


Cancer Incidence

**in Chinese, Japanese and
Filipinos in the US and Asia
1988-1992**

Prepared by:
Angela Prehn, Ph.D.
Scarlett Lin, M.P.H.
Christina Clarke, M.P.H.
Laura Packel, B.A.
Raymond Lum, M.P.H.
Stephanie Lui, M.H.S.
Carolyn Harper, M.D.
Marion Lee, Ph.D.
Sally Glaser, Ph.D.
Dee West, Ph.D.

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This publication was prepared by the:
Northern California Cancer Center
Greater Bay Area Cancer Registry
32960 Alvarado-Niles Road, Suite 600
Union City, California 94587
(510) 429-2500
www.nccc.org

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Inquiries regarding the content of this report should be directed to the Northern California Cancer Center, 32960 Alvarado-Niles Road, Suite 600, Union City, California 94587 (510-429-2500).

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Purpose

This monograph presents information about cancer occurrence in Chinese, Japanese and Filipinos in the United States and Asia. It aims to provide a useful resource of cancer information for these three Asian populations to researchers, health care professionals, and the general public. The descriptions of specific cancers, their risk factors and their patterns of occurrence are designed to provide the reader with a concise and understandable overview of the patterns of cancer in Chinese, Japanese and Filipinos, the three largest Asian populations in Northern California.



Introduction

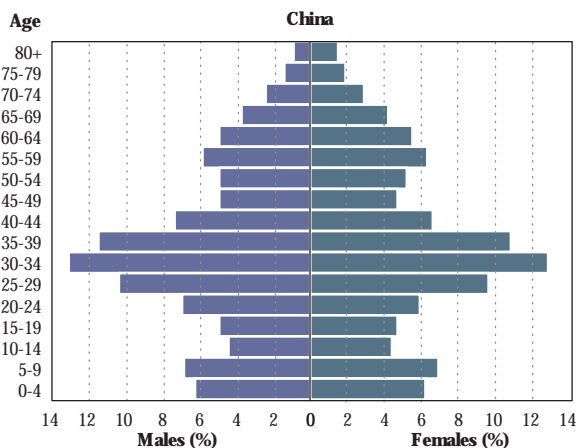


Cancer Registries and Populations

This monograph addresses cancer occurrence in China, Hong Kong and Singapore, Japan, the Philippines, and the United States. Within each of these places, regional registries collect cancer incidence data. Except for Hong Kong and Singapore, the cancer registries only collect data from a defined region, and do not cover the entire population. This section describes the populations each cancer registry represents, based on information obtained from the International Agency for Research on Cancer (IARC)¹. Cancer incidence and population data were grouped according to geographic locale in Asia, and by race/ethnicity in the US; population pyramids by age and sex are presented for these groups. These data are also presented in table format in Appendices 1 and 2.



Figure 1. Age distribution pyramid for the two Chinese populations



China

Data for the mainland Chinese populations came from the cancer registries located in Shanghai and Tianjin (Map 1). Shanghai is on the east coast of China and is its largest industrial city. The population-based Shanghai Registry is the oldest in China and covers approximately 7 of the 13 million people in the city. Tianjin is the third largest city in China and is largely industrial and commercial. The Tianjin Registry covers 3.5 million of the 9 million people living in the city. The age distribution pyramid (Figure 1) combines the Chinese populations of the Tianjin and Shanghai registries. Figure 1 shows that for both males and females, half of the population is between the ages of 20 and 44; the median age is between 30 and 35 years old.

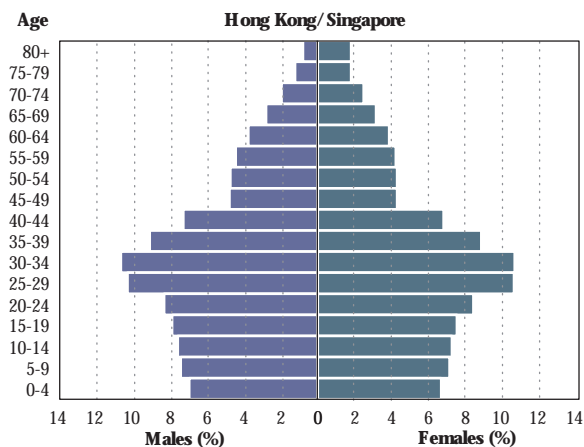
INTRODUCTION

Hong Kong/Singapore

The Hong Kong Cancer Registry covers the entire population of Hong Kong (Map 1). According to the 1991 census, the population was 5.8 million, 98% of whom were Chinese; the majority of these (90%) originated from the Guangdong Province in southern China. The Singapore Cancer Registry encompasses the entire population of the Republic of Singapore, a mostly urban island just south of Malaysia (Map 1). In 1990, the population of Singapore was 2.7 million, with 78% Chinese, 14% Malaysian, and 7% Indian. The data presented in this monograph include only the Chinese of Singapore, who originate mainly from the south-eastern Chinese provinces of Fukien and Kwangtung.

The combined populations of these two regions are presented in Figure 2. Like China, the majority of this population is between 20 and 44 years old, and the median age for both males and females is between the ages of 30 and 35.

Figure 2. Age distribution pyramid for the Hong Kong/Singapore populations



Map 2. Japan

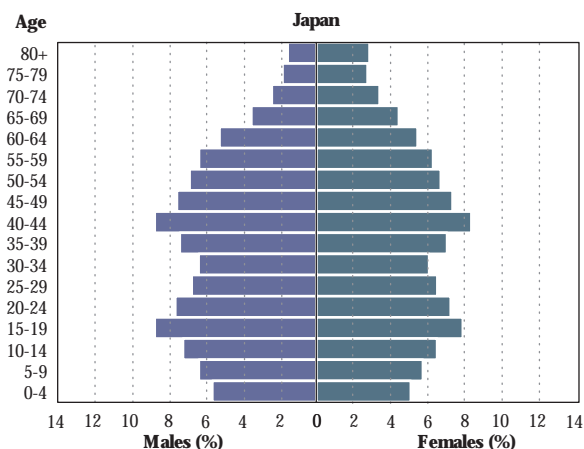


Japan

The population of Japan is largely Japanese, with very few immigrants or other racial/ethnic groups represented. The Japanese population included in this monograph is that covered by the cancer registries for five regions: Miyagi, Nagasaki, Osaka, Saga and Yamagata (Map 2). The Miyagi Cancer Registry in northern Japan covers the entire Miyagi prefecture, including the city of Sendai. The population served is 2.2 million. The Nagasaki Tumor Registry covers the Nagasaki Prefecture located in southwestern Japan, which has a population of 1.5 million, half of which lives in one of the two largest cities, Nagasaki City or Sasebo City.

