INTRODUCTION

Prostate cancer is a major public health problem, which over a lifetime will affect an estimated one in five American men. The American Cancer Society predicts that in 1998 alone, 184,500 men will be diagnosed with prostate cancer and 39,200 will die from the disease. Despite its distinction as the most frequently diagnosed noncutaneous cancer and the second leading cause of cancer deaths in men, little is known about the causes of prostate cancer. Incidence rates increase more sharply with age for prostate cancer than for any other cancer type. Prostate cancer incidence rates are higher among men with a family history of the disease, and are higher in blacks compared to whites or Asian Americans. International incidence rates vary more than 65-fold from low-risk to high-risk populations (Figure 1.1), although this variation is at least partially explained by differences in prostate cancer screening and early detection programs across countries. Migrant studies of prostate cancer show that men who move from low-incidence to higher-incidence countries experience a shift in risk toward that of men from the higher risk areas, implicating environmental determinants in the development of this disease.

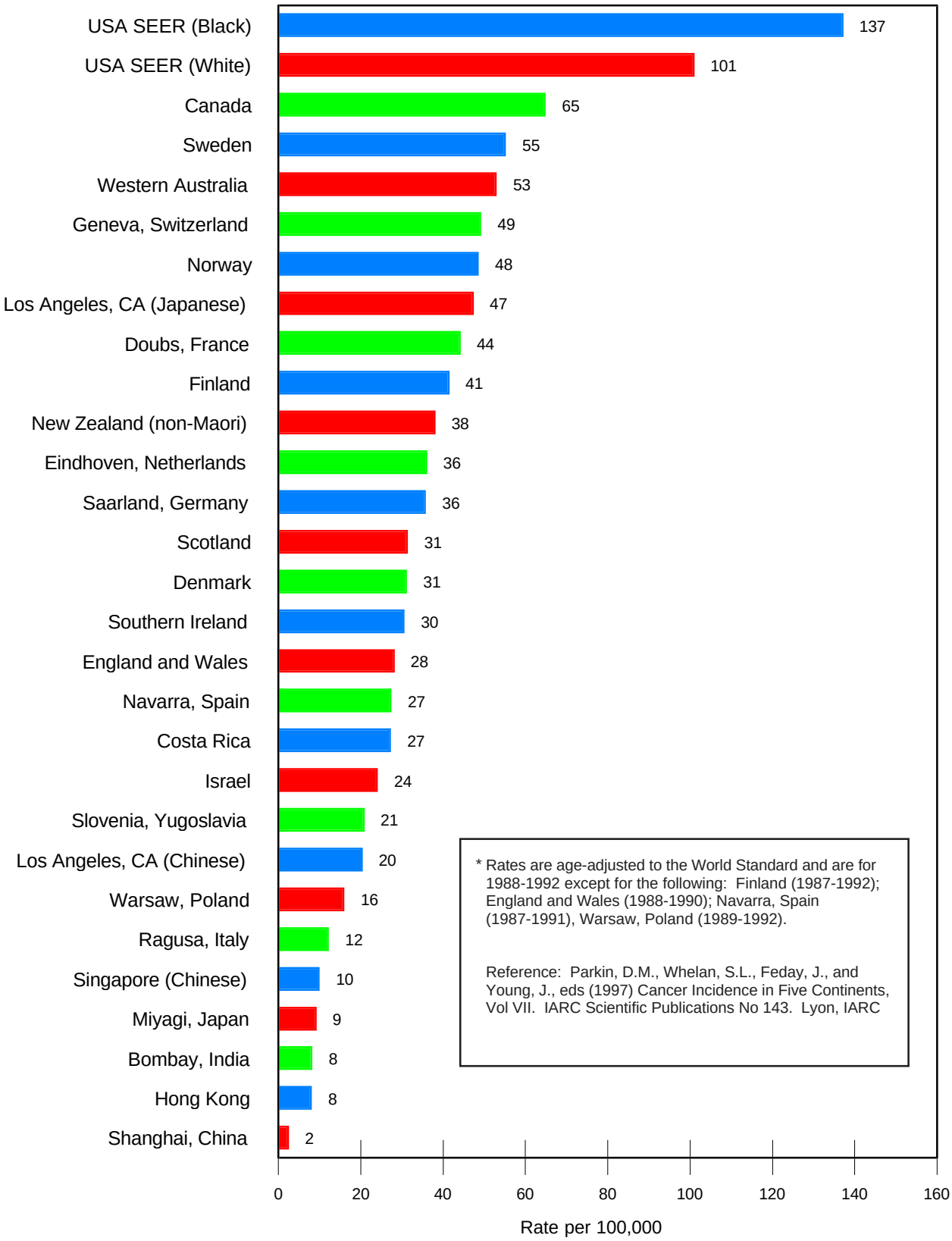
Epidemiologic studies have suggested several factors that may play a role in prostate cancer. In most instances, the evidence is fragmentary or inconsistent (e.g., certain occupational exposures, sexually transmitted infectious agents, sexual activity level, history of benign prostatic hyperplasia, vasectomy, androgenic hormones, weight or obesity, cigarette smoking, alcohol consumption, and vitamin D, vitamin E, and selenium intake). The evidence for dietary fat and red meat intake is somewhat stronger and more consistent, but as yet is inconclusive. Age, race, and a family history of prostate cancer are the only well established risk factors for prostate cancer. Further research is clearly needed on the underlying causes of this cancer.

