Addressing Oral Health Disparities in Settings Without a Research-Intensive Dental School: Collaborative Strategies

David Easa, MD; Rosanne Harrigan, EdD; Zoè Hammatt, Esq; Mark Greer, DMD; Carolyn Kuba, MS; James Davis, PhD; James D. Beck, PhD; Steven Offenbacher, DDS, PhD

Research suggests that oral health is linked to systemic health, and those with poor oral health are potentially at greater risk for important diseases, including 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 cavities than other groups. Hence, conducting further study is vital in adults, particularly APIs, to assess oral health and its correlation to overall health outcomes. Given the lack of a dental school and the lack of fluoridated water in the state, the University of Hawaii's John A. Burns School of Medicine (JABSOM) has identified the need to assume a leadership role in creating effective community-based oral health research and treatment programs. With the support of the National Institute of Dental and Craniofacial Research, JABSOM fostered a collaborative relationship with the University of North Carolina at Chapel Hill School of Dentistry, a premiere research-intensive dental school, the Waimanalo Health Center, and the Hawaii State Department of Health. This partnership has worked together to implement a community-based approach to performing research designed to illuminate disparities and develop innovative strategies to promote oral health in Hawaii's diverse populations. We hope that this collaborative, culturally competent approach may serve as a model for use in other settings without a research-intensive dental school. (*Ethn Dis*. 2005;15:187–190)

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From the University of Hawaii, Manoa, Hawaii (DE, RH, ZH, MG, CK, JD); University of North Carolina, Chapel Hill, North Carolina (JB, SO).

Address correspondence and reprint requests to: David Easa, MD; University of Hawaii; Clinical Research Center; 677 Ala Moana Blvd; Suite 1015; Honolulu, HI 96813; 808-587-8576; 808-587-8540 (fax); davide@kapiolani.org

Introduction

We describe: 1) links between oral disease and general health; 2) health disparities among Asians and Pacific Islanders (APIs); and 3) oral health studies in children and young adults in Hawaii. After noting some of the challenges to improving oral health outcomes in Hawaii, we will illustrate the use of a collaborative approach to mentoring investigators and engaging community participation in the enhancement of research capacity. Collaborative interactions between the John A. Burns School of Medicine (JABSOM), University of North Carolina at Chapel Hill School of Dentistry (UNC), the Waimanalo Health Center (WHC), and the Hawaii State Department of Health included the following activities: bi-monthly teleconferences; on-site planning, mentoring, and training sessions; calibration of research dental hygienists; annual conferences in Hawaii presented by UNC faculty; and, importantly, community involvement in determining research priorities through focus group participation. With this collaborative network, as described below, the state of Hawaii is beginning to address this fundamental area of disparities research.

Links Between Oral Disease and General Health

Recent studies suggest that periodontal disease correlates with important systemic illnesses, including infective endocarditis, cardiovascular disease, stroke, diabetes mellitus, respiratory disease, and adverse pregnancy outcomes.[1] In fact, Beck and Offenbacher, the UNC collaborators, coined the term "periodontal medicine" to emphasize that periodontal disease represents a potentially modifiable risk factor for diverse clinical conditions.[2] For example, they have identified a clear relationship between periodontal disease and low birth weight (LBW).[3] Periodontal bacteria or their products may induce inflammation of maternal membranes, which may lead to premature rupture and preterm labor in some women.[4] Other recent experimental studies indicate that treating periodontal disease may reduce the incidence of preterm and LBW deliveries.[5–7]

Preliminary data from a JABSOM study of women with periodontal disease indicate that diabetic women tend to be more likely to give birth to LBW infants. Asians and Pacific Islanders (APIs), particularly Native Hawaiians, have been shown to have high rates of diabetes, thereby necessitating further study of potential correlations between diabetes and oral disease. Some studies have also associated periodontal disease with a moderate increased risk of cardiovascular disease.[3,8] Given high rates of preterm delivery, diabetes, and cardiovascular disease in APIs in Hawaii, expansion of these preliminary studies and development of long-term interventions would directly contribute to reducing health disparities among Hawaii's diverse populations.

General Health Disparities Among Asians and Pacific Islanders

According to 2000 Hawaii State Department of Health estimates of the state's population, Whites make up the largest group (22%), followed by Hawaiian/part Hawaiian (19%), Japanese (19%), Mixed, except part-Hawaiian

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(15%), Filipino (13%), Chinese (4%), and other (3%). The ethnic diversity of Hawaii's population lends itself to unique opportunities for disparities research. This diversity is especially relevant when considering specific groupings based on ethnicity and socioeconomic status. Hawaii often falls short of national levels for optimal health. Chronic illnesses often associated with periodontal disease occur at higher rates in Native Hawaiian, Samoan, and Filipino populations. 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.

