ORAL HEALTH DISPARITIES AND PERIODONTAL DISEASE IN ASIAN AND PACIFIC ISLAND POPULATIONS

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Introduction: While oral health disparities exist in many ethnic groups in Hawaii, the challenge of developing research and intervention programs is hampered by the lack of a dental school and adequate state resources.

Objective: To use a collaboration model to establish a mentoring relationship with a research-intensive school of dentistry to reduce oral health disparities in Hawaii.

Methods: Collaborative interactions with the University of Hawaii School of Medicine (UH) and the University of North Carolina School of Dentistry at Chapel Hill (UNC) included bimonthly teleconferences, on-site planning and mentoring sessions, yearly conferences in Hawaii open to the community using UNC faculty, and on-site skills training sessions. The community was asked to participate in determining priorities for research through focus-group interactions. Two pilot investigations were also conducted.

Results: Both universities have been awarded grants to fund activities to support the combined intellectual and physical resources of multiple private, public, and community organizations to achieve the goal of improving the oral health status of the people of Hawaii. As a result of initial planning, two related grants have been submitted (one approved, one disapproved) to fund pilot studies on the oral health status of mothers and their babies in a rural community. These studies include both UH and UNC investigators.

Conclusions: Health disparities occur among diverse ethnic groups in Hawaii, and links between general health and oral health continue to emerge. In spite of obstacles to designing effective research and intervention programs in Hawaii, UH fostered a collaborative relationship with a premiere dental research institution to develop competence in clinical research, conduct pilot studies, and obtain extramural funding for comprehensive studies. Direct involvement of community representatives in the research process is integral to the success of such studies and will continue to serve as the foundation of our community-based participatory research. The network partners have accomplished their primary goal of developing culturally appropriate methods for assessing determinants of oral health, oral health-related quality of life, and health outcomes in Asians and Pacific Islanders. (*Ethn Dis*. 2005;15 [suppl 5]:S5-39–S5-46)

Key Words: Collaborative Research, Asians and Pacific Islanders, Hawaii, Oral Health Disparities, Interdisciplinary Research Network

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INTRODUCTION

Research suggests that oral health is linked to systemic health, and those with poor oral health may be at greater risk for diseases such as cardiovascular disease, stroke, diabetes mellitus, and adverse pregnancy outcomes. Asians and Pacific Islanders (APIs) in Hawaii have high rates of many such diseases. Studies in children in Hawaii have revealed disparities in dental health; for example, API children have significantly higher rates of dental caries than other groups. Dental caries and periodontal disease are complex, multifactorial conditions,[1] and their prevalence is essentially unknown in API populations. Hence, further study, particularly in APIs, is a vital first step in the process of assessing oral health and its correlation to overall health outcomes. By advancing understanding of the biological complexities of oral disease and translating discoveries into effective treatment for communities, research in this area can contribute to an overall reduction of health disparities among our nation's diverse populations.

In October 2002, with the support of the National Institute of Dental and Craniofacial Research (NIDCR), the University of Hawaii John A. Burns School of Medicine (UH) fostered a collaborative partnership with the University of North Carolina School of Dentistry at Chapel Hill (UNC), the University of Hawaii School of Nursing and Dental Hygiene (SONDH) and Clinical Research Center (CRC), the Waimanalo Health Center (WHC), and the Dental Division of the Hawaii State Department of Health (DOH). Through an R21 planning grant, we determined the feasibility of conducting a ''Molecular and Epidemiological Study of Oral Health Disparities in an Understudied Population of Adult Asian & Pacific Islanders.'' Together we tested a model for collaborative research implementation in a community without a dental school, trained reliable oral examiners, established a community advisory board, conducted focus groups with community members, designed a community research plan, developed and tested culturally appropriate questionnaires, conducted a pilot study, and gathered preliminary data in preparation for submission of an R01-level application.

