

# Comparative Analysis of Oral Health Indicators Among Young Children in Hawai'i, the Republic of Palau and Territory of Guam, 1999-2000

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**Abstract:** Dental caries prevalence data were collected in Hawai'i, Palau and Guam and analyzed for dft, DMFT, unmet treatment needs, sealant utilization and various caries patterns. Data sets include examinations of 24,752 children ages 5 through 9 years of age in Hawai'i, 558 children in Palau and 1,518 children in Guam. Dental disease in early childhood is truly endemic throughout the Pacific basin. The findings of this report quantify in a standardized manner and contrast, basic oral health / oral disease indicators from each jurisdiction. While children from all three jurisdictions demonstrated dental disease prevalence rates which far exceed those found on the U.S. mainland, overall, children in Guam were found to be the poorest oral health indicators, followed by Palau and Hawai'i. Overall, young children at all sites exhibited excessively high caries prevalence and unmet treatment needs rates. Significant progress has been made at Palau in the past decade, however, at all three sites presented, more work is necessary if early childhood caries is to be brought under control. Findings also include an apparent negative correlation between dental sealants and DMFT rates. (PHD, 2003; 10 (1), Pages 9-11)

## Introduction

The shortage of comprehensive regional and site specific data on the oral health status of Pacific basin children has long been recognized as a problem facing organizations and governmental units striving to develop evidence-based, regional and jurisdictional community oral health plans. In fact, very little has been published regarding oral disease prevalence in the Pacific basin. Recognizing the need for sound, current and standardized oral health data, the dental public health directors of the Republic of Palau and Territory of Guam entered into collaborative agreements with the dental public health administrator of the State of Hawai'i to gather and analyze data which would reflect the state of oral health among young children in their communities. This report reflects the highlights of the statistical findings of this project. The goal of this project was to gather information that has practical application and translates well for non-scientific audiences, while establishing epidemiological baselines for community health assessment which would serve as a relative gauge of oral health status among children.

All forms of dental disease, including dental caries (tooth decay), are chronic and insidious in nature. In the United States, dental caries is recognized as the most common chronic disease of early childhood.<sup>1</sup> Unlike many other epidemiological indicators, dental disease indicators are typically reflective of disease prevalence rather than incidence. Damage resulting from the active forms of dental caries can be treated and, often, arrested. However, once damaged by disease, a tooth is forever counted as diseased. In reviewing the findings of this project, keep in mind that a quantitative analysis of dental caries rates in a community reflects total caries experience, both past and present. Since there is not a reasonable, practical means to quantitatively (or qualitatively) measure "oral health", we are dependent upon the interpretation of quantitative indicators of "oral disease", patterns of service

utilization and an examination of relative disease status by contrast with comparable cohorts. In the interest of economy and resource limitations, this project focused on children between 5 and 9 years of age and employed benchmarking by utilizing single age groups at times to reflect community status. This is appropriate, with the understanding that, across age groups, dental disease is always progressive in nature and that high caries rates in the deciduous or primary dentition is generally considered a predictor of high caries risk in the permanent or secondary dentition.<sup>1</sup> Dental caries is a disease process, which is initiated through the communicable transmission of pathogenic flora, typically transmitted from mother, and other early caregivers to children.<sup>1</sup> Host factors, including peri-natal and post-natal diet, feeding habits, hygiene habits and socioeconomic status affect a child's caries susceptibility.<sup>1, 2</sup>

## Methods

dBASE programs written for the purpose of oral health data collection and analysis were utilized for this project. This computerized data system was designed and written for use in Hawai'i and had been successfully utilized by the Hawai'i State Department of Health since 1989. The system developed analyzes for a variety of statistical oral health indicators, including dft (the mean number of decayed and/or filled primary teeth) and DMFT (the mean number of decayed, missing due to decay and/or filled secondary teeth) and variety of caries patterns. Data entry is made via a single screen, which generates individual records, which may be analyzed for multiple variables, including by gender, location, age, ethnic background and disease pattern. Representative samples were examined utilizing standardized observational criteria, which met the standards of both the United States National Institutes of Dental & Craniofacial Research and the World Health Organization, thus assuring that findings are directly comparable with reported findings from other studies.

Armamentaria included halogen lamps, explorers and mouth mirrors. No radiographs or trans-illumination were utilized and probing was minimal.

