.9)	85 (96.6)	0.908
High	7 (3.0)	4 (3.1)	3 (3.4)	
Adult Self-assessment				
Self-report of physical health*, n (%)				
Very poor/ Poor/ Fair	122 (52.6)	79 (59.0)	43 (43.9)	0.045
Good/ Very good	109 (47.0)	54 (40.3)	55 (56.1)	

*indicates <=7% missing data. Frequency percentages include missing data.

Table 3. Adult: Multiple Logistic Regression Analysis of Poor Dental Health Status

Factors	OR	95% CI	p-value
Sex			
Male	Ref		
Female	1.553	(0.873.-2.77)	0.135
Education			
Secondary and above	Ref		
None and Primary	1.926	(1.048 - 3.540)	0.035
Occupation			
Not earning money	Ref		
Earning money	2.165	(0.904 - 5.184)	0.083

Children

Children who participated (Table 4) were half boys and girls, with a range of ages (0-14 years), and mean age of 6.41 years. Almost half (43.7%) did not brush their teeth even once a day and half (49.7%) had never seen a dentist. Most (82.1%) were exclusively breastfed for 6 months of their lives. Parents reported their children consumed sweets or sweetened beverages a mean of 1.58 times a day and spent about 11.35 Thai baht on snacks per day (about 0.30 US\$, which can buy 1-2 snack bags). Parents assessed that most of these children consumed an

average amount to a large amount of sweet candies, sugary drinks and sweetened milk, 72.2%, 63.6% and 53.7% respectively.

Table 4 displays results of bivariate analyses between the dependent variable PRDH (poor/fair vs good/very good) and independent factors that could have influenced PRDH. Children’s fair/poor dental health was related to: less toothbrushing ($p=0.027$); consuming sweets less than twice a day ($p=0.007$); consuming “very little” sweet candies ($p=0.004$), sweetened drinks ($p=0.001$) and sweetened condensed milk ($p=0.004$); and fair/poor physical health PRPH ($p=0.004$). While parents reported that most children (53%-72%) consumed moderate to high amounts of sweet candies, sugary drinks and sweetened milk, parents of children with worse dental health significantly reported that their children consumed small amounts of these three. Other children’s factors (age, gender, breastfeeding, mean ingestion of sweets, dentist visit) were not significant and one factor (eating sweets more times a day) trended towards being significant ($p=0.058$). After testing different multivariate analysis models with significant factors, only PRPH ($p<0.001$) was associated with sub-optimal dental health (Table 5).

Table 4. Children’s Characteristics and Parental Report of Dental Health (PRDH)

Factors, n (%)	Frequencies n (%)	PRDH and characteristics n (%)		p-value
		Fair/Poor 89 (58.9%)	Good/Very good 62 (41.1%)	
Children demographic factors, n= 151				
Age, mean (min to max range)	6.41 (0-14)			
Age, n (%)				
<= 6.41 years	79 (52.3)	49 (55.1)	30 (48.4)	0.420
> 6.41 years	72 (47.7)	40 (44.9)	31 (51.6)	
Sex, n (%)				
Male	75 (49.7)	49 (55.1)	26 (41.9)	0.113
Female	76 (50.3)	40 (44.9)	36 (58.1)	

Children behaviors

Toothbrushing, times/day*, n (%)

None and < daily	66 (43.7)	46 (51.7)	20 (33.3)	0.027
Once daily and > once daily	83 (55.0)	43 (48.3)	40 (66.7)	

Seen a dentist*, n (%)

None	75 (49.7)	47 (55.3)	28 (45.9)	0.263
Once or twice a year	71 (47.0)	38 (44.7)	33 (54.1)	

Feeding in first 6 months*, n (%)

Breast only	124 (82.1)	74 (83.2)	50 (80.6)	0.693
Bottle and both breast- bottle	27 (17.9)	15 (16.9)	12 (19.4)	

Age stopped breastfeeding,

mean	16.17	16.40	16.06	0.834
(range) in months	(14.60-17.73)	(14.47-18.33)	(13.23-18.88)	