The Osaka Cancer Registry covers the Osaka Prefecture, which has the highest population density in Japan. Located in central Japan, it has a population of 8.7 million. The Saga Cancer Registry in southwestern Japan covers a population of about 800,000. The Yamagata Prefectural Cancer Registry in northern Japan covers the Yamagata Prefecture, which has a population of 1.25 million. Yamagata has a relatively low population density, due to its mountainous geography and cold climate. The population pyramid for Japan presented in Figure 3 combines the demographic information for all five registries. Males and females living in these areas of Japan are, on average, older than those in China and Hong Kong/Singapore. The median age in Japan falls in the 35-40 age group.

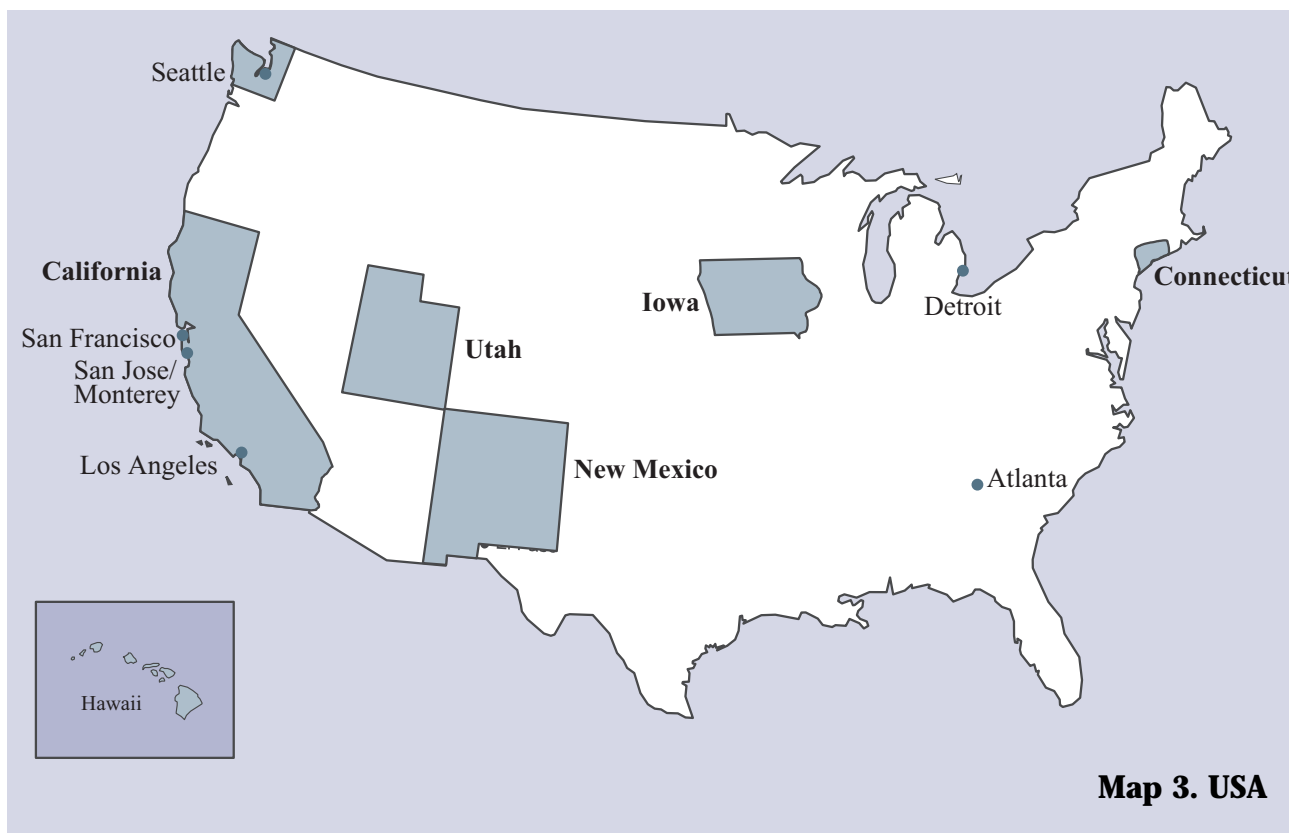
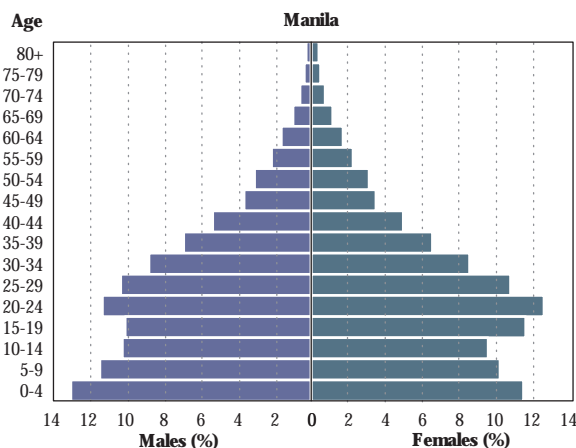
Figure 3. Age distribution pyramid for the five Japanese populations



Philippines

The Filipino population for whom cancer rates were calculated was covered by the Philippine Cancer Society-Manila Cancer Registry, which collects data for the cities of Manila, Pasay, Caloocan and Quezon City. The combined population of these four cities is 4.4 million, and their population density is the highest of anywhere in the country. The age and sex distribution pyramid for the Philippine population reveals a relatively young population (Figure 4); over half of the population is under 25 years of age.