In Hawai'i, screening examinations were conducted and recorded during the 1999 school year on standardized forms utilizing trained and calibrated dental hygienists working at Hawaii's public schools. Batched data forms were subsequently downloaded to create digital data sets by calibrated data entry staff. Though not reported here, large samples assured the availability of sound island, region and ethnic specific information.

In Palau, data collection occurred in 1993, 1994, 1997 and 1999. Screening data was collected by trained observers on standardized forms and batch downloaded in Hawai'i by calibrated data entry staff.

In Guam, data collection was handled differently, however, the observational and recording standards were the same as those employed in Hawai'i and Palau. The Dental Section of the Guam Department of Public Health and Social Services maintained thorough and current written examination records of all elementary school children on Guam who participated in the Department's School Busing Sealant Program. The Guam Chief Public Health Dental Officer was calibrated and provided with a direct entry computer program. The data set generated reflects clinical examination findings for all records generated during the Year 2000. These records were in-put directly to create a digital data set, which was then transmitted electronically to Hawai'i for analysis.

**Results**

Findings are presented in terms of both commonality and uniqueness. Dental health indicators are presented reflecting caries prevalence in both the primary and secondary dentitions, proportion of children affected by caries, proportion of children with unmet needs, proportion

of actively carious teeth, proportion of caries-free children and proportion of children with rampant, severe caries. No single indicator of oral health provides enough information needed to judge the relative oral health of a community. However, the collective interpretation of indicators such as those presented here, provide enough information to develop a fairly accurate and comprehensive cross-sectional picture of oral health among children. A common finding among caries prevalence surveys is a higher dft among Boys by contrast with Girls and a higher DMFT for Girls by contrast with Boys, within the same age cohorts. This gender variance pattern is typically found in caries prevalence studies and is attributed to gender variance in tooth eruption and exfoliation rates.<sup>7,1</sup> This expectation held true at all three sites.

**Caries prevalence in the primary dentition**

Table 1 reflects mean dft rates and standard deviation (s.d.) values for caries prevalence among primary teeth. By contrast with the last reported United States national figures, all three sites, Hawai'i, Palau and Guam, far exceeded the U.S. national average in all ages.<sup>1</sup> For the age-weighted dft for children ages 5 through 9, though Guam demonstrated a higher mean caries rate, that variance was not statistically significant (p>0.05). All three sites demonstrate an excessively high rate of caries in early childhood. This anticipated finding held true at all three sites. The age-weighted mean dft (5 though 9 years of age) value for Hawai'i, Palau and Guam were 2.1 times, 2.9 times and 3.1 times the U.S. national mean, respectively.

As earlier stated, caries prevalence calculations are cumulative and reflective of total caries experience for teeth present upon examination. However, in considering dft data, reductions in caries rates with advancing age are expected as children loose primary teeth through normal exfoliation and/or tooth loss associated with advanced disease.

**Table 1. Mean caries prevalence rate among primary teeth (dft)**

	Hawai'i, 1999		Palau, 1999		Guam, 2000		U.S., 1987	
Age in Years	Mean	(s.d.)						
5	3.689	(4.089)	7.286	(4.645)	7.306	(4.597)	1.716	(6.922)
6	4.165	(3.999)	6.900	(4.525)	7.364	(4.399)	1.773	(4.289)
7	4.145	(3.544)	5.933	(3.557)	6.681	(3.773)	1.999	(3.948)
8	3.788	(3.168)	5.720	(3.429)	5.810	(3.436)	2.018	(3.910)
9	3.096	(2.826)	3.697	(2.978)	3.996	(2.875)	1.891	(4.487)
5 through 9 (Age-Weighted)	3.910	(3.671)	5.561	(3.854)	5.871	(3.887)	1.884	(6.174)
Boys 5 through 9	4.042	(3.736)	5.961	(3.889)	6.109	(3.946)	1.933	(5.633)
Girls 5 through 9	3.765	(3.593)	5.088	(3.754)	5.614	(3.807)	1.831	(4.388)

*Na not available*  
*Hawai'i, n=24,752 Palau, n=558 Guam, n=1,518 U.S., n= 16,547*

### Caries prevalence in the secondary dentition

Table 2 reflects DMFT rates which also all exceed the 1987 U.S. national means, however, to a lesser degree than the dft findings.