Sweets times/day*, mean (+-SD)

1.58	1.50	1.78	0.058
(1.45 - 1.73)	(1.34-1.64)	(1.48-2.07)	

Sweets times/day*, n (%)

< 2 times/day	90 (59.6)	65 (73.9)	25 (51.0)	0.007
=> 2 times/day	47 (31.1)	23 (26.1)	24 (49.0)	

Baht spent on sweets/day, mean (range)**

11.35	11.57	11.26	0.790
(1.65-1.80)	(10.15-13.00)	(9.43-13.10)	

Sweet candy consumed

Very little	36 (23.8)	29 (33.3)	7 (12.1)	0.004
Average and a lot	109 (72.2)	58 (66.7)	51(87.9)	

Sugary drinks consumed

Very little	48 (31.8)	39 (45.4)	9 (15.5)	0.001
Average and a lot	96 (63.6)	47 (54.7)	49 (84.5)	

Sweetened milk consumed

Very little	57 (37.7)	42 (51.2)	15 (26.8)	0.004
Average and a lot	81 (53.7)	40 (48.8)	41 (73.2)	

Parental Health Assessment

Parent-report physical health, n (%)

Very poor/ Poor/ Fair	42 (27.8)	39 (43.8)	3 (4.8)	<0.001
Good/ Very good	109 (72.2)	50 (56.2)	59 (95.2)	

* <=9% missing data. Frequency percentages include missing data.

** Thai Baht, 10 baht ~ 0.30\$US

Table 5. Children: Multiple Logistic Regression Analysis of Poor Dental Health Status

Factors	OR	95% CI	p-value
Parent-report of physical health (PRPH)			
Good/Very Good	Ref		
Very Poor/Poor/Fair	10.90	(3.06 - 38.77)	<0.001
Toothbrushing, times per day			
Once daily + > once daily	Ref		
None + <Daily	2.03	(0.93 - 4.44)	0.077
Consuming sugary drinks			
Average and a lot	Ref		
Very little	3.17	(1.29 - 7.78)	0.012

Children and Mothers

Table 6 displays a subset analysis for 94 children whose mothers had participated. Older mothers ($p < 0.001$) and mothers with more toothbrushing ($p = 0.003$) were correlated with children's fair/poor PRDH. Other maternal factors (SRDH, SRPH, occupation, education, Thai language ability, and flossing) were not-significant for this subset of children. Multivariable regression analysis demonstrated similar findings (data not shown).

Table 6. Children's Mothers' Characteristics and Parental Report of Dental Health (PRDH)

Mother's Characteristics n=94	Frequencies n (%)	PRDH and Characteristics n (%)		p-value
		Fair/Poor 53 (56.38%)	Good/Very good 41 (43.62%)	
Mother's age, mean (range)		30.92 (17-50)	34.02 (22-50)	0.031
Mother's age, n (%)				
- Younger (< 30 years)	33 (35.1)	27 (50.9)	6 (14.6)	<0.001
- Older (\geq 30 years)	61 (64.9)	26 (49.1)	35 (85.4)	
Mother's education, n (%)				
- None and primary	55 (58.5)	27 (50.9)	28 (68.3)	0.090
- High school and higher	39 (41.5)	26 (49.1)	13 (31.7)	
Mother's occupation, n (%)				
- not earning money	0	0	0	

- earning money	90 (100.0)	51 (100.0)	39 (100.0)	
Mother's SRDH, n (%)*				
- Very poor/ Poor/ Fair	67 (77.0)	37 (75.5)	30 (79.0)	0.705
- Good/ Very good	20 (23.0)	12 (24.5)	8 (21.0)	
Mother's toothbrushing, n (%)*				
- none, less than daily, and daily	34 (36.2)	12 (24.5)	22 (55.0)	0.003
- more than daily	55 (58.5)	37 (75.5)	18 (45.0)	
Mother's flossing, n (%)*				
-None	62 (66.0)	37 (80.4)	25 (69.4)	0.250
<daily, once vs >daily	20 (21.3)	9 (19.6)	11 (30.6)	
Mother's SRPH, n (%)*				
- Very poor/ Poor/ Fair	63 (68.5)	37 (71.2)	26 (65.0)	0.529
- Good/ Very good	29 (31.5)	15 (28.8)	14 (35.0)	

*indicates <=9% missing data. Frequency percentages include missing data.

