Cancer epidemiology in the freely associated U.S. Pacific Island jurisdictions: challenges and methodologic issues

Abstract: The health care systems of the U.S.-associated Pacific Island jurisdictions, especially the three freely associated states (Federated States of Micronesia, Republic of the Marshall Islands, and Republic of Belau), are faced with problems similar to developing countries such as malnutrition and infectious diseases, as well as diseases relating to westernization such as diabetes, heart disease, and cancer. Although cancer has emerged as an important cause of morbidity and mortality in the Pacific, little population-based data are currently available. This paper addresses some of the practical and methodological challenges to obtaining accurate and reliable cancer data in these jurisdictions. This paper discusses the use of annualized period prevalence to allow for some measurement of cancer burden when cancer incidence cannot be accurately calculated. This method, however, has its own limitations as cancer prevalence relates to both incidence and duration of illness, and numerous factors impact survival potential (i.e., preexisting diseases, lifestyle practices, and access to treatment). In addition, under-ascertainment and data quality issues will impact any cancer morbidity or mortality measurements. Thus, improvement in the health care systems, including the creation and ongoing support of active cancer registries would be the optimal approach to better delineating cancer occurrence and risk for the populations of these Pacific Island jurisdictions.

Alan R. Katz*
Neal A. Palafox**
David B. Johnson***
Seiji Yamada****
Alan C. Ou*****
Jill S. Minami**

Challenges in the Pacific

The U.S.-associated Pacific Basin is composed of six island jurisdictions. Two are U.S. territories (American Samoa and Guam), one is a commonwealth (Commonwealth of the Northern Mariana Islands), and three are independent nations with compacts of free association with the U.S. [Republic of the Marshall Islands, Republic of Belau (Palau) and the Federated States of Micronesia which include the 4 states of Yap, Chuuk, Pohnpei, and Kosrae]. The health status of these island populations is considerably worse than that of the population residing within the United States, and is especially poor within the latter three "freely associated" states (FAS)[1]. Limited resources and the immediate challenges posed by malnutrition and infectious diseases such as cholera, tuberculosis, dengue, and vaccine preventable illnesses have compromised the ability to adequately address chronic diseases. Cancer has emerged as an important cause of morbidity and mortality in the Pacific, yet little population-based data are currently available[2, 3]. The ability to obtain accurate morbidity and mortality data is a necessary first step in the development of an effective cancer control program.

*Department of Public Health Sciences and Epidemiology, John A. Burns School of Medicine, University of Hawai'i. **Department of Family Medicine and Community Health, John A. Burns School of Medicine, University of Hawai'i, Honolulu, HI. ***QMark Research and Polling, Honolulu, HI. ****Hawai'i/Pacific Basin Area Health Education Center, Office of Medical Education, and Division of Ecology and Health, John A. Burns School of Medicine, University of Hawai'i, Honolulu, HI. *****Preventive Medicine Residency Program, Department of Family and Community Medicine, Tulane University School of Medicine, New Orleans, LA. Contact: Alan Katz, Department of Public Health Sciences and Epidemiology, John A. Burns School of Medicine, University of Hawai'i, Biomedical Sciences Bldg., Room D104M, 1960 East-West Road, Honolulu, HI 96822. Tel: 808-956-5741. Fax: 808-956-2388. Email: katz@hawaii.edu.

Needed information for measurement of accurate cancer incidence and mortality rates.

A major goal of cancer epidemiologists has been the development of uniform data collection strategies and diagnostic classification systems to optimize the quality of cancer morbidity and mortality data. The World Health Organization (WHO), through the International Agency for Research on Cancer (IARC) and the International Association of Cancer Registries (IACR), has played a key role in promoting the collection and analyses of both accurate and reliable cancer data, allowing for international comparability studies[4].

A systematic approach to data collection helps to address the reliability of collected data. The validity or accuracy of the data, however, is influenced by a number of factors including: 1) histologic verification of diagnosis; 2) utilization of standardized International Classification of Diseases (ICD) coding; 3) completeness of ascertainment; and 4) elimination of duplicate reports.

Lack of histologic confirmation threatens the validity of cancer diagnoses. The IARC measures the percentage of cancer cases with histologic verification (HV%) in assessing data quality of national cancer registries[5]. In developing countries with severe limitations on health care expenditures, such as those experienced by the FAS, histologic confirmation may be an unrealistic standard. For example, with an annual per capita health budget of $92 in Chuuk State, Federated States of Micronesia (FSM) [1], histologic confirmation of cancer cases cannot receive high priority in light of unmet basic infrastructural needs.

Completeness of data collection is highly dependent upon the state of a country's health care system. As an estimate of a country's medical coverage, the IARC has measured the number of doctors and hospital beds per 1,000 population[6]. These indices also reveal inadequacies in basic health resources within the FAS[1].