In this case, the age-weighted DMFT for children ages 5 through 9 were higher on Guam by contrast with Palau

In reviewing in the findings presented, consider that the average 6 year old in Guam had over 7 (of a possible 20) primary teeth which were carious, 81.6 percent of children had untreated dental caries, 69.1 percent of all carious teeth observed were actively decayed and in need of treatment, 8.8 percent of children had no carious primary teeth, 76.7 percent had rampant tooth decay (5 or more decayed teeth) and 67.9 percent of primary molars observed had been damaged by caries.

**Table 2. Mean caries prevalence rate among secondary teeth (DMFT)**

Age in Years	Hawai'i, 1999		Palau, 1999		Guam, 2000		U.S., 1987	
	Mean	(s.d.)						
5	0.019	(0.202)	0.000	(0.000)	0.000	(0.000)	0.05	(0.549)
6	0.106	(0.483)	0.164	(0.545)	1.167	(1.362)	0.10	(0.701)
7	0.286	(0.752)	0.552	(0.962)	1.649	(1.573)	0.29	(1.250)
8	0.553	(1.090)	0.917	(1.278)	1.969	(1.414)	0.51	(1.643)
9	0.767	(1.263)	1.448	(1.833)	2.896	(2.490)	0.77	(2.193)
5 through 9 (Age-Weighted)	0.278	(0.798)	0.767	(1.336)	1.806	(1.900)	0.38	na
Boys 5 through 9	0.244	(0.746)	0.705	(1.368)	1.656	(1.775)	0.36	na
Girls 5 through 9	0.315	(0.849)	0.847	(1.295)	1.967	(2.014)	0.41	na

na not available

age-weighted means for the U.S., 1987 derived from calculations based upon published data sets <sup>a</sup>  
 Hawai'i, n=24,752 Palau, n=558 Guam, n=1,518 U.S., n= 16,547

(p<0.001). Both are significantly higher than the rate found in Hawai'i. Low or non-existent rates at 5 years of age are not unusual, considering that typically a child's first secondary teeth, the first permanent molars, generally do not erupt until about 6 years of age. If present at age 5, exposure to the possibly cryogenic environment of the oral cavity has been minimal.

### Progress in Palau

Findings in Table 4 reflect progressive and significant improvements in the oral health status of adolescents in Palau associated with dental disease prevention strategies targeting young children. Associated the dismal statistical oral health profile that emerged when data was

**Table 3. Early childhood oral health indicators (primary dentition) among 6 year olds**

	Sample Size	dft	95% C.I.	%d	Percent of Children Caries-Free	Percent of Children with Rampant Caries <sup>a</sup>	Percent of Children with Unmet Treatment Needs <sup>b</sup>	Primary Molars Which were Decayed
Hawai'i	6,152	4.165	4.065, 4.265	28.7%	30.1%	44.7%	35.8%	43.9%
Palau	140	6.900	6.150, 7.650	87.7	12.9	74.3	78.6	64.2
Guam	305	7.364	6.870, 7.858	69.1	8.8	76.7	81.6	67.9

<sup>a</sup> "Rampant Caries" defined as 5 or more carious teeth

<sup>b</sup> "Unmet Treatment Needs" defined as children with actively carious teeth

### Significant early childhood caries risk

Early caries indicators among 6 year olds reflect high caries rates. Though these statistics (Table 3) demonstrate a severe early childhood caries problem in all three regions, in relative terms, 'caries risk' was found to be highest in Guam and lowest in Hawai'i.

first collected in 1993 and, the Ministry of Health supported a variety of initiatives aimed at preventing and controlling dental disease among young children in Palau.