BACKGROUND

The Institute of Medicine (IOM) report released in March 2002 states that racial and ethnic minorities tend to receive lower quality of care even when insurance, health condition, income,

and age are controlled for.[2] For example, the IOM reports that minorities are less likely to receive cardiac medication, aggressive treatment for HIV, or kidney dialysis. Hawaii's unique position as a state of predominantly ethnic minorities that provides universal health care to its citizens creates opportunities to explore the processes of healthcare seeking, delivery, and status between and among, minority groups. Such exploration is especially needed for those who make up the API ethnic category, the fastest growing category in the nation and the most understudied. A detailed account of health disparities in APIs is needed to develop effective interventions and care.

Given the socioeconomic, racial, ethnic, and cultural diversity of its population, Hawaii provides an outstanding locale for investigations into the role of distinct variables that contribute to oral health disparities. Several factors are related to the cultural diversity and physical setting of Hawaii and create unique opportunities for innovative research. First, no single ethnic group makes up a majority; according to the 2000 US Census estimates of the state's population, Whites were the largest group (24%), followed by those reporting two or more races (21%), Japanese (17%), Native Hawaiian/part-Hawaiian (16%), Filipino (14%), and Chinese (5%).[3] Second, with the exception of Native Hawaiians, the population is composed almost entirely of migrants to the islands. Third, Hawaii is the only US state located in the semitropics. Finally, Hawaii is the most geographically isolated population of considerable size on earth. Given these factors, combined with the higher burden of disease upon the API population, Hawaii is a model environment for research relevant to diverse populations around the world.

When considering specific groupings based on ethnicity and socioeconomic status, Hawaii often falls short of national levels for optimal health. Compared to the general US population, Hawaii's population has almost 10 times as many people who report belonging to more than one racial category; less than 1/3 the proportion of Whites; only 1/7 the proportion of Black/African Americans; and almost 12 times the proportion of Asians. More than 217,000 school-aged children (grades K-12, ages 5–17) live in Hawaii, and approximately half are enrolled in Medicaid. Only 4500 children are enrolled in the state's children's health insurance program (CHIP). Among K-12 children, 29% participate in the free or reduced-cost school lunch program. These figures, compared to the US mainland, indicate that almost twice as many children in Hawaii are living below the poverty level, thereby meeting the "financial distress" qualification for Medicaid. Poverty in Hawaii is prevalent across multiple ethnic groups, facilitating investigations into the independent role of poverty in oral health disparities. Conversely, the effects of cultural behaviors and ethnicity can be identified as independent from poverty and other factors. Thoughtful investigation into these factors may generate cost-effective interventions that are both culturally sensitive and medically appropriate.

Chronic illnesses often associated with periodontal disease are documented at higher rates in Native Hawaiian, Samoan, and Filipino populations in Hawaii. APIs demonstrate high rates of diabetes, heart disease, kidney disease, and obesity. Risk factors associated with heart disease, such as diabetes, hypertension, obesity, and smoking, are especially prevalent among Native Hawaiians. Native Hawaiians die of cardiovascular disease at a rate more than twice the state overall average.[4] Native Hawaiians have a significantly higher incidence of diabetes and die as a result of diabetic complications at a rate of 117 per 100,000, compared to the average rate of 53 per 100,000 for other ethnic groups in Hawaii. The rate of type 1 diabetes in part-Hawaiian children is 2.5 times the rate in White children and 10 times the rate in Japanese children.[5] Moreover, the age-adjusted prevalence rates for type 2 diabetes in Hawaiian Polynesians are among the highest reported for any Polynesian or part-Polynesian population in the world.[6]

Evidence increasingly suggests correlations between periodontal disease and systemic illnesses such as those disparately affecting API populations.[7] Limited available data indicate that Hawaiian adults have high rates of tooth loss, extensive periodontal disease, and caries.[8] While little is known about the dental health of adults in Hawaii, studies of children in Hawaii indicate that their dental health is poor. According to the Hawaii State Department of Health, children ages five through nine in Hawaii have twice the rate of tooth decay compared to children on the mainland. The rate of early childhood caries is four times the national average, despite the fact that Hawaii has a large, single-payer health insurance program and the highest dental utilization rate in the country.[8] The highest tooth decay rates occur among Native Hawaiian, other Pacific Islander, and Filipino children.

