Cancer in North America, 1996-2000
Executive Summary

Cancer Incidence in the United States

Coverage

NAACCR's combined incidence rates for the United States represent the experience of 68 percent of the U.S. population, including 68 percent of Whites, 61 percent of Blacks, and 81 percent of people of other races. The latest annual aggregation of timely, accurate, and complete cancer case reports from 29 states and five metropolitan areas provides a unique opportunity to analyze differentials in the burden of cancer incidence throughout the nation.

The five most common cancers in the U.S. are cancers of the breast, prostate, lung, colon-rectum, and bladder. These cancers represent 61 percent of all cancers diagnosed annually. Fortunately, the burden of these cancers in the United States may be reduced with the systematic application of proven interventions. For example, most cancers of the lung and about half of the cancers of the bladder may be prevented by avoiding exposure to tobacco smoke. Other cancers of the bladder may be prevented by protecting workers from carcinogens in the workplace by systematically complying with OSHA regulations. Cancers of the colon-rectum may be prevented with careful attention to family history of disease and the systematic application of sigmoidoscopy and colonoscopy. (Cancerous tumors are actually *prevented* by removing pre-cancerous polyps from the colon during these procedures.) The regular use of sigmoidoscopy, colonoscopy, and stool tests according to current recommendations also results in the earlier treatment of existing cancers, and has been shown to prevent deaths from cancers of the colon-rectum among diverse study populations participating in clinical trials. Finally, the effect of regular use of the digital rectal examination and the prostatic-specific-antigen (PSA) test on deaths from prostate cancer is the subject of ongoing clinical trials.

Age-adjustment

In the analysis of cancer differentials across populations, the age-adjusted incidence rate is clearly the workhorse among cancer statistics because of its ability to control for the effect of age on cancer incidence across populations with different age structures. Incidence rates for the United States have been computed using the traditional (1970) and new (2000) U.S. standard populations. The traditional (1970) standard has been used to facilitate longitudinal comparisons with previously published age-adjusted cancer incidence rates computed for the 1970s, 1980s, and 1990s. The new (2000) standard has been used to facilitate cross-sectional comparisons for 1996-2000 among contemporary populations. The 2000 U.S. standard population was recently adopted by the U.S. government for the calculation of age-adjusted rates because it is closer in age structure to many contemporary U.S. sub-populations than earlier standards, a desirable characteristic in the selection of a standard population for age-adjustment. In the 30 years between 1970 and 2000 the United States population aged considerably. As a result, the U.S. 2000 standard population is weighted more heavily in those decades of life when cancer is more common, *and the resulting age-adjusted incidence rates are substantially higher (~20 percent) than those computed with the 1970 standard*. Readers are cautioned to keep this in mind when comparing age-adjusted incidence rates across these two standard populations.

Differentials by Sex, Race, and Ethnicity

Age-adjusted incidence rates have been computed by sex, race, and Hispanic ethnicity. Constructing age-adjusted incidence rates by sex is not only important for the proper calculation of sex-specific cancers such as cancers of the uterine cervix and prostate, but also because sex differentials in age-adjusted cancer incidence rates reveal clues about differences between the sexes in behaviors and experiences relevant to cancer control, such as smoking, diet and obesity, sun exposure, and acceptance of screening recommendations. In a similar vein, racial and ethnic differentials in age-specific cancer incidence reveal clues about differences among various sub-populations in their access to cancer control interventions, such as cancer prevention information, access to primary care (where much cancer prevention education occurs and where most cancer screening recommendations are made), and access to specialized screening services such as colonoscopy. Monitoring sex, race, and ethnic differentials in age-adjusted cancer incidence over time helps us evaluate the cancer control interventions developed in recent years expressly to eliminate these "disparities".

The age-adjusted incidence rate for all cancers combined is a full third higher among men than women in the United States. Much of this differential is attributable to higher levels of tobacco use among men in past decades. If cancers associated with tobacco use (cancers of the buccal cavity, pharynx, larynx, esophagus, lung, bladder, kidney, pancreas, and others) are removed from the aggregate, the disparity between men and women is reduced substantially.

Blacks suffer disproportionately from cancer of the prostate, cancers related to use of tobacco (cancers of the buccal cavity, pharynx, larynx, esophagus, lung), and cancers of the liver and stomach. The reason for the prostate cancer differential is unknown, but Black men tend to get prostate cancer earlier, on average, than White men, and prostate cancer is more aggressive in younger men (men in their 40s and 50s) than older men. The reason for the tobacco-cancer differential is complicated, and is the subject of considerable recent study. Blacks do not initiate smoking at higher rates than Whites. The reverse is actually true. White teens are much more likely to begin smoking regularly than Black teens, a phenomenon that has been well documented in national studies of high school students. However, later in life, during early adulthood and middle age, Whites are more likely to quit smoking than Blacks, and therefore tend to have shorter smoking histories (“pack-years” of smoking) than Blacks. Furthermore, Blacks are more likely to smoke mentholated cigarettes than Whites. Mentholated cigarettes have qualities that may lead to a higher likelihood of lung cancer than non-mentholated brands.