Dissemination

A year later in 2015, the research team communicated the basic descriptive results to the CHW, the villagers at a village meeting and the public health center staff. In addition, we created a videotape in Hmong interviewing preschool teachers and a CHW mother to encourage village parents and grandparents to support their children's toothbrushing, reduce sugar intake, and increase visits to the dentist (Kev Pab Kom Koj Menyuum Hniav Zoo).

Reflections

Generally, the PI and CHWs were not surprised at the low level of dental health in adults and children, given the visual evidence of children and adults' decaying, broken and missing teeth (see pictures). We could understand that lower dental status corresponded with lower physical health, and vice versa, as it seemed that some adult villagers were generally less healthy than others. While we had not heard about "traditional" Hmong dental practices, such as grandparents teaching grandchildren to clean their teeth or avoid eating certain foods, the only traditional dental procedure we had heard about was extracting bad teeth. It seemed that villagers generally accepted a dental life cycle (born edentulous, loose deciduous teeth, and gain

permanent teeth that ultimately decay, break and fall out) as an expected part of life. A grandfather said about grandchildren's rotten teeth, "They will get adult teeth soon enough".

After their teeth broke, a man said "Teeth just get old" and a middle-aged woman said, "Now I am an old woman". An edentulous woman said, "Now I am like my grandmother".

"Western" concepts of dental hygiene practices were introduced to children by their Thai teachers. Historically, boys started receiving formal education before girls, while staying in Buddhist temples outside the village. When the village's primary school was built for all children in 1974, both boys and girls were exposed to toothbrushing with fluoridated toothpaste. This support for dental hygiene continued into secondary schools located in Chiang Mai city. A village preschool was added in 2007, where preschool children brushed their teeth twice during the school day and parents were encouraged to continue this at home. Hence, we were not surprised that older adult men and people with more education had better dental status than older women and people with less education, while both boys and girls had similar dental status. We were surprised that children were not brushing daily, as we knew families who brushed their teeth once or twice a day and thought everyone was brushing. We knew that people were not using dental floss, as people saw it as an additional expense without much benefit: teeth still rot and fall out. However, we also knew that teeth brushing behaviors were private events; there was a cultural preference to not picking teeth in public with a toothpick and not showing teeth in public (even large laughs with wide open mouths could be considered vulgar), which limited us from knowing people's private dental hygiene behaviors.

"Western" preventive and therapeutic dental services were available to villagers in the Thai public healthcare system and covered by the universal coverage scheme. Given that government services were limited, some people accessed expensive private dental clinics in

Chiang Mai city for therapeutic care such as extractions and dentures. Obtaining dentures may have started about 1975 when the Thai royal family visited the village and Queen Sirikit chose some edentulous villagers to receive free dentures and may have expanded after 2005 when the Royal Denture Project provided free dentures, although appointments were limited. Generally, villagers were not accessing preventive care, so we were not surprised that about half of the children had not received preventive dental care. Our perceptions of reasons that villagers did not obtain preventive care and only obtained limited therapeutic care expanded upon the participants' expressed reasons: direct cost of care (particularly when had to use private clinics), indirect costs of care (time and transportation costs for care outside of the village), time (time to access care), competing priorities (seasonal agricultural work or family obligations), weather (rainy season causing dangerous roads especially before the roads were paved), limited government services (not enough available dental services to meet demand) and futility. Futility was related to people's experiences that since dentists mostly extract teeth (rather than do fillings, crowns or bridges) and since painful teeth ultimately die and fall out, then there is not much gain for the cost. The CHWs thought that more children would get preventive care if the primary health center would bring dental services to the village.

