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

Mark H.K. Greer *
Keith Larson **
Suzanne Sison ***

**Chief, Dental Health Division, Department of Health, State of Hawai'i, 1700 Lanakila Avenue, Room 203, Honolulu, Hawai'i 96817, phone: 808 – 832-5700, fax: 808 – 832-5722, mhkgreer@mail.health.state.hi.us; **Chief, Division of Oral Health, Ministry of Health, Republic of Palau: ***Chief Public Health Dental Officer, Department of Public Health & Social Services, Territory of Guam.*

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)

ORIGINAL PAPERS

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.[1] 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.[1] 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.[1] Host factors, including peri-natal and post-natal diet, feeding habits, hygiene habits and socioeconomic status affect a child's caries susceptibility.[1, 2]

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.[7,1] 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.[1] 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 (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.

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)

	Hawai'i, 1999		Palau, 1999		Guam, 2000		U.S., 1987	
Age in Years	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 [7]
Hawai'i, n=24,752 Palau, n=558 Guam, n=1,518 U.S., n= 16,547

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 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

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 [a]	Percent of Children with Unmet Treatment Needs [b]	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

a "Rampant Caries" defined as 5 or more carious teeth
b "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.

3. Berkowitz, RH, Jones P. Mouth- to-mouth transmission of the bacterium Streptococcus mutants between zmother and child. *Atch Oral Biol.*, 1985; 30: 377-379.

4. Mouradian, WE et al. Disparities in children's oral health and access to dental care. *JAMA*. 2000; 284: 2625-2631.

5. Vargas CM et al. Socioeconomic distribution of pediatric caries: NHANES III, 1988-1994. *JADA*, 1998; 129:1229-1238.

6. Burt, B and Eklund, S. Dentistry, Dental Practice and the Community. 5th edition, *WB Saunders*, 1999.

7. Oral Health of United States Children: *The National Survey of Dental Caries in U.S. Children: 1986-1987*. Epidemiology and Oral Disease Prevention Program, National Institute of Dental Research, *NIH Publication No. 89- 2247*, September 1989.

8. Weintraub JA. The effectiveness of pit and fissure sealants. *J Pub Health Dent*, 989; 49(5) 317-330.

9. Ripa LW. Sealants revisited: an update of the effectiveness of pit and fissure sealants.*Caries Res*, 1993;27:77-82.

10. U.S. Department of Health and Human Services. *Healthy People 2010: Understanding and Improving Health*. 2nd ed. Washington, DC: U.S. Government Printing Office, November 2000.

11. Oral Health in America: A Report of the Surgeon General. National Institute of Dental and Craniofacial Research, ational Institutes of Health, *NIH Publication No. 00-4713*; September 2000.

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)