UH investigators recognized the need for developing innovative strategies for conducting further studies intended to document and ultimately improve oral health in Hawaii. Hawaii has no dental school, which restricts the University's capacity to obtain extramural funding for effective research programs and contributes to a lack of expertise among faculty in the field of oral health. Hawaii's civilian community does not benefit from fluoridated drinking water, although fluoridation has been shown to prevent dental caries.[9] As a result, Honolulu, where approximately two thirds of Hawaii residents live, is soon to be the third largest unfluoridated city in the nation

(following San Jose, California and Portland, Oregon). Historically, the most successful public health efforts to improve oral health, such as community water fluoridation and sealant application in schools, have been effective largely because the intervention does not depend on individual behavior related to oral hygiene. Thus, the lack of a dental school, lack of research expertise, and lack of fluoridation for most of Hawaii's communities are challenges to improving oral health in the state. To address some of these challenges, UH investigators created a collaborative research network.[10] The network's members formed a community-based partnership to conduct a feasibility study in Waimanalo, a rural community on the island of Oahu.

Waimanalo is divided into Hawaiian Homestead, where residents must have at least 50% Native Hawaiian ancestry; beach lots; farm lots; and Waimanalo town, where public housing and businesses are located. Community leaders in this politically active town have been engaged in an ongoing effort to secure affordable housing, a stable economy, and culturally appropriate healthcare for its members. Many community members speak Hawaiian, and some paddle outrigger canoes and grow traditional foods. Many support the Hawaiian sovereignty movement and advocate for an independent Hawaiian nation. Waimanalo is composed of several racial categories according to the 2000 US Census: people of two or more races or other race make up 37.6%; Native Hawaiian and other Pacific Islanders, 24.7%; Asians, 26.8%; and Whites, 10.8%. Approximately 14% of Waimanalo residents fall below the poverty level compared to the state average of 9.9%. Only 60% percent are high school graduates, versus the state average of 73.8%. The Waimanalo Health Center (WHC) provides the only medical care in the community, and the nearest hospital is in Kailua, five miles away. Waimanalo has been federally designated as a medically under-served population. Little is known about the oral health status of APIs in Hawaii, and Waimanalo's diverse community offers a research setting conducive to exploring some of the complex variables that may contribute to periodontal disease.

METHODS AND RESULTS

The primary objective, ''to use a collaboration model to establish a mentoring relationship with a research intensive school of dentistry in order to develop competence in dental research, to conduct pilot studies, and to write an R01 application, with the overall goal of reducing oral health disparities in Hawaii,'' was addressed via a succession of studies funded by various agencies. Therefore, study methods and results are presented as each study is described.

A Planning Grant for a Molecular and Epidemiological Study of Oral Health Disparities in an Understudied Population of Adult Asian & Pacific Islanders

As a result of strategic initiatives to encourage and to support biomedical research that were developed under the leadership of former Dean Edwin C. Cadman, UH obtained a planning grant (R21DE015020, Easa PI, Harrigan co-PI) to establish a collaborative research network in preparation for a comprehensive prevalence R01 study of oral health and disease in adult APIs. The long-term goal is to use results to design and implement interventions to reduce oral health disparities found among racial and ethnic subgroups. The specific aims for the R21 application included training, network development, and pilot study development.

