

Cancer in Guam and Hawaii: A comparison of two U.S. Island populations



Brenda Y. Hernandez^{a,*}, Renata A. Bordallo^b, Michael D. Green^a, Robert L. Haddock^c

^a Hawaii Tumor Registry, University of Hawaii Cancer Center, University of Hawaii at Manoa, 701 Ilalo St., Honolulu, HI 96813, USA

^b Guam Cancer Registry, Cancer Research Center of Guam, University of Guam, House #7, Dean Circle, UOG Station, Mangilao, Guam 96923, USA

^c Guam Department of Public Health and Social Services, Office of Epidemiology and Research, Mangilao, Guam 96923, USA

ARTICLE INFO

Keywords:

Guam
Hawaii
Chamorro
Native Hawaiian
Cancer
Incidence
Mortality

ABSTRACT

Background: Cancer disparities within and across populations provide insight into the influence of lifestyle, environment, and genetic factors on cancer risk.

Methods: Guam cancer incidence and mortality were compared to that of Hawaii using data from their respective population-based, central cancer registries.

Results: In 2009–2013, overall cancer incidence was substantially lower in Guam than in Hawaii for both sexes while overall cancer mortality was higher for Guam males. Cervical cancer incidence and prostate cancer mortality were higher in Guam. Both incidence and mortality were higher among Guam men for cancers of the lung & bronchus, liver & intrahepatic bile duct, and nasopharynx; Chamorro men were disproportionately affected by these cancers. Filipinos and Whites in Guam had lower overall cancer incidence compared to Filipinos and Whites in Hawaii. Although breast cancer incidence was significantly lower in Guam compared to Hawaii, women in Guam presented at younger ages and with rarer disease histologies such as inflammatory carcinoma were more prevalent. Guam patients were also diagnosed at younger ages for cancers of bladder, pancreas, colon & rectum, liver & intrahepatic bile duct, lung & bronchus, stomach, non-Hodgkin lymphoma, and leukemia. **Conclusion:** Smoking, infectious agents, and betel nut chewing appear to be important contributors to the burden of cancer in Guam. Earlier onset of cancer in Guam suggests earlier age of exposure to key risk factors and/or a more aggressive pathogenesis. Contrasting cancer patterns within Guam and between Guam and Hawaii underscore the potential influence of genes, lifestyle, and environmental factors on cancer development and progression.

1. Introduction

The burden of cancer varies globally by geographic regions, locations and across racial and ethnic populations. Guam and Hawaii are each comprised of unique ethnically diverse populations including indigenous peoples and individuals of Asian, European, and Pacific Island ancestry. Guam, a U.S. territory located in the Western Pacific, is the largest island in Micronesia with a population of approximately 159,000 [1]. Guam's population includes indigenous Chamorros (including part-Chamorros) (42.2%), Filipinos (26.3%), Chuukese and other Micronesians (7.2%), Whites (6.8%), other Asians (6.2%), and other race/ethnic groups (11.3%) [1,2]. Hawaii, the 50th U.S. state located in the Central Pacific, consists of a population of 1,360,000 residing on six main islands [3]. Hawaii's population is comprised of indigenous Native Hawaiians (including part-Hawaiians) (21.3%), Whites (22.8%), Filipinos (17.2%), Japanese (16.3%), Chinese (6.8%), and other race/ethnicities (15.6%) [3].

The contribution of Hawaii's multiethnic population to its cancer

burden has long been recognized based on numerous epidemiologic studies conducted over more than four decades [4–11]. These studies have provided important insight into cancer development and progression across Hawaii's population and the interacting influence of genes with lifestyle, diet, environment, and other factors. In contrast, infrastructure and resources for cancer surveillance and cancer research were not established in Guam until relatively recently. Consequently, there is limited knowledge of the epidemiology of the cancer in this island population. Ethnic variation in cancer incidence and mortality across Guam's population has been observed [12,13]. Prevalent exposures such as cigarette smoking and *Areca* (betel) nut chewing likely influence disease risk [14,15].

The present report utilizes cancer surveillance data to characterize and compare the current burden of cancer in Guam and Hawaii. Ethnic comparisons focus on variation within Guam's major ethnic groups. Elucidation of factors influencing cancer risk and progression is key to informing future research and public health efforts for Guam's population.

* Corresponding author.

E-mail addresses: brenda@cc.hawaii.edu (B.Y. Hernandez), renatab@triton.uog.edu (R.A. Bordallo), michael@cc.hawaii.edu (M.D. Green), robhad@yahoo.com (R.L. Haddock).

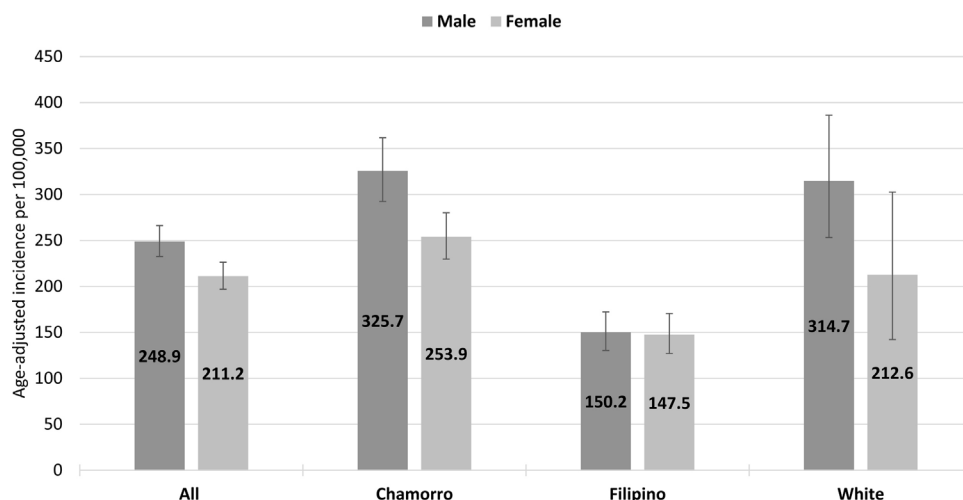


Fig. 1. Overall Cancer Incidence, ¹ Guam, 2009–2013. ¹Average annual rates age-adjusted to the World (WHO 2000–2025) Standard Million Population