Like Blacks, Asians and Pacific Islanders also suffer disproportionately from cancers of the liver and stomach. These cancers are much more common in developing countries than in the United States. Liver cancer may be caused by forms of hepatitis and parasitic diseases that are much more common in developing countries than in the developed world. Stomach cancer may be caused by forms of food preservation (like heavy salting) that are more commonly used in areas without refrigeration. It is believed that many of the liver and stomach cancers thus found originated with infections and exposures in countries from which Blacks, Asians, and Pacific Islanders recently emigrated. Some of the stomach cancers may also have been caused by diets heavy in old-fashioned preservatives (like salt) retained after immigration to the United States.

Whites suffer disproportionately from several cancers, notably cancers of the breast, bladder, brain and central nervous system, leukemias, lymphomas, and melanoma of the skin. Little is known about the causes of these differentials, except for cancers of the breast and melanomas of the skin. Cancers of the breast seem to be more common in nulliparous women and women who delay child bearing, practices more common among Whites than Blacks in the United States. White women may also have been screened more aggressively than Black women for breast cancer in the last decade, resulting in more of a short-term rise in breast cancer incidence (a "screening effect") for White women than Black women. Melanomas of the skin, caused almost exclusively by excessive sun exposure, is much more prevalent among fair skinned people than dark skinned people.

Differentials by State or City of Residence

Large incidence differentials are observable across states and municipal areas. Although a proportion of these differentials may be attributable to factors elusive of cancer control interventions in the United States, such as recent immigration (by which cancer risk histories or cancers themselves are "imported" from other places) and racial differentials (which might affect the incidence of early and aggressive prostate cancer, for example), many are due to differential behaviors and health care practices that may be replicated from one state to the next. Thus geographic differentials in the United States suggest possibilities for cancer control based on "best practices" and should be studied by cancer control planners. Care must be taken, however, in the selection of desirable outcomes on the basis of incidence rates. For example, states with low age-adjusted colo-rectal cancer incidence rates are probably those in which systematic colo-rectal cancer screening has been more firmly established, and should be studied to confirm higher rates of screening and to reveal those factors that led to higher rates of screening. However, one would look to states with high age-adjusted breast cancer incidence rates for the same purpose, because in the latter case, screening tends to increase the breast cancer incidence rate, by finding "occult" breast tumors earlier, while in the former case, screening tends to decrease the colo-rectal cancer incidence rate, by finding and facilitating the removal of adematous polyps before they develop into malignant neoplasms.

Children and Adolescents

For the second year in a row, special sets of rates have been constructed for children and adolescents. Doing so allows us to focus on the particular cancers that are common early in life but not throughout the lifespan, and that otherwise might get lost in the shadow of cancers common later in life.

The five most common cancers among children ages 0-9 in the U.S. are leukemias, cancers of the central nervous system, lymphomas, cancers of the sympathetic nervous system, and soft tissue sarcomas. These five cancer types represent 78 percent of all cancers in children.

Among adolescents ages 15-19 the five most common cancers are lymphomas, germ cell tumors, leukemias, cancers of the central nervous system, and cancers of bone. These five cancer types represent 69 percent of all cancers in adolescents.

Cancer Mortality in the United States

Coverage

NAACCR's combined death rates for the United States represent the experience of 100 percent of the U.S. population. The five most common causes of cancer deaths in the U.S., cancers of the lung, colon-rectum, breast, prostate, and pancreas, cause 58 percent of all cancer deaths annually. Of these five, cancers of the lung, colon-rectum, and breast are all controllable with prevention or screening efforts, and a fourth, cancer of the prostate, may yet prove to be controllable with screening:

Cancer	Control Technique	Potential Mortality Reduction
Lung	Avoid tobacco smoke	More than 90 percent
Colon-rectum	Screening ages 50+ and high risk	Close to 100 percent
Breast	Screening ages 40+ and high risk	More than 30 percent
Prostate	Screening ages 50+ and high risk	Unknown

Age-adjustment

Cancer death rates for the United States have been computed using the traditional (1970) and new (2000) U.S. standard populations. The U.S. 2000 standard population is weighted more heavily in those decades of life when cancer death is more common, *and the resulting age-adjusted cancer death rates are substantially higher (~25 percent) than those computed with the 1970 standard*. Readers are cautioned to keep this in mind when comparing age-adjusted death rates across these two standard populations.