Dr. Harrigan, co-PI for the planning grant and proposed PI for the submitted R01 application, carried out a pilot study to determine the feasibility of conducting a larger study by using principles of community-based participatory research. She has worked weekends as a nurse practitioner at WHC on a volunteer basis for the past nine years and has earned the trust of community members. Dr. Harrigan's work involved establishing a relationship with community groups, organizing a community advisory board, and engaging several local client groups in the planning process. Members of the UNC team visited WHC, enabling open exchange between investigators and the community and allowing for discussion of perceptions and expectations. Research participants expressed that any research proposed should have practical application beyond the local level and that adequate compensation must be made available to the community to encourage participation. The community suggested that investigators provide compensation in two forms: first, monetary incentives for those who undergo examinations, donate blood samples, and complete questionnaires and second, communitywide dental care, including emergency care, infection control, and pain relief at minimal cost based on ability to pay. These two forms of compensation would reward both individual study participants and the broader community. Consequently, the community advisory board developed this strategy, and the community endorsed it as representative of fair and equitable compensation. The National Institutes of Health (NIH), however, has mandated that clinical services cannot be provided with funds allocated for research. Although the community accepted this position, it urged that the NIH reconsider its policy in order to demonstrate a meaningful commitment to supporting community-based research.

To supplement the limited amount of data collected during the examinations funded by the planning grant, additional data were collected with

complementary funding from the Hawaii State Biomedical Research Infrastructure Network. Results from the pilot study are described as follows.

Hawaii State Biomedical Research Infrastructure Network Grant

The Research Centers in Minority Institutions supported a pilot study (P20RR16467, Le Saux PI, Easa and Harrigan co-PIs) to gather additional feasibility data to include in an R01 application. Twenty-five participants were recruited through personal contact at the Waimanalo Health Center. Data was collected from November 2003 to February 2004. We learned the following lessons from this pilot project:

- Practically everyone (N=24) who was eligible (within the age range and competent in English) and asked to participate completed the questionnaires. No one refused to participate because blood samples were being banked for future use. Such active participation is a positive indicator for recruitment expectations for the anticipated R01 study.
- Everyone scheduled for the dental examination immediately after completing the questionnaire underwent the examination, but nearly everyone who rescheduled for the dental examination at a later date did not return. This unexpected finding has affected our plans for the R01 so that we are now planning to conduct all clinical examinations at participants' homes immediately upon completion of the questionnaire.
- We had expected that participants would object to periodontal probing, but no such objections were raised.
- The portable dental chairs were inappropriate for ≈70% of the participants because their weight was in the 300-pound range. Regular medical examination tables with pillows were used as a reasonable substitute. If the R01 is funded, clinical examinations will take place in participants' homes on beds, living room chairs, or reclining chairs.
- Completion of questionnaires took ≈35 minutes, dental examinations and collection of intraoral samples took ≈55 minutes, and blood draws took ≈20 minutes. Excluding recruitment time, overall time spent with each participant was approximately two hours.
- A recruiter or administrator from within the community will be more capable of establishing trust and thus more effective than one from outside the community.
- The calibration experience produced reliable examiners.
- The questionnaire composed of reliable, valid instruments adapted from the UNC tool proved feasible for administration in this population. Minor revisions were made after the pilot administration, such as adjusting the level of English for better comprehension and ensuring culturally appropriate responses.

Table 1 presents highlights from questionnaires completed and dental examinations conducted.

Table 2 presents highlights from dental examination of 13 participants in the pilot study at Waimanalo Health Center.

These pilot data can be compared to those from NHANES III, a national survey in which a sample representative of the US civilian, noninstitutionalized population was clinically examined during the years 1988–1994. For purposes of comparison, we asked John Elter, a UNC oral epidemiologist, to analyze the periodontal status among participants age 20–52 years by using the publicly available NHANES III dataset (N=8176). Without making statistical comparisons, the two samples are contrasted below:

- Mean number of teeth: NHANES III = 26.1 (out of 28 teeth); pilot study = 25.3 (out of 32 teeth)
- Mean extent of pocket depth ≥4 mm: NHANES III = 2.2%; pilot study = 7.3%
- Mean extent of attachment loss ≥3 mm: NHANES III = 5.2%; pilot study = 12.7%
- Mean extent of bleeding sites: NHANES III = 8.2%; pilot study = 22.6%

As for decayed teeth, in NHANES III for individuals age 18–45 years, the mean number of decayed coronal surfaces (DS) was 1.8,[11] compared to the mean DS of 5.4 in the Waimanalo sample. These preliminary comparisons show that if the pilot study sample adequately represents the Waimanalo population, the community's oral health status is quite poor.