Figure 4. Age distribution pyramid for the Manila population



United States

The US Asians included in this monograph are those populations covered by the Surveillance, Epidemiology and End Results (SEER) program of the National Cancer Institute, and the California Cancer Registries (CCR). The SEER registry areas include: the states of Hawaii, Connecticut, Iowa, New Mexico, and Utah; and the urban centers of San Francisco/Oakland, San Jose/Monterey, Los Angeles, Atlanta/rural Georgia, Detroit and Seattle (Map 3). The CCR covers the entire California population. Together, these two registries cover over half of the Chinese, about three-quarters of the Japanese and about 70% of Filipino populations living in the US (Table 1).

Table 1. Proportion of US Chinese, Japanese and Filipinos Residing in the SEER and CCR Cancer Registries' Catchment Areas, 1990

Race/ethnicity	US (population)	Registry Areas (population)	% in Registry
US Chinese	1,645,472	845,678	51%
US Japanese	847,562	627,400	74%
US Filipino	1,406,770	957,711	68%
TOTAL	3,899,804	2,430,789	62%

Among these populations, the Filipinos are the most recently immigrated group. According to the 1980 census, Filipinos had the largest proportion of persons foreign-born (65%), followed by Chinese (63%) and Japanese (42%)². Moreover, the proportion of foreign-born has increased 82% between 1980 and 1990 for Filipinos, indicating recent waves of immigration.

The US age pyramids include all populations covered by the SEER and California Cancer Registries. [For those regions covered by both registries (San Francisco/Oakland, Los Angeles, San Jose/Monterey), data from the CCR were used.] The US Chinese population (Figure 5) has a median age for both males and females between 30 and 35 years, similar to the Chinese population of Shanghai/Tianjin. The US Japanese population (Figure 6) is similar to the Japanese population in Japan, being slightly older than the US Chinese, with a median age between 35 and 40 years for both sexes. In contrast, the US Filipino population (Figure 7) is not as young as the Manila population. The median age for US Filipinos lies between the ages of 25 and 30 for males. The females are slightly older with a median age between 30 and 35 years.

Figure 5. Age distribution pyramid for the US Chinese population

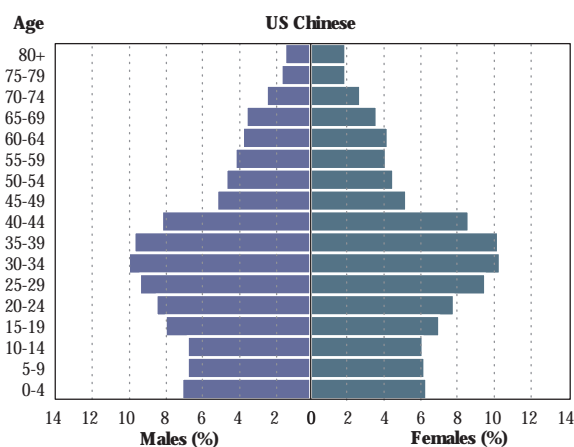


Figure 6. Age distribution pyramid for the US Japanese population

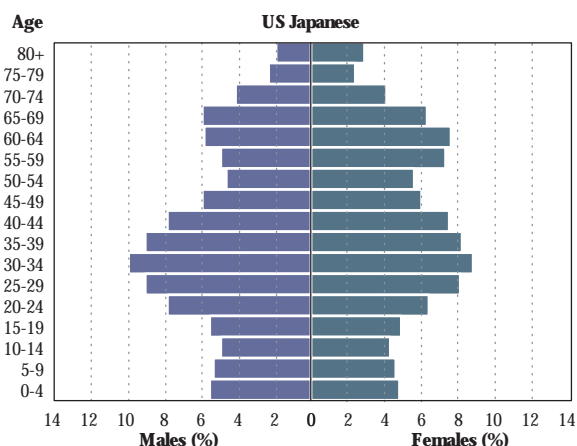
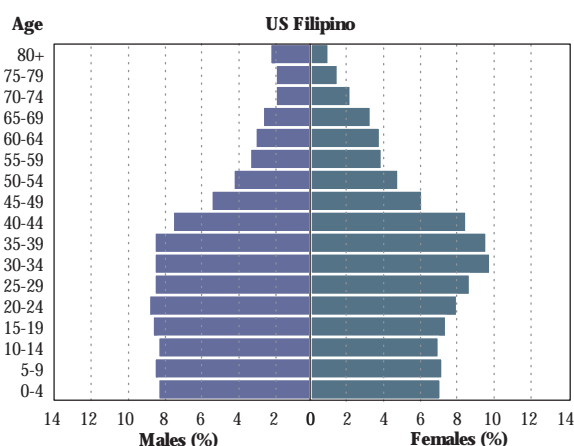


Figure 7. Age distribution pyramid for the US Filipino population



Introduction to Cancer Registry Data

A cancer registry collects certain demographic and medical data on cancer patients and stores it under secure conditions that protect confidentiality. The data are usually obtained from medical records provided by doctors, hospitals, and other care facilities. In many countries, this process is mandated by law.

The purpose of collecting data in a cancer registry is to:

- monitor trends in cancer occurrence;
- support research on factors related to cancer causes, treatment and prevention;
- educate the public, health professionals, and scientists on specific cancer rates and risks;
- provide cancer data to persons involved in health policy, planning, resource allocation, targeting appropriate populations for intervention programs on cancer prevention and screening, and evaluating the effectiveness of current programs.

Data Collection and Management

Several issues need to be considered when interpreting and comparing data that come from different cancer registries. For example, data collection and management practices may differ among registries in a way that impacts the validity and reliability of the data. The following is a general discussion of data collection and management procedures used by cancer registries.

Case Identification

The completeness with which cancer cases are identified and reported to a cancer registry depends on the methods utilized by that registry to collect the cases. Many registries work with tumor registrars located in area hospitals, who identify cancer cases and report them directly to the registry. Some cases may be reported from outside the hospitals by physicians, radiation centers, and surgery centers. In some registries, including those in the US, registry staff may also look for additional cases by visiting pathology laboratories, outpatient surgery and radiation centers and nursing homes, and by reviewing death certificates. Table 2 outlines the data collection methods used by each registry whose data are included in this monograph.

Data Collected

Data submitted to cancer registries are usually abstracted from the medical record, often using specially designed computer software. The software organizes the information into a standard format, including both textual and coded data, and edits the data for accuracy. This process varies among registries, however. A more complete description of the data collection methods for each of the registries mentioned in this monograph can be obtained elsewhere¹. The information collected generally includes patient descriptors (e.g., age, race, ethnicity, sex) and cancer characteristics (e.g., tumor grade, stage of disease at diagnosis). Inclusion of additional information, such as cancer treatment and survival data, varies among registries. Occasionally, additional information is obtained to answer specific research or treatment questions.