Over the past decade, there have been dramatic changes in the descriptive epidemiology of prostate cancer. Following the introduction in 1986 of the serum prostate-specific antigen (PSA) test to monitor progression and recurrence of prostate cancer, the incidence of this disease began to rise steeply to a peak in 1992, and subsequently declined each year from 1993 through 1995. This pattern is most pronounced for localized and regional stage disease. An evaluation of histologic grade indicates that most of the increase in incidence has been in moderately differentiated, not well differentiated, tumors. By comparison, the age-adjusted incidence of distant stage prostate cancer peaked in 1985 and declined in subsequent years. Concurrent with the shift toward earlier stage disease, there has been a shift toward earlier ages at diagnosis among both blacks and whites. The mean age at diagnosis is about two years younger among black men compared to their white counterparts.

The widespread use of PSA screening and early detection programs are thought to explain most of the changing patterns in prostate cancer incidence, although the benefit of screening on the

Figure 1.1

Prostate Cancer
International Incidence Rates*



mortality from this disease remains undetermined. The overall age-adjusted mortality rate peaked in 1991, and a 6.7% decline was observed by 1995. The magnitude of this decline is about 1.8 deaths per 100,000 men per year.

The purpose of this monograph is to provide a descriptive review of temporal trends (1973-1995) in the epidemiological and clinical characteristics of prostate cancer patients ascertained through the population-based cancer registries that participate in the Surveillance, Epidemiology and End Results (SEER) Program of the National Cancer Institute. Age-adjusted and age-specific incidence rates (1973-1995) are shown by race for blacks and whites. Recent data (1990-1995) for racial minorities and Hispanic populations are described separately. Incidence trends are examined by age, histologic grade, stage of disease at diagnosis and first course of treatment. Relative survival following the diagnosis of prostate cancer is also examined. Mortality data are provided by the National Center for Health Statistics and the rates are based on prostate cancer deaths between 1973 and 1995 for the SEER areas and for the entire United States population.

The SEER Program

The Surveillance, Epidemiology and End Results (SEER) Program was established in 1973 as part of the National Cancer Institute. The SEER Program has a mandate to collect cancer incidence, treatment, and survival data, which can be used to monitor the impact of cancer in the United States population. There are currently eleven SEER geographic areas that maintain population-based cancer reporting systems, including the states of Connecticut, Hawaii, Iowa, New Mexico, and Utah, and the metropolitan areas of Atlanta, Georgia, Detroit, Michigan, Los Angeles, San Francisco-Oakland, and San Jose-Monterey, California and Seattle-Puget Sound, Washington. These regions cover about 14% of the total United States population and were selected to provide information from diverse population subgroups such as various racial and ethnic groups as well as urban and rural residents. Data used for this report are primarily from the nine standard SEER geographic areas for the period 1973-1995. Data from two more recently added registries, San Jose-Monterey and Los Angeles, California, were available only for the period 1988-1995 and are included in some analyses as indicated.