Over the previous three decades as the village had changed from subsistence farming to cash-crop farming, the village had more markets to sell non-food items (i.e., candy, sweetened beverages, tobacco and alcohol) and villagers had more money to spend on these and other items (i.e., toothbrushes, toothpaste). We were not surprised that people with occupations that provided income had better dental status, both to purchase toothbrushes and toothpaste and to obtain dental care. And we expected that people who consumed more sweets, tobacco and alcohol would have worse dental health. Taught by their local public health station, the CHWs

had already incorporated “Western” dental prevention concepts about reducing sugar into their public health messages. As a response to this research, the CHWs vowed to continue their messaging in order to improve people’s dental status, supported by their videotape (Kev Pab Kom Koj Menyuam Hniav Zoo).

Discussion

This population-based descriptive dental health study of Hmong adults and children in one Thailand village found that more than half (57.8%) of adults and more than half (58.9%) of children had suboptimal dental health, as measured by responses to a single question of dental health status.

Risk factors that could have been contributing to poor dental health in the village were evident. Villagers drank non-fluoridated water. Children spent money on sweets every day and consumed sweets and sweetened beverages on average 1.5 times a day although adults only ate sweets and drank sweetened beverages two-three times a month. People had inadequate dental hygiene behaviors. Almost half of adults (44%) were brushing less than twice a day, some were brushing less than once a day or not brushing at all (9.5%) and only a few were flossing some days (8.6%). Almost half of children (44%) were brushing less than once a day. Preventive dental visits were a missing service; children had low rates of preventive dental care while adults only sought dental services when they identified problems, and even then, some people did not obtain dental care. People avoided dental care due to cost, distance and futility. Our findings are consistent with WHO’s general assessment that poor oral health is related to inadequate fluoride, high sugar consumption and poor access to community dental care service (WHO 2022a; WHO 2024).

Factors related to adults' suboptimal dental health in this study included: women, less formal education, wage earning occupations, and suboptimal physical health, with education being the most salient factor. These factors seem to be intertwined in multiple ways. Education has been correlated with dental health (Finlayson et al. 2010) and was a mediating factor in our study. We explained that historically children first learned to brush their teeth in school and schools continue to support dental hygiene practice. Education was directly related to gender, as the village women historically received less formal education than men. With poor dental health contributing to poor physical health (Hajishengallis 2022), SRDH and SRPH have been shown to be directly correlated (Dolan et al. 1991), although SRDH has been reported to be lower than SRPH (Li et al. 2019) as in our study. Studies have found strong connections between poor SPRH and chronic diseases (such as cardiovascular diseases, diabetes, osteoporosis) as well as all-cause mortality (Yu et al. 2024) and between poor SRDH with edentulism and all-cause mortality (Khan et al. 2024).

Furthermore, lower economic situations have been associated with lower SRDH (Hakeberg and Wide Boman 2017; Finlayson et al. 2010), including in Thailand (Amornsuradech and Vejvithee 2019). Our study did not clearly support this trend, as people with earning-occupations had worse SRDH and SRPH; however, we did not collect direct financial information on participants. We speculated that perhaps people with wage earning occupations used their money to purchase sweets, which could worsen dental health. Adults did report their increased sugar consumption, especially eating sweets and drinking sweetened beverages, over the past 10 years and cited the enjoyable taste, the availability and affordability. Historical village data from 1991 to 1999 indicated there was a profound change in economic activity with subsistence agriculture in 1991 giving way to a cash-based agricultural economy in

1999 (Culhane-Pera 2009) and hence people had more money to spend. Concurrently, children's nutritional status improved, indicated by the increase of mean weight-for-age Z score (WAZ) from -1.786 to -1.443 ($p < 0.01$) and children's dental health worsened, as indicated by increase in presence of dental caries from $< 1\%$ to 12% ($p < 0.01$). This trend could have continued.