Asians and Pacific Islanders (APIs) demonstrate a high rate of diabetes, which up-regulates inflammatory hyperresponsiveness, heart disease, kidney disease, and obesity. In particular, Native Hawaiians have a significantly higher incidence of diabetes and die as a result of related 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.[9] 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. 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.[10] In light of clear evidence that APIs experience disparities in general health, JABSOM has become increasingly aware of the need to identify the potential correlations between such disparities and oral health. This need is amplified by the fact that studies have shown that children in Hawaii have poor oral health when compared to the nation as a whole.

Oral Health Studies in Children and Young Adults in Hawaii

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 caries in API children is twice the national average and four times the rate in early childhood. The worst tooth decay rates occur among Native Hawaiian, Pacific Islander, and Filipino children.

Studies conducted in Hawaii since the 1960s, primarily focusing upon children and young adults, document a persisting pattern of poor oral health. Results from the first comprehensive study in children showed a statewide problem; by age 16 only one child in 100 had permanent teeth with no caries.[11] The average 16-year-old had 13.36 caries. In age-adjusted comparisons, Whites had the lowest rates of decayed, missing, or filled permanent teeth (decayed, missing, filled [DMF] rates), followed by Chinese, Hawaiians, Filipinos, part Hawaiians, and Japanese. Alarming disparities emerged; the age-adjusted DMF rates in children of Japanese ancestry were 63% higher than Whites, and 37% higher than Whites in part-Hawaiian children.

Two studies in the 1970s confirmed high rates of DMF teeth among students in Hawaii schools. Disparities continued to emerge to a varying degree; Native Hawaiian children had the highest DMF rates, and White children had the lowest. In addition, Native Hawaiian children reported the highest consumption of starchy foods, sweet beverages, desserts, snacks, candy and gum, all of which contribute to poor dental health.[12,13] More recently, the Dental Health Division of the Department of Health conducted dental health surveys among 5- to 9-year-olds in 1989 and 1999.[14] On both occasions, the numbers of decayed or filled primary teeth in Hawaii's children represented more than double the rates of the US mainland. White children experienced the lowest rates, followed by Japanese, Chinese, Native Hawaiians, and Filipinos.

Limited data related to adults in Hawaii stem from a pair of studies of 939 adults that examined the presence and degree of periodontal disease as assessed by gingivitis, the average pocket depth, and the deepest pocket size.[15,16] Males, participants with fewer years of education, and smokers had poorer periodontal health. Adults of European and Japanese descent demonstrated significantly better periodontal health than Native Hawaiians, part Hawaiians, Samoans, and Filipinos.

Challenges to Improving Oral Health Outcomes in Hawaii

In light of the above studies, leaders at JABSOM recognized the need for developing innovative strategies for conducting further, more comprehensive research intended to improve oral health in Hawaii. Hawaii has no dental school, which hinders the university's capacity to compete for extramural funding and design effective research and treatment programs. Given the lack of research expertise among clinical faculty at the university and within the broader community, combined with the geographic distance from research-intensive universities on the mainland, minimal progress in this important area has been made.

To compound the problem, in spite of the fact that the Centers for Disease Control has emphasized that "community water fluoridation effectively prevents dental caries" and that "children

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in communities with water fluoridation experience 29% fewer cavities,'' the State of Hawaii does not offer fluoridated drinking water.[17] The only fluoridated water systems in Hawaii are found on military bases, which benefit only 9% of the state's overall population.[18] As a result, Honolulu, where about 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). One of the primary objectives of *Healthy People 2010* is to increase the proportion of US populations served by community water systems with optimally fluoridated water. While legislators in Hawaii consider the importance of this public health measure, JABSOM has taken a lead in forging ahead with alternative means of addressing the relatively poor oral health of Hawaii's diverse communities.

The Collaborative Model

The Surgeon General's 2003 Report, *A National Call to Action to Promote Oral Health,* invites special efforts to reduce health disparities affecting "members of certain racial and ethnic groups and people who are poor, geographically isolated, or vulnerable because of special oral health care needs."[19] Our effort is entirely consistent with the Surgeon General's emphasis on programs that are science-based, culturally sensitive, and routinely evaluated. The *Call to Action* specifies the need for implementing innovative mechanisms that allow for translation of state-of-the-art scientific techniques to community-based efforts to prevent disease and promote oral health. Our collaborative network draws upon the expertise and experience of investigators from a premiere dental research institution and involves the active participation of community members. This combination has been instrumental in increasing our capacity to conduct high-quality, community-based dental research.