The residents of these countries live on geographically dispersed atolls and islands, many of which are relatively isolated from health care services. Persons with cancer who rarely or never come into contact with the medical care system may not have their conditions recognized or diagnosed, further diminishing case ascertainment.

Ascertainment of cancer incidence is the main focus of cancer registries. In order to accurately measure incident cases, information on date of diagnosis is needed. Although cancer diagnoses are generally documented on both hospital discharge records and death certificates, the date of diagnosis may not be recorded. Previously published reports of cancer incidence from the Pacific Island jurisdictions with no established or active cancer registries, have utilized retrospective record searches in an attempt to identify incident cases. The authors of these studies recognized the problems of under-ascertainment and suboptimal level of histologic confirmation. Comparability between countries is further complicated by diverse systems of medical care, language, and culture[7, 8].

The quality and completeness of data collection within developing countries are also problematic. In some jurisdictions, ICD coding is not utilized, nor are computerized databases maintained with death certificates or hospital discharge data, necessitating manual searches of records and laboratory reports.

In general, mortality data tend to be more complete than morbidity data, but reliance on death certificates as the sole or predominant source of cancer incidence will result in an underestimation of true cancer incidence as it will tend to miss neoplasms with a more indolent, non-lethal course, such as thyroid or prostate cancers. In addition, cancers with a short mean survival (where incidence rates approximate mortality rates) may be easily misclassified (e.g., cancer metastatic to the lung being classified as primary lung cancer). IARC uses the percent of cases registered on the basis of death certificates only (DCO%), as one indicator of cancer registry data quality, with the understanding that this is a negative correlate of validity. None of the country cancer registries included in a recent IARC listing had DCO% in excess of 24%[5]. By contrast, a recent study by Palafox and colleagues of cancer occurrence in Micronesia revealed that most jurisdictions had DCO% in excess of 50%. Only one country had a DCO < 10%[9].

Use of annualized cancer period prevalence as a (less than optimal) substitute for cancer incidence

In the absence of complete incidence data, annualized site-specific cancer period prevalence may be more easily calculated. This would allow for some measurement of cancer burden on the Pacific jurisdiction of interest. The "period" is defined as the number of years during which data were available for a given jurisdiction. Included in the numerator are persons diagnosed with cancer during that period (incident cases) and persons diagnosed with cancer prior to that same period who either died during the period or were still alive at the end of period (prevalent cases). The denominator includes the total population from census data available for a year close to the mid-point of the period. The period prevalence is annualized by dividing by the number of years during which data were collected (Figure 1).

The utilization of trained record abstractors to review all available data sources, including hospital and clinic records, as well as death certificates, pathology logbook records,

Figure 1. Formula for "annualized site-specific cancer period prevalence"

$$\text{annualized site-specific cancer period prevalence} = \frac{\begin{array}{l}\textit{(Number of persons diagnosed with site-specific cancer during specified period [incident cases]} \\ \textit{+ Number of persons diagnosed with site-specific cancer prior to specified period who either died} \\ \textit{during the specified period or who were alive during the specified period [prevalent cases])}\end{array}}{\begin{array}{l}\textit{Total population (estimated population from a year close to the mid-point of the specified period)} \\ \text{X } \textit{Number of years during which data were collected}\end{array}}$$

Note: Period = number of years during which data were collected; hence the period prevalence is "annualized" by dividing by the number of years during which data were collected.

Table 1. Annualized site-specific cancer period prevalence for selected sites, freely associated U.S. Pacific Basin jurisdictions, circa 1985-98, age adjusted to U.S. population 1988[9]

	Jurisdiction					
	Federated States of Micronesia				Republic of Belau	Republic of the Marshall Islands
Cancer site	Chuuk	Kosrae	Pohnpei	Yap		
Breast	8.9	11.5	17.5	17.0	21.3	57.4
Cervix	6.2	39.5	27.1	12.7	48.2	75.5
Hematologic	2.2	2.2	4.7	3.3	7.8	4.9
Liver	6.0	4.4	14.7	26.5	24.9	13.3
Lung	32.5	8.6	28.4	53.7	46.5	52.7
Oral	4.2	13.1	7.7	31.8	16.1	16.2
Prostate	3.4	16.7	8.9	18.3	115.1	13.9
Thyroid	3.1	2.0	3.6	4.6	5.0	33.3

Number of cases per 100,000 population

and overseas referral databases, may help improve completeness. To the extent that data sources are comparable within the differing jurisdictions, reliability of case ascertainment will also be improved. This strategy has been utilized by researchers at the University of Hawai‘i John A. Burns School of Medicine to calculate annualized site-specific cancer period prevalence for the FAS[9] (Tables 1 and 2).