Finally, as expected, study data showed that the periodontal health of smokers (n=5) was worse than that of nonsmokers (n=8), consistent with the notion that smoking is related to periodontal disease. Table 3 illustrates this potential correlation.

The above preliminary data from our small pilot study confirm that further research is needed to illuminate the extent of periodontal disease in APIs in Waimanalo and throughout the state. Two additional investigations, the Hawaii Diabetes and Preterm Delivery study and the Oral Conditions and Pregnancy study from North Carolina, have revealed data that suggest links between oral disease and diabetes.

Hawaii Diabetes and Preterm Delivery Study (HDPD)

Though definitive studies of oral disease have not been conducted among adults in Hawaii, the investigators hypothesized that traditional risk factors for periodontal disease, such as diabetes, might emerge in the Waimanalo community. Findings from the HDPD study, a pilot study funded by the NIDCR (R21 DE 014984, Offenba-

Table 1. Highlights from questionnaires (*N*=25)

Sociodemographic Information	
Age:	Range 20–52 years, median 30 years
Race:	71% Native Hawaiian, 12% White Non-Hispanic, 12% Hispanic, 4% Other Pacific Islander
Sex:	80% female, 20% male
Education:	72% ≤12 y, 28% ≥13 y
Family Income:	92% <$30 K/y, 4% ≥$30 K/y, 4% unknown
Dental insurance:	36% private, 24% Medicaid, 32% none, 8% unknown
Primary language:	92% English
Number in household:	33% 1–4, 54% 5–7, 12% ≥8
Zip code:	80% 96795 (Waimanalo community), 20% other
Information on Oral Behavior	
Own a toothbrush:	100%
Use toothpaste:	100%
Brush teeth:	0% never, 0% irregularly, 12% 2–3 x/wk, 40% 1 x/day, 48% ≥2 x/day
Use floss:	48% never, 9% irregularly, 16% 2–3 x/wk, 16% 1 x/day, 8% ≥2 x/day
Drink regular soda:	36% never, 24% 1–3 x/wk, 24% 4–6 x/week, 16% ≥2 x/day
Drink diet soda:	76% never, 12% 1–3 x/wk, 12% 4–6 x/week, 0% ≥2 x/day
Have regular dentist:	40%
Frequency of dental cleanings:	8% never, 52% irregularly, 36% once/y, 4% twice/y
Primary reason to go to dentist:	16% regular care, 52% if discomfort, 16% if something needs to be fixed, 12% never go, 4% other
Primary reason for avoiding dentist:	52% cost, 20% go as needed, 12% no dental needs, 8% fear, 4% can't find dentist, 4% don't have time
Other Oral Health-Related Information	
Water supply:	76% public/city/community, 24% bottled
Mother has most of her natural teeth:	44% yes, 40% no, 16% unknown
Father has most of his natural teeth:	60% yes, 24% no, 16% unknown
Participant has lost natural teeth because of:	44% cavities, 20% gum disease, 16% accident, 8% overcrowding, 12% unknown
Gum pain in the last 3 months:	16% a great deal, 24% somewhat, 24% a little, 36% not at all
Gums bleed when brushing:	28% never, 20% rarely, 28% sometimes, 12% almost all the time, 12% always
General Health Information	
Rating of overall health:	8% excellent, 8% very good, 60% good, 12% fair, 12% poor
Current smokers:	50%
Live/work around smokers:	68%
History of disease or condition:	16% diabetes, 8% heart disease, 12% high blood pressure, 16% asthma, 16% arthritis
Use traditional herbal medicines:	28%

cher PI, Millar co-PI) support this hypothesis. The purpose of the case-control study was to begin assessing the role of diabetes and periodontal disease in preterm deliveries. The Kapiolani Medical Center for Women and Children (KMC) in Honolulu, the hospital in which more babies are born than any other in Hawaii, was the study site. All women who gave birth within the previous 48 hours were invited to participate, and enrollment was designed to provide cases (preterm delivery) and controls (term delivery) stratified by diabetic status. Before hospital discharge, participants were given full-mouth periodontal examinations. As of 1/10/05, analysis had been conducted for 244 participants (Table 4).