Cancer Trends

The primary measures associated with assessing the impact of cancer in the general population are the number of new cases per year per 100,000 persons (incidence rate), the number of deaths per year per 100,000 persons (mortality rate), and a determination of the proportion of patients alive at some point subsequent to the diagnosis of their cancer (relative survival rate). All three measures are included in this report. The incidence and mortality rates are age-adjusted to the 1970 United States standard population, unless otherwise specified. Age-adjustment minimizes the effect of differences in age distributions when comparing rates between two or more populations or between two or more time periods in the same population. This report includes incidence, mortality and relative survival data from 1973 through 1995.

Eligible Cancer Cases

All newly diagnosed prostate cancer cases (ICD-O-1 site code 185.9 and ICD-O-2 C61.9) who were residents of the defined geographic regions covered by the SEER

registries were abstracted and entered into the SEER database. (An internal SEER audit of hospital reporting from 1991 indicated that the incidence data for all cancer sites were 98 to 99 percent complete.) Data items collected include: demographic information, primary site, tumor histology, tumor behavior (in situ, invasive), tumor grade or differentiation, diagnostic confirmation, extent of disease at diagnosis, and first course of cancer-directed therapy. All incident prostate cancer cases remain under lifetime surveillance for survival.

For the purposes of this monograph, only newly diagnosed invasive cases of adenocarcinoma (histology codes 8010, 8140-8570) of the prostate (n=284,925) were considered eligible for inclusion, representing 98.7 % of the 288,539 available cases diagnosed during 1973-1995. In addition, cases that were not microscopically confirmed (n=8,731) and those that were diagnosed only by autopsy or on a death certificate (n=3,505) were excluded, leaving 272,689 patients for analysis. The distributions of these incident cases by age and race are shown in Figure 1.2 and Table 1.1. Overall, 83.8% of cases are white and 10.3% are black. Across all races shown in Table 1.1, 4.2% of cases are of Hispanic origin.

Mortality Data

A public use tape containing information on all deaths occurring in the United States by calendar year is obtained annually from the National Center for Health Statistics (NCHS). Information on each death includes age at death, sex, geographic area of residence, underlying and contributing causes of death. Only the underlying cause of death was used in the calculation of mortality rates. Numbers and mortality rates for the total U.S. and for the SEER geographic areas were obtained from these tapes.

Figure 1.2
Prostate Cancer Cases
Distribution by Age
SEER Program*, 1973-1995

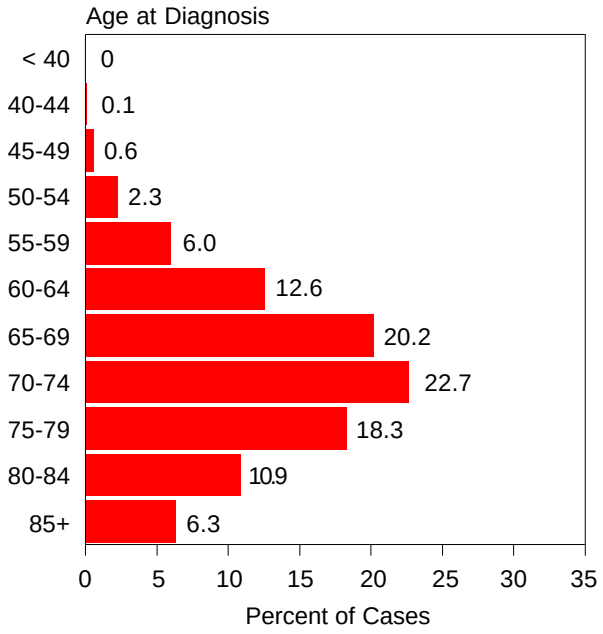


Table 1.1
Prostate Cancer Cases
Distribution by Race
SEER Program*, 1973-1995

Race	Number	Percent
White	228,602	83.8
Black	28,172	10.3
Asians	9,721	3.6
Japanese	3,489	1.3
Filipino	3,014	1.1
Chinese	1,880	0.7
Hawaiian	594	0.2
Korean	158	0.1
Other Asian	586	0.2
Native American	466	0.2
Other race	390	0.1
Unknown	5,338	2.0
Total	272,689	100.0

* Data from San Jose-Monterey and Los Angeles used only for 1988-1995.