At various times since, oral health surveys were conducted in monitoring program impact. The experience of 8-year-old children is representative of the impact of disease prevention and early intervention programs targeting all age groups in Palau. Findings reflect significant reductions

in caries prevalence in both the primary and secondary dentitions, a significant increase in sealant placement and utilization, an increase in the proportion of the population that is free of caries in the secondary dentition, a reduction in the proportion of carious secondary molars within the population and a reduction in the percentage of unmet treatment needs.

dental care services, participation in other dental disease prevention activities, such as targeted sealant programs, dietary counseling, daily home care and regular, periodic professional dental care visits. Nevertheless, the contrast is caries prevalence shown between children with and without dental sealants, in all three communities, is

**Table 3. Early childhood oral health indicators (primary dentition) among 6 year olds**

	Sample Size	dft	95% C.I.	DMFT	95% C.I.	Percent of Children with at Least One Sealant	Secondary Molars Which were Decayed	Percent of Children Caries-free (Secondary Teeth)	Percent of Children with Unmet Treatment Needs	
Palau, 1993	79	8.329	7.400, 9.258	2.823	2.404, 3.242	13.9%	60.6%	10.1%	98.7%	
Palau, 1994	83	5.952	5.140, 6.764	1.205	0.889, 1.521	10.8	23.4	48.2	95.2	
Palau, 1997	240	5.008	4.617, 5.399	0.917	0.761, 1.073	81.2	15.5	52.5	92.1	
Palau, 1999	132	5.720	5.135, 6.305	0.917	0.699, 1.135	81.1	5.2	53.8	78.0	
By Contrast..										
Hawaii, 1999	5975	3.788	3.708, 3.868	0.553	0.525, 0.581	20.4	3.16	73.5	35.3	
Guam, 2000	126	5.810	5.210, 6.410	2.032	1.760, 2.304	69.0	43.94	23.8	79.4	

**Correlations with dental sealant utilization**

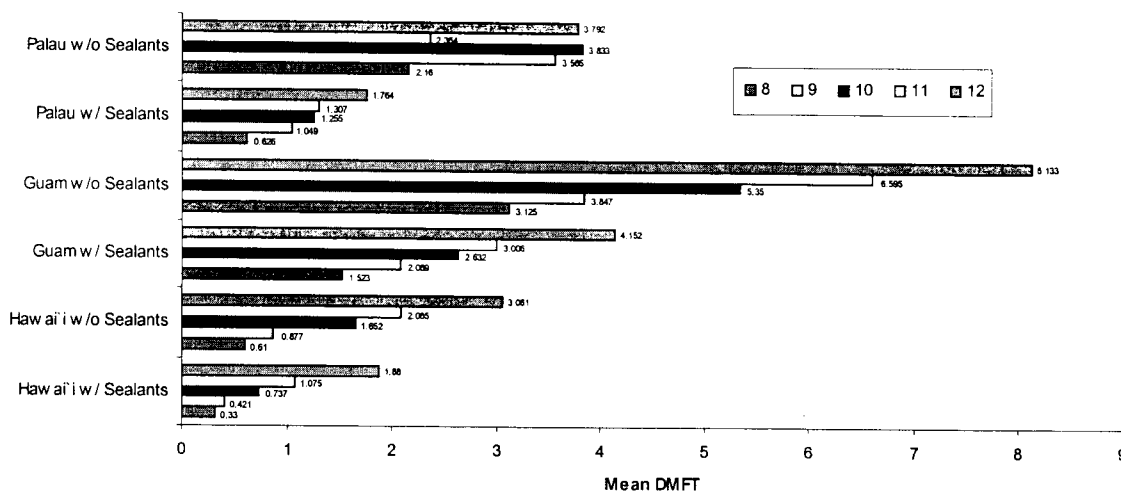
Findings shown in Figure 1 demonstrate a strong correlation between the utilization of dental sealants and lower caries prevalence among secondary teeth among adolescents in each of the three jurisdictions. Comparable correlations have been found in several recent U.S. national and regional cohorts.<sup>3,4</sup> It's difficult to attribute the lower caries prevalence demonstrated directly to the sealants themselves. Without evidence to the contrary, it can be argued that children with sealants may be from more affluent and/or from more 'dentally conscious' homes, which might be at lower risk for caries

striking, with sealed children having significantly lower DMFT rates than unsealed children in all ages examined.

**U.S. national oral health objectives**

Oral health indicators (Table 5) associated with the U.S. National Oral Health Objectives demonstrate poor oral health and high needs among adolescents in all three jurisdictions.<sup>5</sup> National Objectives 21.1b and 20.2b relate primarily to the high early childhood caries experience in the primary dentition. Objective 21.8a on the other hand, is a proxy indicator of preventive services utilization targeting caries prevention in the secondary dentition.

**Figure 1 Variance in DMFT Associated with Sealant Utilization**



development than children less likely to have sealants upon examination.