Quality Assurance and Data Management

Various procedures are used to evaluate the completeness and accuracy of the data. In addition to edits performed on the data as they are entered into the registry software, internal computer systems undertake further checks, including comparison of responses for consistency. In many registries, including those in the US, staff visually review every abstract, looking for missing data and discrepancies. They also visit hospitals periodically to check the completeness of case ascertainment and the accuracy of information

Table 2. Comparability of data collection between registries¹

Registry	Reporting Voluntary (V)/ Compulsory (C)	Sources of data									
		Public Hospital Records	Outpatient Clinics	Private Clinics	Pathology Laboratory	Autopsies	Haema- tology	Death Certificate	General Practitioner	Screening Program	Others
US SEER + California	C	X	X	X	X	X	X	X	X		X
Shanghai, China	C	X	X					X			
Tianjin, China	C	X	X	X				X			
Hong Kong	V	X	X	X	X		X	X	X		
Singapore	V	X		X	X	X	X	X	X		
Miyagi, Japan	V	X	X	X	X	X	X		X	X	
Osaka, Japan	V	X	X	X	X	X	X	X	X	X	X
Saga, Japan	V	X	X	X				X	X		
Yamagata, Japan	V	X	X	X				X	X		
Nagasaki, Japan	V	X	X	X	X	X		X	X	X	
Manila, Philippines	C	X	X	X	X	X	X	X			

abstracted from the medical record. Once data are received by the registry, much effort is expended to edit them and to merge information for cases reported from multiple sources. When data are missing or inaccurate, the staff returns to the reporting source to correct the problems. In the US, each registry has a dedicated computer and management staff to prepare the data for use in research activities and in publications such as this one. Again, the extent of this process differs among cancer registries.

Confidentiality

The cancer registries respect the confidentiality of the information from cancer patients and are bound by national and state laws to protect patient privacy. Names of persons diagnosed with cancer are never used in reports such as this one and are not released to anyone, except for approved scientific research purposes under strict privacy guidelines.

Data Quality and Comparability

Asia

The international (non-US) data in this monograph come from registries covering areas with the largest populations of the three Asian groups highlighted in this publication: Chinese, Japanese, and Filipinos (See “Cancer Registries and Populations”). These registries all met the guidelines for inclusion into the IARC Registry, thereby satisfying certain data quality criteria. Data submitted to IARC from the registries have been edited for consistency using IARC rules with regards to the comparability, completeness, and validity of data, as well as the accuracy of the population counts¹.

In general, data quality and comparability from these registries are influenced by the following factors: 1) the definition of an incident (newly occurring) cancer case, 2) the completeness in the coverage of cases in the underlying population, and 3) the accuracy of abstraction and coding of information¹. Quality of cancer rates is also affected by the accuracy of the denominator, or the number of person-years at risk of cancer for the years under consideration, in each population¹.

To avoid misleading comparisons, this monograph includes registries only if they had the following attributes: a) completeness of case ascertainment acceptable to the IARC program, including indices of the proportion of histologically verified cases, mortality-incidence ratios, historic data methods (e.g., examining the stability of incidence rates over time), and death certificate methods¹; b) similarity in cancer risk profiles within a country; and c) absence of extenuating factors that influence cancer risk in a way unique to that population (i.e., exclusion of Hiroshima, Japan).

United States

This report includes information collected from the Surveillance, Epidemiology and End Results (SEER) Program as well as the California Cancer Registry (CCR). The SEER program was established in 1973, following the National Cancer Act of 1971, which mandated the collection, analysis and dissemination of data useful in the prevention, diagnosis and treatment of cancer. As a continuing project of the National Cancer Institute, the SEER Program is responsible for monitoring the impact of cancer in the general population. The eleven regional registries in the SEER Program were selected for their ability to operate and maintain a population-based cancer reporting system and for the variety and size of their regional population subgroups that are of special epidemiologic interest.

In California, cancer reporting became mandatory in 1987, as established by Assembly Bill 136. This legislation designated cancer as a reportable disease, and created the statewide California Cancer Registry, which is operated through the Cancer Surveillance Section of the California Department of Health Services. Ten regional cancer registries

covering the entire state of California have been reporting cancer incidence data to the CCR since 1988.

The quality and completeness of case ascertainment is generally high for SEER and CCR. For example, it was estimated that in 1989, the overall completeness rate was 97% for the SEER registries³. For the CCR, case reporting for the 1988-1992 time period was estimated to be virtually complete based on projected case counts⁴.

Materials and Methods

Incidence Data

Incidence data presented in this report are based on new cases of primary cancer diagnosed between January 1, 1988 and December 31, 1992 in selected regions of the US, China, Japan and the Philippines. US cases included persons of Chinese, Japanese or Filipino race/ethnicity reported to the eleven population-based cancer registries of the SEER program and/or the CCR. Three registries (San Francisco/Oakland, San Jose/Monterey, and Los Angeles county) report cancer cases to both programs. For these three registries, data were extracted from the CCR database, as it had been more currently updated. Thus, data from eight SEER registries were combined with CCR data to create a group representing US cases. For all US cases, race/ethnicity was assigned from individual case report information (as determined from medical records) to the mutually exclusive categories of Chinese, Japanese, and Filipino.

Cancer cases from the Asian registries were derived from the electronic database of IARC's Cancer in Five Continents, volume VII (CI5VII)⁵. Information on race/ethnicity was not available in the database. Therefore, racial/ethnic designation was based on geographic location of the registries. For example, all cancer cases in Shanghai were assumed to be Chinese. The exception to this assumption was Singapore, for which data on cases of Chinese ethnicity were available separately.

Seventeen cancer sites were chosen for inclusion in this monograph. Most sites were selected because of their impact on cancer burdens in the populations of Asia (lung, liver, stomach, esophagus, cervix uteri) and the US (colon, rectum, prostate, breast, corpus uteri). Three sites—nasopharynx, biliary tract, and thyroid—were selected for their respective impact on Chinese, Japanese and Filipino populations. Other sites (bladder, pancreas, non-Hodgkin's lymphoma, ovary) were chosen because of their public health importance and their poorly understood etiologies.

