



## Epidemiology of areca (betel) nut use in the mariana islands: Findings from the University of Guam/University of Hawai'i cancer center partnership program



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### ABSTRACT

**Background:** Areca (betel) nut is considered a Group 1 human carcinogen shown to be associated with other chronic diseases in addition to cancer. This paper describes the areca (betel) nut chewing trend in Guam, and health behaviors of chewers in Guam and Saipan.

**Methods:** The areca (betel) nut module in the Guam Behavioral Risk Factor Surveillance Survey was used to calculate the 5-year (2011–2015) chewing trend. To assess the association between areca (betel) nut chewing and health risks in the Mariana Islands, a cross-section of 300 chewers,  $\geq 18$  years old, were recruited from households in Guam and Saipan. Self-reported socio-demographics, oral health behaviors, chronic disease status, diet, and physical activity were collected. Anthropometry was measured. Only areca (betel) nut-specific and demographic information were collected from youth chewers in the household.

**Results:** The 5-year areca (betel) nut chewing prevalence in Guam was 11% and increased among Non-Chamorros, primarily other Micronesians, from 2011 (7%) to 2015 (13%). In the household survey, most adult chewers (46%) preferred areca nut with betel leaf, slaked lime, and tobacco. Most youth chewers (48%) preferred areca nut only. Common adult chronic conditions included diabetes (14%), hypertension (26%), and obesity (58%).

**Conclusion:** The 5-year areca (betel) nut chewing prevalence in Guam is comparable to the world estimate (10–20%), though rising among Non-Chamorros. Adult and youth chewers may be at an increased risk for oral cancer. Adult chewers have an increased risk of other chronic health conditions. Cancer prevention and intervention strategies should incorporate all aspects of health.

### 1. Background

The University of Guam (UOG) and the University of Hawai'i Cancer Center (UHCC) partnership has been supported by funding from the United States (US) National Cancer Institute (NCI) since 2004 to develop cancer research capacity at the UOG and to expand the Pacific Islander cancer health disparities research at the UHCC [1]. Initial work through the partnership resulted in the estimation and dissemination of

oral cancer rates in Guam. For example, Haddock [2] reported disparity in mouth cancer incidence rates across racial and ethnic groups. The mouth cancer incidence rates for the period 1997–2003, age-adjusted to the US 2000 standard population per 100,000 people, were (in descending order): 17.9 in Micronesians, 8.1 in Chamorros, 5.4 in Whites, 3.5 in Asians, and 2.2 in Filipinos [2]. In a follow-up paper by Haddock and colleagues, the mortality rates for the period 1998–2002 for cancer of the mouth and pharynx (excluding nasopharynx) per 100,000 people

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was highest in Chamorros (6.4) and Micronesians (6.3), followed by Caucasians (2.6) [3]. These disparities in oral cancer rates were confirmed in the first Guam Cancer Facts and Figures supported by the UOG/UHCC partnership and published in 2009 [4]. Since the oral cancer incidence and mortality rates were highest among Chamorros and Micronesians in Guam, it was proposed that areca (betel) nut chewing, a behavior practiced by both groups, may partly explain the racial and ethnic disparities in oral cancer [2,3].

The areca (betel) nut, a food item classified as a Group 1 human carcinogen [5], is chewed by approximately 600 million people worldwide [6]. Once limited to an endemic practice in the peoples of Yap, Palau and the Marianas (Guam and the Commonwealth of the Northern Mariana Islands (CNMI)) in Micronesia, areca (betel) nut chewing has become ubiquitous throughout the Micronesian region as other islands adopted the practice. Chewing patterns have been found to vary among Micronesian populations, from as simple as chewing the areca nut alone among the Chamorros in Guam to chewing combinations of the areca fruit with *Piper* (betel) leaf, slaked lime, tobacco and spiked with alcohol among other Micronesians in Guam [7].

The estimation of exposure to areca (betel) nut chewing in Micronesia has been limited in the past and largely excluded from the world estimate. Furthermore, the habit has been found to be associated with all-cause mortality [8] and with non-cancer non-communicable diseases, such as cardiovascular disease, diabetes, obesity, and hypertension [8,9]. The health risks of areca (betel) nut chewing are of particular interest, because non-communicable diseases contribute to the leading causes of death in the Mariana Islands.

The UOG/UHCC partnership has supported a pilot study to examine the feasibility of screening and examination of pre-malignant, malignant, and other health risks among areca (betel) nut chewers in Guam and Saipan. The results of oral potentially malignant disorders from this study have been described elsewhere [10]. The objectives of this paper are to describe the areca (betel) nut chewing trend using national surveillance data in Guam, and to describe the health behaviors of areca (betel) nut chewers from the pilot study in Guam and Saipan.