Factors related to children's suboptimal dental health were less toothbrushing; eating sweets less than twice a day; consuming small amounts of candies, sweet drinks and sweetened milk; and suboptimal parent-reported physical health (PRPH), with PRPH being the most important factor. It is well known that low dental hygiene can result in suboptimal dental health (WHO 2022a), and that low reported physical health is correlated with low reported dental health (Bramantoro et al. 2020). However, eating sweets fewer times per day and only eating "a little bit" of sweets are not consistent with known processes; rather, the opposite is supported (Kandelman 1997; van Loveren 2019). Our data did not capture aspects of sugar consumption that relate to destruction of enamel, such as amounts of sweets, types of sweets, frequency of sweets, and duration of exposure to teeth (Kandelman 1997; van Loveren 2019). It is possible that children from poorer families bought fewer sweets, but their overall lower socio-economic situation contributed to their worse dental health than children from families with more funds that could afford to buy sweets twice a day (Chi et al. 2014). Since these are parent-reported data about children's consumption of sweets, parents may not be accurately assessing the amounts of consumed sugars that could adversely affect dental health.

For the subset of children with maternal data, younger mothers and mothers brushing more than once a day were correlated with children's poor SRDH. Perhaps younger mothers have more young children to raise and therefore less time to supervise toothbrushing (Soares et al 2020) or mothers were brushing more to set an example for their children with poor health.

One study showed that mothers with good oral behavior and attitudes influenced their children's dental hygiene practices and overall oral health mothers' brushing frequency had no direct correlation with children's dental caries (Kuter and Uzel, 2020). Given that family-based education and role-modeling about dental hygiene can be significant factors in children's dental health (Kaushik and Sood 2023), it may have been illuminating to explore more parental factors related to dental health.

We have limited data about why people were not obtaining preventive dental care, or early dental treatment, even with universal healthcare coverage scheme (UCS) including dental care. Participants with poor dental health who had not seen dentists described issues of cost, time, distance, and futility. Other studies in Thailand may be illuminating. Exploring Thai national data to understand why only 6.6% of a sample had received preventive care, researchers found that those obtaining preventive care had the highest education, income, and oral health satisfaction compared to those with the lowest (Chainant et al. 2022). Our findings are consistent with these findings, as those adults with highest education, wage-earning occupations and orientation towards dental hygiene had higher SRDH. Despite UHCS, societal inequities in education, occupation, and location have been found to impair dental service utilization for adults (Chainant et al. 2022), for elderly in need of dentures (Limpuangthip et al. 2019) and for children under 5 years of age (Somkotra 2009). These societal inequities may be active factors for Hmong villagers in distant rural areas accessing dental services. In addition, factors identified during a qualitative study of Karen subsistence farmers in Northern Thailand seem to be true for Hmong villagers as well, given our qualitative reflections: given people's competing priorities for time and money, dental care was a low priority unless there was dental pain; extraction was the main dental service provided, so people relied on their own cultural practices; primary teeth

were not a main concern especially when children were afraid of dental services; and people did not see benefit in preventive dental care (Thu et al. 2020).

Limitations

This study has several limitations. One, participants may have modulated their responses to the questionnaire out of desires to impress others or not embarrass themselves. To minimize this, CHWs and not researchers collected the questionnaire data; participants may have been more forthright with village CHWs given their long-standing relationship and familiarity with discussing health information. Two, self-reported information is limited; not objectively evaluating dental health (such as a mean decayed missing filled teeth (DMFT) assessment) to evaluate participants' self-reported dental health was a weakness. However, some studies have found that people's dental self-assessments have good validity with dental examiner's assessments (Meyers-Wright et al. 2018). Three, our basic quantitative questionnaire lacked depth in pursuing multiple issues, such as socio-economic conditions, parent-children interactions about dental health, details about sugar consumption, and decisions about dental health services. Nonetheless this baseline observational survey provides an insight into people's dental needs, and indicates that additional efforts are needed to identify, understand, address, and rectify factors contributing to poor dental health.