For each site presented in this monograph, incidence rates were calculated for invasive cancers only, with the exception of bladder cancer. Because of the difficulties in pathologic assessment of the degree of invasion of bladder cancers, incidence rates of bladder cancer were based on combined *in situ* and invasive cases for all registries for which both *in situ* and invasive case information was available. The Shanghai and Tianjin registries did not report *in situ* cases of bladder cancer to IARC, and thus only invasive bladder cancer rates are presented for these registries. Because of the exclusion of *in situ* cases, bladder cancer rates including data from these registries may underestimate the true incidence of bladder cancer, thus making their comparison with rates from other registries problematic.

Population Data

Population estimates for each geographic area included in this monograph were obtained from SEER, CCR or IARC. SEER and the CCR provided midyear population estimates by sex, race/ethnicity and five-year age group. These data were derived from unmodified 1990 US census data for each of the eight geographic areas of the SEER program and the state of California⁶. IARC provided one-year population estimates by

sex and five-year age group for each of the Asian registries included in this monograph⁵. These population estimates had been provided to each regional registry by local or central government agencies.

Registry Groupings

Data from individual population-based registries were combined to provide seven groups for incidence rate comparison. “US Chinese,” “US Japanese” and “US Filipino” rates contain data from both SEER and the CCR, “China” represents data collected by the Shanghai and Tianjin registries, “Hong Kong/Singapore” contains combined Hong Kong and Singapore-Chinese data, and “Japan” contains information from the Miyagi, Nagasaki, Osaka, Saga and Yamagata registries. “Manila” registry data represent cancer data from Manila. These seven groupings are used in incidence rate comparisons for all cancer sites except rectum. Data for rectal cancer exclude Hong Kong from the “Hong Kong/Singapore” grouping and Yamagata and Saga from the “Japan” grouping because these three registries did not provide information for rectal cancer separately from anal cancer.

Site and Histology Recodes

For US cases, primary site and histologic type of cancer were coded according to the International Classification of Diseases for Oncology (ICD-O), Second Edition⁷. Asian cases obtained from IARC were coded according to International Classification of Diseases-9 (ICD-9)⁸. Thus, site groupings presented in this monograph, which follow the conventions outlined in Appendix 3, call upon either combined ICD-O-2 site and histology information (US cases) or ICD-9 coding (Asian cases). Regardless of primary site, no hematopoietic cancers (ICD-O-2 histology codes 9590-9989) were included in counts and rates for site-specific cancers. Counts and rates for non-Hodgkin’s lymphomas (ICD-O-2 histology codes 9590-9595, 9670-9717 or ICD-9 200, 202) are presented separately, regardless of primary site of presentation. In addition, Kaposi’s sarcoma cases (ICD-O-2 histology code 9140) were excluded from counts and rates for site-specific cancers in the US data; it was not possible to exclude them from the Asian data based on ICD-9 codes. However, additional Kaposi’s sarcoma data provided to IARC by the Asian registries (with the exception of Shanghai) indicate that in a one-year period, a total of only 13 Kaposi’s sarcoma cases were diagnosed⁵. Thus, any over-estimation of incidence rates due to the inclusion of Kaposi’s sarcoma cases can be assumed to be negligible.

Rate Calculations

Two kinds of cancer incidence rates, age-adjusted and age-specific, are presented in this monograph. For both, cancer case counts over the five-year period were summed, and one-year population estimates were multiplied by five, to provide the basis for the incidence rates that represent the average annual rate over the five-year period. All incidence rates are reported per 100,000 population. Cases of unknown age were not included in the rate calculations.

To calculate age-adjusted incidence rates, which account for differences in age distributions between populations, five-year case counts and five-year population estimates were grouped into 17 five-year age categories, beginning with birth to four years old and ending with ages 80 and older. The direct method⁹ of age adjustment was used to standardize the rates to the 1970 US standard million population (Appendix 4). Rates were also standardized to the 1970 world standard million population (Appendix 5) and reported in the tabulated data section of this monograph so that comparisons can be easily made to incidence rates for other international populations. Relevant formulas for the direct method of age adjustment are presented in Appendix 6.

Age-specific incidence rates were calculated for five age groups, 0-19, 20-34, 35-49, 50-64 and 65 and older. Average annual rates were calculated for each age group according to specifications outlined in Appendix 6.

Technical Terminology

The following definitions are presented for several technical terms that appear in this monograph.

Age-adjusted rate: *Age-adjustment* is a statistical method that allows meaningful comparisons of disease incidence to be made among populations with differing age distributions. An age-adjusted cancer incidence rate is the number of new cancers per 100,000 population that would occur in a specific time period if that population had a given, or standard, age distribution. In this monograph, average annual rates were age-adjusted by the direct method to two standards: the 1970 US million population and the 1970 world standard million population (Appendices 4 and 5).

Age-specific rate: The *age-specific incidence rate* is the number of new cancer cases occurring within a specified age group of a population, in a defined time period. In this monograph, age at diagnosis is grouped into five age categories, beginning with 0-19 years old and ending with ages 65 and older. Average annual age-specific rates are reported per 100,000 population.

Confidence Interval: A *confidence interval* for an observed rate is a measure of the precision of the rate. The observed incidence rate, which is an estimate of true incidence based on counts of disease cases and of population, is subject to variation from the true value of the rate. The confidence interval for the observed rate is a range of values within which the true rate is thought to lie with a specified level of confidence, e.g., 95%. Rates based on larger numbers are subject to less variation.

Histology: *Histology* is the study of the minute structure of cells, tissues, and organs in relation to their function. Cancers are identified and diagnosed primarily on the basis of histology. They often are classified further by histologic subtype.

Limitations

Accuracy of case counts

Race/ethnicity: The reliability of US Chinese, Japanese, and Filipino rates is contingent on the accuracy of racial/ethnic classification for both cases and population estimates. Because race/ethnicity data for US cancer cases are largely obtained from the patients' medical records, such information may come from sources of varying accuracy, including the patient, hospital personnel, and medical records staff. As rates from the Asian registries were calculated by using geographic regions as a proxy for determining race/ethnicity, the implied assumption that cases in the Asian registries are ethnically homogeneous may have led to some misclassification and a slight over-estimate of race/ethnic-specific rates.