Table 2. Highlights from dental examinations (*N*=13)

Characteristic	Mean	SD	Min	Max
Number of teeth	25.3	6.5	8	32
Extent of pocket depth ≥4 mm	7.3	10.2	0	29.0
Extent of attachment loss ≥3 mm	12.7	20.9	0	71.0
Extent of bleeding sites	22.6	21.8	1.2	85.7
Number of crowns	0.5	0.8	0	2
Number of decayed coronal surfaces	5.4	9.5	0	31
Number of filled coronal surfaces	32.7	28.1	2	108
Number of decayed root surfaces	3.7	9.0	0	33
Number of filled root surfaces	0	0	0	0

We anticipate that members of Hawaii's communities experience greater levels of oral disease than comparable groups on the US mainland but that traditional risk indicators of oral disease apply across racial and ethnic populations in Hawaii. Several results from HDPD are consistent with this hypothesis. Data indicated that diabetes, edu-

Table 3. Periodontal findings in smokers and nonsmokers (*N*=13)

Characteristic	Smoker	Mean	SD	Min	Max
Number of teeth	Yes	20.0	8.6	8	31
	No	28.4	2.4	26	32
Extent of pocket depth ≥4 mm	Yes	13.7	14.0	0	29.0
	No	2.3	3.3	0	10.1
Extent of attachment loss ≥3 mm	Yes	23.6	29.6	0	71.0
	No	2.7	4.5	0	12.9
Extent of bleeding sites	Yes	17.3	13.0	6.8	38.4
	No	23.5	26.6	1.2	85.7

cation, income, and smoking status were related to periodontal disease. Specific findings are as follows:

- Periodontal status was significantly different ($P<.05$) among the four groups, as 10%, 36%, 27%, and 57% of participants in groups 1–4, respectively, had moderate-to-severe oral disease. Other periodontal indicators such as bleeding on probing, extent of attachment loss ≥3 mm, and extent of pocket depths ≥4 mm also were significantly different among groups, and group 4, diabetic preterm mothers, had the worst periodontal health for all variables.
- On a bivariate basis, women with moderate-to-severe periodontal disease tended to have less education and lower income than those with better periodontal health and were less likely to be employed or married and more likely to be smokers.
- Multivariable logistic regression models controlling for confounders showed that compared to group 1 mothers, group 4 mothers had 11.3 times the odds of having moderate-to-severe periodontal disease (95% confidence interval 4.0–31.5), while the corresponding figures for group 2 and group 3 mothers were 6.3 (2.6–15.1) and 2.8 (1.1–6.8), respectively.

Data on ethnicity of mothers in the ongoing study are incomplete. However, because of the diversity of babies born at Kapiolani, we assume that mothers were of diverse ethnic backgrounds.

In part, data from the above HDPD study can be compared with those from Oral Conditions and Pregnancy (OCAP), a longitudinal study in North Carolina. In the OCAP study, new mothers, regardless of diabetic or preterm delivery status, were given periodontal examinations within 48 hours after delivery. Because diabetes was an exclusion criterion for mothers in OCAP, direct comparison with HDPD data would not be meaningful. Nevertheless, using identical case definitions for healthy, mild, or moderate-to-severe periodontal disease and considering only the nondiabetic term mothers, mothers from the Hawaii study demonstrated much worse periodontal health than mothers from the North Carolina cohort, despite that HDPD mothers were slightly younger. Table 5 illustrates the disparity between periodontal health of mothers from the OCAP and HDPD studies held in North Carolina and Hawaii, respectively:

In light of the above general comparison, the likelihood of direct links between diabetes and periodontal disease in the Hawaii cohort suggests that further investigation is required, particularly in APIs, who experience high rates of diabetes and other systemic illnesses potentially related to oral disease.