Sealant presence, in a broad sense, is reflective of access to and utilization of preventive dental services, which may be influenced by many factors including socioeconomic status, the availability and accessibility of professional

Over the past decade, the Republic of Palau Ministry of Health and Guam Department of Public Health and Social Services have made concerted efforts to invest in prevention in working to break the cycle of dental disease so prevalent among young children in the region. This is reflected in the high sealant rates found among 8 year olds. Given limited resources the challenge remains to

develop and implement effective strategies aimed at reducing community caries risk among younger children and provide sufficient treatment services to lower the proportion of children with unmet treatment needs.

however, with the high rates of unmet treatment needs and the high caries prevalence rates which remain, it's apparent that more needs to be done to bring early childhood caries under control. The implementation and

**Table 5. Status associated with U.S. national oral health objectives<sup>a</sup>**

	U.S. Baseline	Year 2010 Objective	Hawai'i, 1999	Palau, 1999	Guam, 2000
Obj. 21.1b ...the proportion of 6 through 8 year old children with one or more caries (primary or secondary dentition)	52%	≤ 40%	74.69% ±0.63	91.13% ±2.77	93.05% ±1.59
Obj. 20.2b ...the proportion of 6 through 8 year old children with untreated caries (primary and/or secondary dentition)	29%	≤ 22%	35.97 ±0.70	79.56 ±3.92	82.64 ±6.61
Obj. 21.8a ...the proportion of 8 year old children with at least one secondary molar occlusal sealant	23%	≥ 70%	20.44 ±1.02	81.06 ±6.68	69.05 ±8.07

95% C.I. a Source: *Healthy People 2010*

## Discussion

Data presented here reflect findings by age and gender and in some cases, by an age selected as a community benchmark, representative of children in their communities. All data collected demonstrate disease rates which far exceed those found on the U.S. mainland, though in relative terms, children in Guam were found to be the least healthy (have the worst oral health indicators), followed by Palau and Hawai'i. Though not an issue in the scheme of this project, the authors acknowledge that the disproportionately poor oral health indicators found among Guam children by contrast with Hawai'i and Palau, could be an artifact considering that data was collected utilizing a slightly different methodology. However, we believe that the data is certainly representative of a significant public health problem. The statistical findings at all three sites clearly justify the concerns raised for many years throughout the region over the apparent early childhood dental caries epidemic which affects so many of our children and communities.

Oral disease has been called America's "silent epidemic" by U.S. Surgeon General Dr. David Satcher.<sup>6</sup> Dental disease is insidious, painful, associated with enhanced risk of chronic disease, costly and disfiguring...and, for the most part, completely preventable. It's no longer accepted that tooth decay and other forms of oral disease are a normal part of childhood and aging. Public programming aimed at early detection and intervention and the delivery of both preventive and treatment services is in order where access to private sector services is limited. High disease rates are indicative of the need for primary, secondary and tertiary preventive services. Particularly when dealing with young children, none should be provided at the exclusion of the others.

The oral health crisis demonstrated by the findings of this project warrant the focused attention of community health planners, public administrators and our elected representatives. Our findings reflect that progress has been made in recent years with the implementation of targeted dental disease programs at Palau and Guam,

maintenance of fluoride supplement programs, such as community water fluoridation where feasible, systematic programs of early and periodic dental examinations with treatment targeting pre-school children and school-linked dental sealant and weekly fluoride mouth rinse programs may help lower the caries risk of these communities.

As efforts continue towards the development of a common regional (Pacific basin) data set, we recommend that basic, standardized indicators be utilized which are reflective of disease rates, unmet treatment needs rates and dental sealant utilization rates and that, in the interest of economy, that a few benchmark or proxy ages be identified. With an understanding of basic trends and tendencies, data associated with a few, or even single age cohorts, can yield inexpensive, fairly easy to collect, accurate, timely and useful data for establishing community baselines and monitoring of community oral health status.

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**The oral health crisis demonstrated by the findings of this project warrant the focused attention of community health planners, public administrators and our elected representatives.**

For years I have let dentists rough shad over my teeth: I have been saved, hacked, chopped, whittled, bewitched, bewildered, tattooed, and signed on again; but this is cupid's last stand  
(S.J. Perelman in *Crazy Like a Fox*)