Primary site: The reliability of site-specific rates depends on the accuracy with which each cancer site is coded. International differences in cancer ascertainment, other diagnostic practices, or coding conventions may result in variability in the accuracy of cancer case counts. Overall, some small part of the variation in rates among groups may be attributable to these kinds of misclassification bias rather than a true difference in cancer risk.

Accuracy of census denominators

1990 US census data, used as denominators for incidence rate calculations, count the Chinese, Japanese, and Filipino populations in the geographic regions of interest as of July, 1990. Thus, these denominators do not account for fluctuations in immigration occurring after July, 1990, nor do they incorporate estimates of illegal immigrant populations within the racial/ethnic categories. The effects of fluxes in legal or illegal immigration may not impact Chinese, Japanese, and Filipino populations equally in the US. The population estimates used in this monograph likely represent undercounts, and the degree to which these estimates vary from the size of the true population at risk may be different for the three racial/ethnic groups being compared¹⁰. Little information regarding the accuracy of Asian population estimates was available from IARC. Even though IARC editors do conduct quality control checks on the data submitted to them, the quality of population estimates from the Asian registries may be variable. Because these inaccuracies cannot be quantified, it is important to note that they are likely responsible for some of the differences in incidence rates observed between any two groups.

Organization of this Monograph

The cancer incidence data for each of the 17 specific cancers included in this monograph are presented alphabetically by anatomic site. Each site-specific description contains graphs of age-adjusted (1970 US standard) and age-specific incidence rates by sex and geographic region. Text with information about each site, focusing mainly on risk factors and incidence in Asian populations, is also included in each section. Tables containing the associated incidence case counts, age-adjusted rates (US-and world standard-adjusted), age-specific rates and 95% confidence intervals by sex, race/ethnicity and geographic region for each specific site and all sites combined, are presented in a separate section of the monograph.

Overview

Cancer in Chinese, Japanese and Filipino Populations

Cancer is a leading cause of mortality in Asian populations around the world; for example, it is the leading cause of death in Japan¹¹ and the second leading cause of death in the United States¹². Therefore, understanding the burden of cancer within these populations is important for implementing effective public health measures against this disease.

Figure 8 illustrates the average annual occurrence of cancer in Asian and US Chinese, Japanese and Filipino populations during the period 1988-1992 by race/ethnicity and geographic region. These rates are “crude,” meaning they represent the actual average number of persons diagnosed with cancer each year per 100,000 population; there is no statistical adjustment for the differing age structures or other characteristics of the populations. Overall, Japanese were more likely to be diagnosed with cancer than Chinese or Filipinos, regardless of geographic region. The highest rate of cancer was in US Japanese, 385 cases diagnosed per 100,000 population per year; this rate is 2.6 times higher than the rate in Manila, which was lowest among these groups. Cancer rates in Chinese were similar regardless of geographic region, with approximately 250 cases per 100,000 persons diagnosed each year. Filipinos had the lowest cancer rates overall, although their rates were the most likely to differ by geography. On average, US Filipinos had over twice the number of cancer cases diagnosed of their counterparts in Manila.

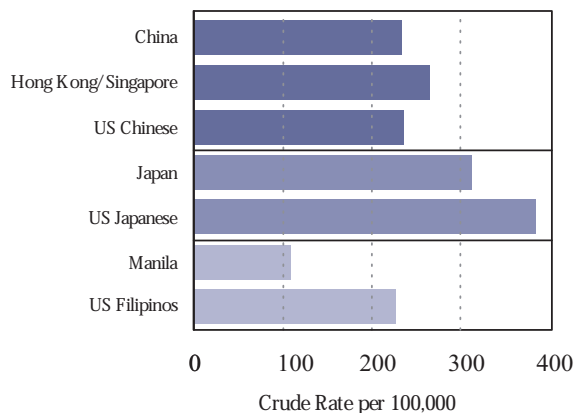
Examining “crude” incidence rates in this manner allows a better understanding of how many people within a particular population are affected by the disease. One major determinant of the cancer burden is the age structure of the population. Cancer is largely a disease of the elderly; therefore, older populations will accordingly have higher cancer incidence rates than younger populations. As shown previously (See “Cancer Registries and Populations”), the Japanese populations represent the oldest and the Filipino the youngest of the populations included in this monograph. Therefore, much of the difference in the crude cancer rates among racial/ethnic groups is due to the fact that these groups have differing age structures. In addition, geographic differences in the occurrence of cancer may indicate that: 1) environmental and lifestyle factors that differ among the locales may be responsible for the differences in cancer incidence rates; 2) access to medical services, such as techniques for early detection and diagnosis of cancer, as well as the availability of prevention programs, may differ by location; and/or 3) geographic differences in the quality and accuracy of the cancer and population data collected may exist.