Even if we assume that cancer prevalence is accurately and reliably measured, attempts to estimate cancer incidence from measured prevalence may lead to highly inaccurate estimates, as prevalence relates to both incidence and duration of illness[10]. How long a person lives with cancer is determined by a number of factors including: the availability of treatment modalities either on-site or through overseas referral, the co-existence of other health conditions (e.g., diabetes, heart disease, hypertension, poor nutrition), and lifestyle practices (e.g., smoking, alcohol use, poor eating habits) that could reduce longevity.

Other methodological concerns

An additional concern in cancer morbidity or mortality comparison studies is the possibility of confounding by age. Differences in population age distribution may confound the comparison of site-specific cancer rates between populations, as older populations have higher overall rates of cancers than younger populations, and younger persons experience different types of cancer compared to older persons. In addition, smaller populations tend to have less stable rates and more observed variation in cancer incidence over time than larger populations.

Many Pacific Island nations are small in population. A comparison of age- and site-specific cancer rates might lead to unstable estimates due to the small number of cases. Age-adjustment may be utilized to calculate more stable “summary” standardized rates and eliminate the confounding effect of age. Adjusted rates may be calculated using either the “direct” or “indirect” method[11]. The choice of an appropriate standard population for adjustment introduces another methodologic issue, as the use of different “stand-

Table 2. Annualized site-specific cancer period prevalence for selected sites, freely associated U.S. Pacific Basin jurisdictions, circa 1985-98, age adjusted to WHO world standard population[9]

	Jurisdiction					
	Federated States of Micronesia				Republic of Belau	Republic of the Marshall Islands
Cancer site	Chuuk	Kosrae	Pohnpei	Yap		
Breast	7.9	11.5	10.7	15.6	17.1	36.0
Cervix	4.8	33.4	24.8	13.1	37.5	60.5
Hematologic	2.2	2.6	4.7	2.7	6.0	4.7
Liver	5.2	4.1	11.9	24.4	19.4	10.2
Lung	24.6	8.7	21.3	39.6	34.6	41.1
Oral	3.8	7.9	6.2	22.1	12.4	12.6
Prostate	2.5	10.9	4.9	14.0	74.9	9.3
Thyroid	2.6	1.6	3.0	2.6	4.2	28.6

Number of cases per 100,000 population ard" populations will affect the magnitude of the calculated adjusted rates and may actually alter the ranking of site-specific cancer rates among study populations[12].

Comparing the use of an "older" standard population (e.g., the U.S. 1988 population (Table 1) and a "younger" standard population (e.g., the world population[13]) (Table 2) to calculate age-adjusted, site-specific cancer prevalence for the FAS[9], the most apparent difference is the magnitude of the prevalence measurements. Those derived from the "older" U.S. standard are generally much higher than those calculated from the proportionately "younger" world standard population. In addition, the relative ranking of certain age-adjusted site-specific prevalence measurements between jurisdictions is indeed changed. Using the U.S. standard population for adjustment, Yap State (FSM) is ranked number one among the jurisdictions with respect to lung cancer prevalence, while the RMI is second; however, by age-adjusting to the world standard population, the RMI becomes number one for lung cancer followed by Yap State (FSM). As adjusted rates are by definition "fictitious" and are calculated for comparison purposes, the appropriate standard population should be chosen on the basis of relevance to the study populations[11], and the maximization of potential for wider comparability.

The "direct" adjustment method has generally been used for international cancer incidence comparison purposes[13] and was used in calculating the data presented in Tables 1 and 2. The use of "indirect" adjustment may be preferable to the "direct" method when age- and site-specific cancer rates are statistically unstable due to the small number of cases in each study population[11]. However, indirect adjustment is not a viable option, as there are no generally available or accepted standard populations with delineated age-specific cancer prevalence "rates" (proportions).

Conclusion

Although the focus of this paper was the three FAS (as these jurisdictions are in greatest need of resources), the discussion is relevant for all six U.S.-associated Pacific Island jurisdictions. Lack of standardized regional health information impacts all aspects of health delivery. The Institute of Medicine's Committee on Health Care Services in the U.S.-associated Pacific Basin stated, "Accurate and informative data are critical for health care reform. The lack of good data hampers policymakers' and administrators' ability to analyze the current situation, set priorities, and plan for the future[1]."

In the absence of an active cancer registry to detect and measure incident cases, and recognizing the current suboptimal health care infrastructure and limited resources in the FAS, the use of annualized period prevalence may allow measurements of cancer burden on these populations and permit some degree of comparability assessments between jurisdictions. However, improvement in the health care systems, including the creation and ongoing support of active cancer registries would be the optimal approach to better delineating cancer occurrence and risk for the populations of these Pacific Island jurisdictions[2].

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