Population Data

Population estimates were obtained from the U.S. Bureau of the Census. Estimates of the populations of U.S. counties were obtained by five-year age group (0-4, 5-9,..., 85 and over), sex, and race (white, black, other) for each year as of July 1.

Explanation of Terms

Several measures for assessing the impact of prostate cancer in the general population are used in this report. The following definitions are presented to clarify their meaning.

The cancer **incidence rate** is the number of new cancers of the prostate diagnosed in a specified population during a defined time period such as a year, expressed as the number of cancers per 100,000 men. Except for five-year age-specific rates, all incidence rates are age-adjusted to the 1970 U.S. standard population.

The prostate cancer **mortality rate** is the number of deaths with prostate cancer given as the underlying cause of death occurring in a specified population during a defined time period such as a year, expressed as the number of deaths due to prostate cancer per 100,000 men. Except for age-specific rates, all mortality rates are age-adjusted to the 1970 U.S. standard population.

An **age-adjusted rate** is a weighted average of the age-specific cancer incidence (or mortality) rates, where the weights are the proportions of persons in the corresponding age groups of a standard population. Age-adjustment allows direct comparison of cancer incidence or mortality rates between two or more years in the same population or between two or more populations with different age structures. For this report, the 1970 United States standard million population is used in computing all age-adjusted rates.

The **observed survival rate** is obtained using standard life table procedures and represents the proportion of prostate cancer patients surviving for a specified length of time after diagnosis.

The **relative survival rate** is the ratio of the observed survival rate to the expected survival rate for a patient cohort. The expected rate is based on mortality rates for the total population taking into account, as appropriate, the age, sex, race, and calendar year of diagnosis of the patients. It is assumed that the presence of cancer is the only factor which distinguishes the cancer patient cohort from the general population, with the relative survival rate indicating the probability that patients will escape death due to causes associated with their diagnosed cancer.

Stage of disease at diagnosis of prostate cancer is defined as follows: **Localized** - an invasive neoplasm confined entirely to the prostate. **Regional** - a neoplasm that has directly extended beyond the limits of the prostate capsule into surrounding organs or tissue; into regional lymph nodes, or both. **Distant** - a neoplasm that has spread to parts of the body remote from the primary prostate tumor, i.e., metastatic. **Unstaged** - information is not sufficient to assign a stage. For prostate cancer, SEER records the best available information on stage of disease as it appears in the medical record within two months of diagnosis. No distinction is made between clinical or pathological stage. Surgically treated cases undergoing radical prostatectomy may be reclassified from clinically localized to regional stage disease

based on the more accurate information obtained from the operative or pathology report. Since this does not occur with other therapies (i.e., radiation or hormonal treatments), it presents a problem of selective upstaging. To evaluate how this problem may affect trends by stage of disease, cases undergoing radical prostatectomy with stage coded as regional disease were re-coded as clinically localized disease for some analyses.

The **histologic grade** or degree of differentiation of malignant prostatic tumors is coded as well differentiated (corresponding to Gleason score 2-4), moderately differentiated (Gleason 5-7), poorly differentiated or undifferentiated (Gleason 8-10), or unknown grade.

Treatment is the first course of cancer-directed treatment that is administered or planned within four months of the initial course of therapy as recorded in the medical records. The primary source of treatment information is the hospital medical record. Only treatment data for 1983-1995 are included since these are the only years during which a consistent coding scheme was used for site-specific surgery. Treatment data were classified according to the following hierarchy: radical prostatectomy (alone or with radiation, hormone therapy, or chemotherapy), radiation therapy (alone or with hormone therapy or chemotherapy), hormone therapy (alone or with chemotherapy), other treatments, and no treatment.