With the support of an R21 grant from the National Institute of Dental and Craniofacial Research (NIDCR), leaders at JABSOM have established a collaborative research network in partnership with UNC School of Dentistry, which is renowned for its pioneering role in oral health research. Hawaii-based collaborators include the following: University of Hawaii's School of Nursing and Dental Hygiene (SONDH), JABSOM, and Clinical Research Center; the WHC; and the Dental Health Division of the Hawaii State Department of Health. The primary goal of the R21 was to determine the feasibility of applying state-of-the-art molecular and epidemiologic approaches to examining oral health disparities in adult API populations and to eventually submit an R01 application to conduct a comprehensive study.

The specific aims for the R21 application included training, network development, and pilot study development. We accomplished these aims through training, network development, and pilot study development.

Training

The University of North Carolina (UNC) provided mentorship and consultation through seminars, development of educational materials, and conferences, such as the "Short Course Addressing Oral Health Disparities: Development of Research Competence." The University of North Carolina (UNC) provided training to JABSOM investigators through visits between UNC and University of Hawaii as well as via regular teleconferences. Local dentists and dental hygienists were trained in the clinical examination and biological sample collection and achieved excellent-to-outstanding reliability scores when compared to a standard examiner and each other.

Network Development

Through teleconferencing, training sessions, and community-based focus groups, we established a network to enhance capacity to conduct culturally appropriate oral health research in Hawaii. The network is designed to identify community research questions, secure funding to find solutions, and provide vital education and training in all phases of study design and implementation. Importantly, the WHC has become an integral part of the network, participating in all stages of research design and implementation. Co-Principal Investigator Rosanne Harrigan trained focus group facilitators (primarily Native Hawaiian women) on the islands of Maui (N=6) and Oahu (N=15), significantly increasing community participation in the research network and fostering community members' trust in the research process.

Pilot Study Development

By defining and refining study variables, developing questionnaires, training dental examiners, and conducting examinations to familiarize the study team with the protocol, we pilot-tested the tools to generate preliminary data. To support the pilot study phase, complementary funding was successfully secured from the Hawaii State Biomedical Research Infrastructure Network (BRIN). Twenty-five subjects were successfully interviewed, given oral examinations, and had serum and oral plaque samples taken per protocol as a demonstration of capability. Data were analyzed and used to provide preliminary data in an R01 application.

Through this initial R21, we have created a collegial network that is engaged in advancing the progress of oral health research in Hawaii. By establishing a solid foundation based on com-

munity involvement, state-of-the-art techniques, and stellar expertise on behalf of the UNC mentors, we have significantly increased the capacity to obtain R01 funding.

The proposed R01-level research will be multidisciplinary and comprehensive. It will include community, clinical, and molecular approaches. One phase will collect demographic, social, behavioral, and traditional clinical indices for measuring dental caries and periodontal disease (plaque scores, DMF scores, probing depth, cementoenamal junction measures, bleeding on probing, and gingival scores) in order to better describe the oral disease burden existing in API adults. Other phases will use molecular probes to characterize organisms in oral biofilm, quantify inflammatory profiles, and identify genetic markers. We will then explore infectious burden, host response, inflammatory capacity, and genetic markers as they correlate to various medical conditions.

If funded, additional grant applications will lead to innovative scientific approaches to examining gene-environment interactions in populations that not only exhibit dental disease but also manifest other systemic diseases that are currently associated with oral infections, including cardiovascular disease, kidney disease, diabetes, and preterm delivery. The primary goal of this research will be to expand on the community-based research partnership in developing culturally appropriate prevention and treatment strategies.

CONCLUSION

General health disparities occur among Hawaii's diverse ethnic groups, and links continue to emerge between general health and oral health. Researchers in Hawaii face tremendous challenges in their efforts to design effective research and intervention programs. To overcome these obstacles, JABSOM has fostered a mentoring relationship with a research-intensive dental school in order to develop competence in dental research, conduct community-based pilot studies, and prepare competitive R01 applications.

Our collaborative model embodies the themes of Dr. Elias Zerhouni's *NIH Roadmap* by advancing understanding of the biological complexities of oral disease, using interdisciplinary teams, and translating discoveries into treatments through unique partnerships in community-based participatory research. We hope that this model serves as an exemplary approach to expanding oral health research capacity in other settings without a dental school.

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AUTHOR CONTRIBUTIONS

Design and concept of study: Easa, Harrigan, Hammatt, Davis, Offenbacher
Acquisition of data: Easa, Harrigan, Hammatt, Greer, Kuba
Data analysis and interpretation: Harrigan, Hammatt, Greer, Beck, Offenbacher
Manuscript draft: Easa, Harrigan, Hammatt, Kuba, Davis, Beck
Statistical expertise: Harrigan, Davis, Offenbacher
Acquisition of funding: Easa, Harrigan, Hammatt, Beck, Offenbacher
Administrative, technical, or material assistance: Easa, Harrigan, Greer