Comparing Cancer Case Counts

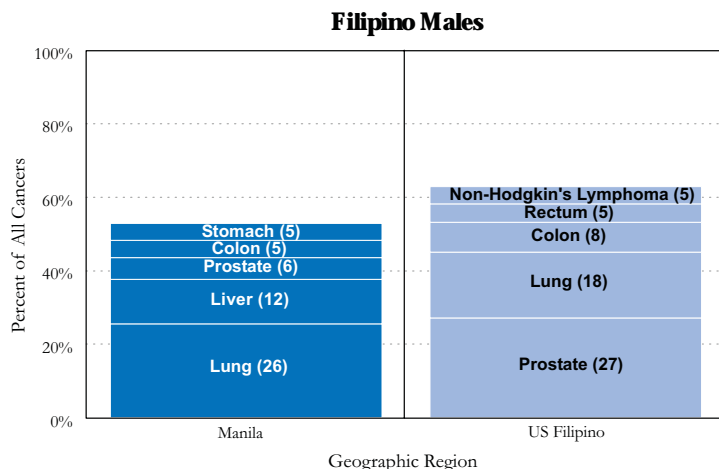
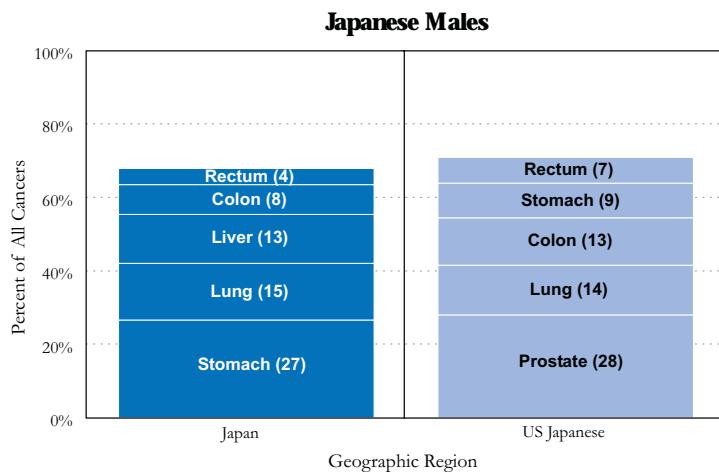
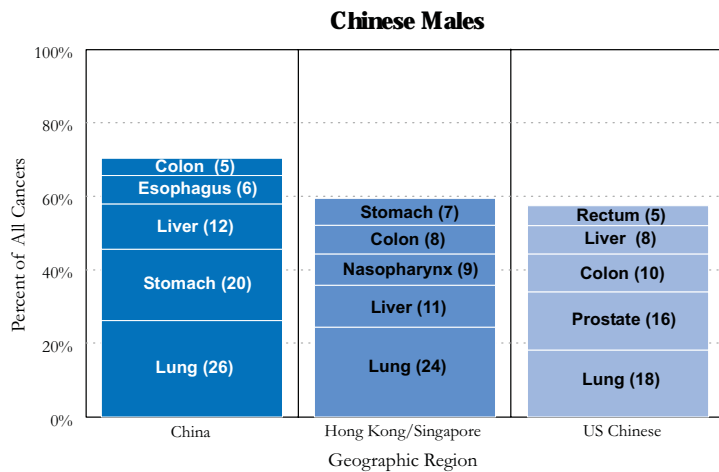
Examining the proportion of all case counts contributed by an individual cancer site can provide a means of quantifying the burden caused by that particular cancer. Figures 9 and 10 present the five cancer sites contributing most to the overall cancer burden in groups defined by race/ethnicity, sex, and geographic region.

Several cancers were responsible for much of the cancer diagnosed in these populations worldwide between 1988 and 1992. Regardless of race/ethnicity, sex, or geographic region, lung cancer accounted for a large proportion of cancer diagnoses, ranging from 7% of all cancers diagnosed in Japanese and Filipino females, to 26% in Chinese males in China. Colon cancer also represented a significant proportion of all cancer cases in both males and females.

Figure 8. Cancer burden in Asian populations by race/ethnicity and geographic region, crude incidence rates, 1988-1992



Figures 9. Five cancers contributing most to overall cancer incidence burden in males by race/ethnicity and geographic region (%), 1988-1992



Other cancers impacted Chinese, Japanese and Filipino populations differently. Stomach cancer was a particularly large contributor to the cancer burden in all Japanese populations, whereas it impacted Chinese and Filipino populations to a lesser extent. Cervical and thyroid cancers represented 5-12% of all cancers diagnosed in Filipinas, but tended to be much less burdensome in Chinese or Japanese female populations.

Within racial/ethnic groups, the impact of particular cancers on the overall cancer burden varied by the geographic region of residence. Liver and stomach cancers impacted Chinese, Japanese, and Filipino male populations in Asia to a much greater extent than corresponding populations in the US. Likewise, prostate cancer was responsible for 16-28% of all cancers diagnosed in US Asian males, but accounted for 6% or less of all cancers in Asian males in Asia. While breast cancer contributed significantly to the cancer burden in Asian females, it affected US Chinese, Japanese, and Filipino females more heavily. Nasopharyngeal, esophageal, and stomach cancers accounted for a substantial proportion of all cancers diagnosed in Chinese populations, although their importance varied by geographic region. For example, nasopharyngeal cancer was responsible for 9% of all cancers in Hong Kong/Singapore males, but affected males in other Chinese populations to a much lesser extent. Esophageal and stomach cancers were significant sources of cancer cases in China, but not in Hong Kong/Singapore or the US.

Comparing Age-Adjusted Rates

Many of the observed differences in cancer occurrence between populations may be related to the differing age structures of those populations. To better identify differences in cancer occurrence that may be related to factors other than age, such as infectious agents, diet and lifestyle, incidence rates are routinely adjusted to a common age standard through a statistical procedure known as “age-adjustment.” Although age-adjusted rates no longer represent the actual rate of cancer in a population because they have been statistically altered, age-adjustment facilitates the comparison of rates across populations. If cancer incidence rates still differ from each other after having been age-adjusted, it is assumed that those differences are due to differences in exposure to disease risk factors other than age. These comparisons are most informative for understanding the different causes of

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cancer that may be preventable and/or modifiable. Therefore, the remainder of the incidence rates presented in this monograph have been age-adjusted.