## 2. Methods

The UOG/UHCC partnership was established and funded by the NCI to develop research capacity at UOG; develop cancer health disparities research at UHCC focusing on Pacific Islanders; raise awareness of cancer and cancer prevention in Guam, Hawai'i and the US Associated Pacific Islands; and increase the number of cancer and biomedical researchers of Pacific Island ancestry in the US [1]. This paper presents findings from two projects, the surveillance project and the areca (betel) nut chewers' health project, supported by the partnership.

The surveillance project sought to document the areca (betel) nut chewing patterns and estimate use in Guam. The partnership worked with the Guam Department of Public Health and Social Services to re-establish areca (betel) nut use module, used in 1991, into the 2007 Guam Behavioral Risk Factor Surveillance System (BRFSS), a national health survey administered by the Centers for Disease Control and Prevention (CDC). The module was modified in 2007 to capture the maturity and variety of the areca nut, addition of other ingredients, spiking with alcohol, and the practice of ingesting or discarding the betel quid – the combination of the nut with other ingredients. The module has been active in the Guam BRFSS surveys since that time, although with modifications over the years. Recruitment into the BRFSS is through a complex sampling method described elsewhere [11]. A random sample of Guam residents are called on the telephone and asked questions on a range of health indicators. The sampling methodology changed in 2011 to capture both landline and mobile phone users. The areca (betel) nut chewing prevalence reported in this paper reflects the 5-year trend from 2011 to 2015. The BRFSS was conducted in the CNMI only in 2009, so trend data on areca (betel) nut chewing in the CNMI are unavailable.

The areca (betel) nut chewers' health project sought to perform an oral screening and health assessment among 300 areca (betel) nut chewers,  $\geq 18$  years of age, in Guam ( $n = 137$ ) and Saipan ( $n = 163$ ) from January 2011 to June 2012. Recruitment details are described elsewhere [10]. Up to three adult chewers were selected from a household and completed the full survey assessment. Selected areca (betel) nut behaviors and demographics of household members that chewed at the time of the survey, other than the 1–3 respondents, were provided by the head-of-household to assess the extent of household use, especially among the youth. Two teams, one in each island, were trained to consent participants, administer health questionnaires, and collect anthropometric measures. Approval from the Institutional Review Boards at the University of Hawai'i - Mānoa (CHS #18174) and the University of Guam (CHRS #10-73) was obtained. All the participants were informed of and consented to the study.

### 2.1. Questionnaires

A questionnaire on demographics and socioeconomic status, and self-reported medical history, which have been used in a previous local study [12], was administered to all respondents. To validate self-reported chronic conditions, permission was requested from a subset of the participants to contact their primary physician to verify their reports. Of the 49 participants in Guam with self-reported chronic conditions, 11 could not remember their primary physician, some of whom have migrated to Guam in recent years. Self-reports from the remaining 38 participants were sent to the reported primary physician or clinic for verification. The self-report of 11 participants were validated by the physician or clinic and returned to the research team. All the returned self-reported chronic conditions were confirmed. Two additional conditions (hypertension and stroke), not reported by the participant, were reported by the physician or clinic. The median percent agreement between the participants' self-reports and the physicians' confirmation was 89% for all chronic conditions.

Three other questionnaires were administered to all respondents. A validated questionnaire on areca (betel) nut use [13] was simplified to collect information on individual chewing practices. One 24-h Dietary Recall was used to collect dietary intake according to the multiple-pass approach [14]. Physical activity over the past 30 days was measured using the Physical Activity Rating Questionnaire [15]. In addition, the Head-of-Household was administered a survey on areca (betel) nut chewing practices and demographics of other household members who were not respondents.

### 2.2. Anthropometry

The teams were trained on the collection of height, weight, waist, and hip measurements. Height and weight were measured using a stadiometer (Seca, Germany) and a digital scale (ProFit Lifesource, Milpitas, CA), respectively. These measurements were used to categorize participants by Body Mass Index (BMI; calculated as  $\text{kg}/\text{m}^2$ ). A tape measure (Seca, Germany) was used to measure hip and waist circumference. A waist-to-hip ratio was used to determine risk of metabolic complications with the cut-point of  $\geq 0.90$  cm for men and  $\geq 0.85$  cm for women [16].

### 2.3. Analysis

The Guam BRFSS sampling weights were provided by the CDC. The weights were computed similarly to the US state-level weights, which account for sex, age, national race/ethnicity, education, marital status, home ownership, and phone usage [17]. The Guam BRFSS final weights were used to estimate the sex- and ethnic-specific areca (betel) nut chewing prevalences overall, and for each year from 2011 to 2015. Logistic regression was used to test trends across years, where the binary outcome of BN chewing status was regressed on BRFSS years as

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