Table 4. Diabetic status and preterm delivery (*N*=244)

Diabetic Status	Delivery Status	Group Number	Intended Ratio of Participants	Number Analyzed as of 1/10/05
No	Term	1	4	107
Yes	Term	2	2	58
No	Preterm	3	2	52
Yes	Preterm	4	1	27

DISCUSSION

During our focused network development activities, community leaders and advisory board members specifically identified oral health as a high priority for addressing community healthcare needs. Quantitative oral health data are needed to design and implement effective interventions. However, many Native Hawaiian and other Pacific Islander communities are reluctant to participate in research because of concerns regarding government-sponsored research and the motives of researchers. In the past, research has been conducted without community consultation, without community engagement in study design and implementation, and without direct benefit to the community through improved healthcare programs. Consequently, many community members distrust researchers, and open communication has been fostered to alleviate concerns about ethical breaches and documented social harms to research participants in Hawaii.

We have learned that periodontal diseases and dental caries occur as a joint concordance of environmental biofilm exposure and genetic immunodeficiencies associated with the immune response to microbial organisms. We plan to identify these immunodeficiencies in future studies by first establishing inflammatory phenotypes that are associ-

Table 5. Comparison of mothers' periodontal health in North Carolina ($n=725$) and Hawaii ($n=107$)

Characteristic	North Carolina (OCAP)	Hawaii (HDPD)
Number	725	107
Mean age (SD)	28.5 (6.7)	27.6 (6.0)
Healthy (%)	52.7	9.4
Mild periodontal disease (%)	35.7	80.3
Moderate-to-severe periodontal disease (%)	11.6	10.3

ated with oral diseases. Our new, unpublished analyses from other population studies suggest that in patients with severe periodontal disease, several subgroups of inflammatory phenotypes are evident; some have abnormal IgG levels, others have high levels of serum C-reactive protein or interleukin-6, while still others have high levels of markers of oxidative stress. These inflammatory markers are more strongly associated with periodontal disease severity than plaque scores or levels of organisms. What is termed "periodontal disease" appears to be a heterogeneous condition of various inflammatory malfunctions in terms of microbial abatement, each with differing genetic determinants but similar clinical presentations. Understanding these phenotypes will enable us to identify potential genotypes for diagnosis, prevention, and therapy.

To complete the planning phase, the partners in our collaborative research network have submitted an R01 application that proposes longitudinal study to estimate the prevalence and incidence of periodontal disease and dental caries in the Waimanalo community. If funded, this study will help the network design effective prevention and treatment programs that will directly benefit the community of Waimanalo and the broader community of APIs throughout Hawaii and the nation.

Despite advances in modern epidemiology, progress has been slow in explaining the cause of disparate outcomes and generating findings that can be directly translated into beneficial programs and policies designed to improve health care.[12] Creating community partnerships and engaging participation of community representatives is vital to making progress in this area. Community-based participatory research requires an established relationship with community groups who are interested in the study results and a desire by the community to use the results in a practical manner to achieve change. Our oral health research network builds upon longstanding relationships within the community and is based on trust and open communication between community representatives and investigators. If an R01 is funded, we are committed to fostering these relationships and adhering to these participatory research principles.

CONCLUSIONS

In spite of obstacles to designing effective research and intervention programs in Hawaii, UH has fostered a collaborative relationship with a premiere dental research institution to develop competence in clinical research, conduct pilot studies, and obtain extramural funding for comprehensive studies. By establishing a community-based oral health research network specifically tailored to addressing disparities between and among APIs in Hawaii and by drawing upon the unique strengths of each of its members, we have trained oral examiners, organized a community advisory board, held community focus groups, formulated a community research plan, conducted examinations and a pilot study, and designed and tested culturally appropriate questionnaires. The network partners have accomplished their primary goal of developing culturally appropriate methods for assessing determinants of oral health, oral health-related quality of life, and health outcomes in APIs. A more comprehensive R01-level study will enable us to identify the nature and extent of oral health disparities in Hawaii. Using a community-based participatory research model, we anticipate that our data will elucidate effective means of reducing such disparities in Hawaii's diverse communities.

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