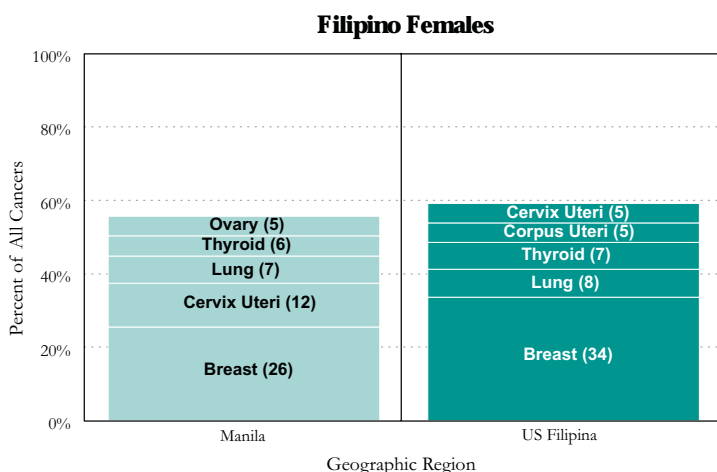
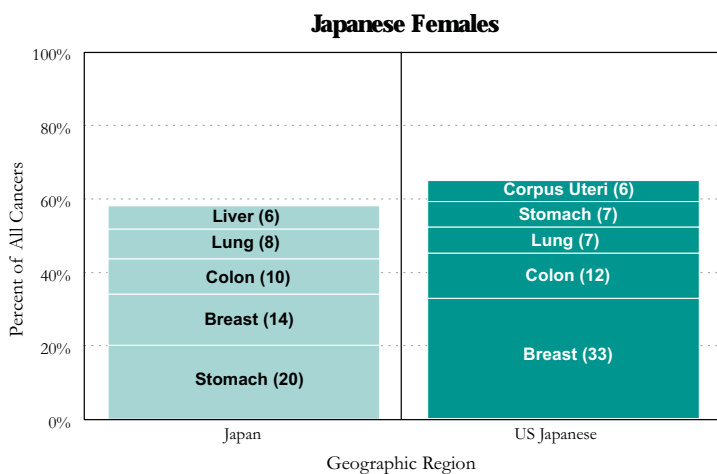
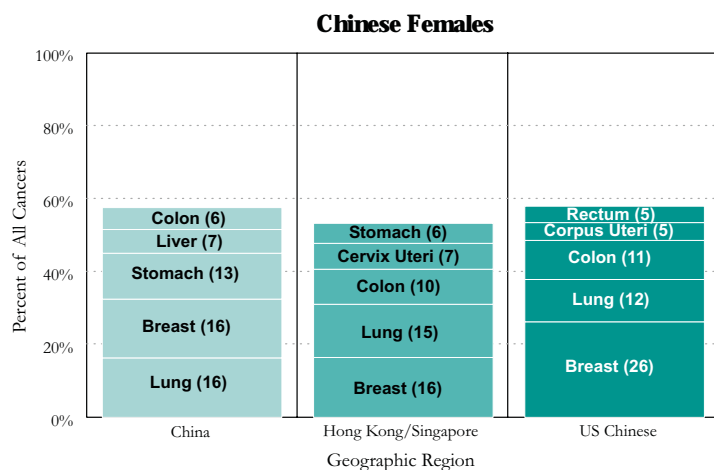
Table 3 presents the five cancer sites with the highest age-adjusted incidence rates for each geographic region by sex. Overall, lung cancer had the highest rate, ranking either first or second, in males, and second, third or fourth in females. In particular, it was highest among Chinese males, regardless of geographic region, which most likely reflects the higher proportion of cigarette smokers in this group.

Several cancers had higher incidence rates in US Asian populations than in Asians living in Asia; these include cancers of the prostate, colon and corpus uteri. The occurrence of prostate and colon cancer has been linked with decreased physical activity and increased dietary fat, two factors associated with Western lifestyle. Additionally, the incidence of corpus uteri cancer has been shown to be related to reproductive patterns and hormonal exposures, such as increased exposure to exogenous estrogen, more common in the US than Asia.

Likewise, some cancers occurred more frequently in Asians in Asia than in the US. These include cancers of the stomach, liver and cervix uteri. Stomach cancer occurrence has been shown to be related to the consumption of particular foods more commonly available in Asian countries than in the US. In addition, all three of these cancers have been associated with infectious agents that are more prevalent in Asia. Asians in Asia are more likely to have been exposed to the *Helicobacter pylori* bacteria, hepatitis B and C viruses, and the human papilloma virus (HPV), which have been associated with the occurrence of stomach, liver and cervical cancer, respectively.

Finally, there are cancers whose occurrence does not fit a particular geographic pattern. Breast cancer had the highest incidence rates of all cancers in females, with the exception of females in Japan and China. This is interesting given that the known risk factors for breast cancer, mainly reproductive patterns related to high estrogen exposure, differ substantially among these groups. Also, incidence rates of nasopharyngeal and thyroid cancers ranked high only in specific populations, namely Hong Kong/Singapore Chinese males and US Filipinas, re-

Figures 10. Five cancers contributing most to overall cancer incidence burden in females by race/ethnicity and geographic region (%), 1988-1992



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Table 3. The five cancer sites with the highest age-adjusted incidence rates, by sex and geographic region, 1988-1992¹.

Region	1st	2nd	Ranking 3rd	4th	5th
MALES					
Chinese					
US ²	Lung ⁶	Prostate	Colon	Liver ⁷	Rectum
China ³	Lung	Stomach	Liver	Esophagus	Colon
HK ⁴ /Singapore	Lung	Liver	Colon	Stomach	Nasopharynx
Japanese					
US	Prostate	Lung	Colon	Stomach	Rectum
Japan ⁵	Stomach	Lung	Liver	Colon	Rectum
Filipino					
US	Prostate	Lung	Colon	Rectum	NHL ⁸
Manila	Lung	Liver	Prostate	Stomach	Colon
FEMALES					
Chinese					
US	Breast	Lung	Colon	Corpus Uteri	Rectum
China	Lung	Breast	Stomach	Liver	Colon
HK/Singapore	Breast	Lung	Colon	Cervix Uteri	Stomach
Japanese					
US	Breast	Colon	Lung	Stomach	Corpus Uteri
Japan	Stomach	Breast	Colon	Lung	Liver
Filipino					
US	Breast	Lung	Thyroid	Colon	Corpus Uteri
Manila	Breast	Cervix Uteri	Lung	Colon	Ovary

1 based on US Standard Million Population

2 US = SEER + California

3 China = Shanghai + Tianjin

4 HK/Singapore = Hong Kong + Singapore Chinese

5 Japan = Miyaki, Osaka, Saga, Yamagata, Nagasaki

6 Lung = Lung and Bronchus

7 Liver = Liver and Intrahepatic Bile Duct

8 NHL = Non-Hodgkin's Lymphoma

spectively. This may reflect exposure to risk factors for these cancers that are unique to a particular population or geographic location.

Examining the pattern of the cancers with the highest age-adjusted rates among these groups allows for a better understanding of exposures that may be of particular importance in the occurrence of certain cancers. Some of these exposures may be specific to a particular location (e.g., early life exposure to hepatitis B virus), while others may be modified upon migration and acculturation (e.g., modification of diet). While the data included in this monograph cannot directly assess the impact of migration and acculturation on geographic differences in cancer incidence rates, the information can provide valuable clues to help identify possible risk factors for further study.