2. Materials and methods

The present analysis utilized cancer registry data from cases diagnosed in 2009–2013 in Guam and Hawaii. The Guam Cancer Registry (GCR) was established as a unit of the University of Guam (UOG) in 2004 through a partnership of the UOG, the Guam Department of Public Health and Social Services, and the University of Hawaii Cancer Center. The GCR is partly supported through the University of Hawaii–University of Guam Partnership (NCI 5 U54 CA143727). The Guam Cancer Registry is also a member and reporting registry of the Pacific Regional Central Cancer Registry (PRCCR) (CDC U58 DP000976 and U58 DP003906). PRCCR consists of cancer registries covering the U.S. Affiliated Pacific Islands including Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, the Federated States of Micronesia, the Republic of the Marshall Islands, and the Republic of Palau. The GCR offices at the UOG serve as the central host location for PRCCR. The GCR is responsible for the collection of data on newly diagnosed cancer cases and annual follow-up of existing cases throughout the territory of Guam. Data is collected, coded, and maintained based on standards of the CDC National Program of Cancer Registries and the North American Association of Central Cancer Registries (NAACCR).

The Hawaii Tumor Registry (HTR) of the University of Hawaii Cancer Center (UHCC) was established in 1960 and has been a part of the National Cancer Institute’s Surveillance Epidemiology and End Results (NCI/SEER) Program since 1973. The HTR is responsible for cancer surveillance for the state of Hawaii and contributes to U.S. cancer incidence, mortality, and survival data [16]. The HTR works closely with the GCR to provide technical assistance and training.

Comparisons of cancer in Guam and Hawaii necessitate consideration of certain limitations in the quality of data from the GCR as a relatively new central cancer registry. For 2009–2013, GCR data met the standards of data completeness [17] for the proportion of cases with unknown age, sex, and residence (0% for all). However, the proportions of unknown race/ethnicity and death certificate-only cases were 7.1% and 11%, respectively, which did not meet data quality standards.

Site, and histology were coded according to the International Classification of Diseases for Oncology (ICD-O), Third Edition [18]. Cancer sites and stage at diagnosis were categorized according to WHO and SEER definitions [19]. The present analysis was limited to invasive cancers with the exception of bladder cancer, which includes both in situ and invasive cancers consistent with SEER standards. Demographic, clinical, and pathologic information was available from both registries. The GCR data also included cancer-screening history for a subset of cases.

Average annual age-adjusted incidence and mortality rates per

100,000 were calculated for the 5-year period, 2009–2013. Rates were age-standardized to the World Health Organization 2000–2025) World Standard Million Population. Ninety-five percent confidence intervals were calculated for all rates. To ensure the stability and reliability of rates, incidence and mortality rates were limited to sex-ethnic categories with at least 10 cases or deaths over the 5-year period. Overall incidence comparisons in Guam included Chamorros, Filipinos, and Whites (Caucasians). Hawaii comparisons included Whites (Caucasians), Japanese, Native Hawaiian, Filipino, and Chinese. Unpaired *t*-tests, Wilcoxon two-sample tests, and Pearson’s chi square statistics were used to compare continuous and categorical variables; *p*-values less than 0.05 were considered significant.

3. Results

3.1. Cancer incidence

In 2009–2013, cancer was diagnosed in 1708 individuals (342 per year) in Guam and 33,521 individuals (6704 per year) in Hawaii, respectively. The overall cancer incidence was significantly lower in Guam than in Hawaii for both sexes (Males: 248.9, 95% CI 232.5–266.2 and 329.3, 95% CI 324.2–334.5 per 100,000, respectively; Females: 211.2, 95% CI 196.9–226.3 and 317.3, 95% CI 312.1–322.4 per 100,000, respectively). (Hereafter all incidence and mortality rates shown exclude “per 100,000”).

Overall cancer incidence varied across the major race/ethnic groups of both island populations. In Guam, among both sexes, overall incidence was significantly higher in Whites and Chamorros compared to Filipinos (Fig. 1). In Hawaii, overall incidence among males was highest for Whites, followed by Native Hawaiians, then Filipinos and Japanese—whose rates were comparable—, and Chinese, who had the lowest incidence (Fig. 2). Overall incidence among Hawaii females was highest for Native Hawaiians and Whites, followed by Japanese, and Filipinos, and lowest in Chinese (Fig. 2).

Cancers of the prostate, lung & bronchus, and colon & rectum were the most frequently diagnosed malignancies among males in both Guam and Hawaii (Table 1). Cancers of the lung & bronchus, liver & intrahepatic bile duct, and nasopharynx were of significantly higher incidence among Guam compared to Hawaii males. Rates of liver & intrahepatic bile duct cancer among Guam males was nearly double and nasopharyngeal cancers more than four times higher than that of men in Hawaii.

Melanoma of the skin, the 4th most common malignancy among Hawaii males, was rare in Guam. Other cancers with significantly lower incidence among Guam compared to Hawaii males included bladder, kidney & renal pelvis, pancreas, and non-Hodgkin lymphoma. The

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