Next steps

Since this 2014 study was conducted, the availability of governmental dental care services in the public health system have expanded in Northern Thailand. Now the village's primary care center has a dental chair, has a dentist on site a few days a week to provide treatment, and is more equipped to handle preventive dental care services for adults and children. Our next steps are to build on this baseline study, identify current dental care needs through in-depth data

collection and support Thailand's dental health education and provision of dental services to address people's needs.

Conclusion

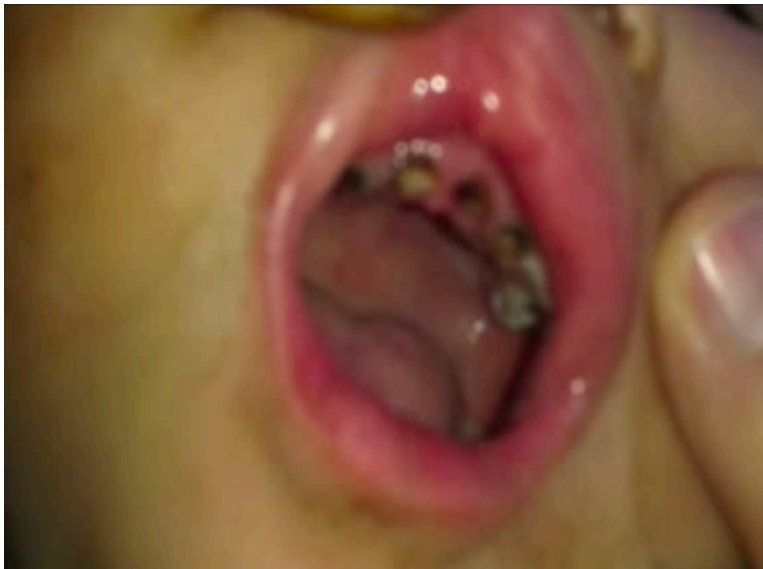
More than half of Hmong adults and children in one Thailand village have sub-optimal dental health, which highlights the need for effective dental health education and services in this village, and most likely in other Hmong communities. Since adult and children's dental health were correlated with self-reported physical health, support of dental services along with physical health services would be appropriate.

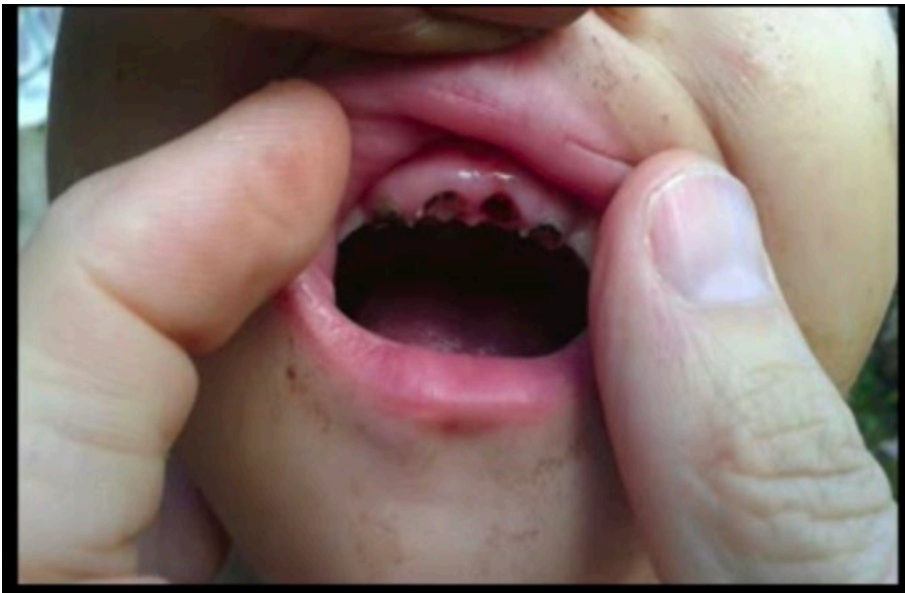
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Conflicts of Interest: None

Hmong Child Dental Caries Photographs





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