Differentials by Sex, Race, and Ethnicity

Age-adjusted cancer death rates have been computed by sex, race, and Hispanic ethnicity. Although differentials in age-adjusted cancer death rates are similar to differentials in age-adjusted cancer incidence rates, the correlations are not perfect, because disparities in cancer causation and prevention, on the one hand, may not be related to disparities in cancer screening and treatment, on the other. Thus, a judicious comparison of the two sets of age-adjusted rates (incidence versus mortality) is suggested, to tease the two sets of disparities apart. One approach to this analysis involves the computation of incidence-to-mortality (I/M) rate ratios using similarly constructed age-adjusted incidence and death rates. I/M rate ratios have been used extensively as crude but helpful proxies for case fatality, and thus help reveal potential disparities in the delivery of cancer screening and treatment to sub-populations. Interpreting incidence-to-mortality comparisons, including use of the I/M rate ratio, is useful in hypothesis generation, but should be followed with more detailed and specific analyses for the proper interpretation of the differentials thus found. Two examples are presented to illustrate the potential for hypothesis generation by using NAACCR combined rates, focusing on racial differentials in cancer of the female breast and cancer of the cervix.

Population	Cancer	Incidence Rate*	Death Rate*	I/M Ratio
Black females	Breast	112.6	35.9	3.1
White females	Breast	134.1	27.2	4.9
Black females	Cervix	14.6	5.9	2.5
White females	Cervix	9.4	2.7	3.5

* Age-adjusted to the U.S. 2000 standard and expressed as cases or deaths per 100,000 population.

Example 1; Cancer of the Female Breast: In the U.S., White women are 19 percent more likely to develop invasive breast cancer than Black women. As discussed previously, this differential is believed to be related to differences in patterns of childbearing, White women being more likely than Black women to delay childbearing

and to remain childless into middle age. However, Black women are 32 percent more likely to die from breast cancer than White women. Thus, superficially, breast cancer appears to be a more fatal for Black women (I/M = 4.9) than White women (I/M = 3.1). Why is this? It has been hypothesized that Black women may have less access to breast cancer screening than White women, and are therefore more likely to be diagnosed later in the course of disease, when it is likely to be fatal. A careful review of age-adjusted, stage-specific cancer incidence rates would be useful in testing this hypothesis. It has also been hypothesized that Black women may have less access to state-of-the-art breast cancer treatment than White women, and are therefore more likely to develop metastatic illness and to experience faster courses of metastatic illness. A careful review of age-adjusted, stage-specific cancer death rates would be useful in testing this hypothesis.

Example 2; Cancer of the Cervix: In the U.S., Black women are 55 percent more likely to develop invasive cancer of the cervix than White women. This differential is believed to be related to differences in screening, Black women being less likely than White women to be screened for cancer of the cervix according to national guidelines. Black women are also 219 percent more likely to die from cancer of the cervix than White women. Does one differential explain the other, or does the higher I/M rate ratio for White women (3.5 versus 2.5 for Black women) suggest as well that invasive cervical cancer is more fatal for White women than Black women? What would explain this observation? Are Black women receiving better care for cervical cancer than White women, or are the fewer (proportionately) White women who develop invasive cervical cancer more likely to be diagnosed at later stages of disease than Black women who develop invasive cervical cancer? A careful review of age-adjusted, stage-specific cancer death rates would be useful in answering this question.

Differentials by State or City of Residence

Large mortality differentials are observable across states and municipal areas. Generally, they are believed to be explained by the underlying differentials in cancer incidence discussed previously, and thus may also be used to explore differential behaviors and health care practices that may be replicated from one state to the next.

Cancer Mortality in Canada

Coverage

NAACCR's combined death rates for Canada represent the experience of 95 percent of the Canadian population, and mirror the experience of the U.S. population closely. The five most common causes of cancer deaths in Canada, cancers of the lung, colon-rectum, breast, prostate and pancreas, cause 58 percent of all cancer deaths annually. Of these five, cancers of the lung, colon-rectum, and breast are all controllable with prevention or screening efforts, and a fourth, cancer of the prostate, may yet prove to be controllable with screening (as discussed above).

Age-adjustment

Cancer death rates for Canada have been computed using the 1996 Canadian standard population and the 2000 U.S. standard population. The latter was used to facilitate comparison with analogous cancer death rates for the United States.

Differentials by Sex

Age-adjusted cancer death rates have been computed by sex. In Canada, men suffer disproportionately from cancer, generally. The age-adjusted cancer death rate for all cancers combined is a full third higher among men than women in Canada. Much of this differential is attributable to higher levels of tobacco use among men in past decades. If cancers associated with tobacco use (cancers of the buccal cavity, pharynx, larynx, esophagus, lung, bladder, kidney, pancreas and others) are removed from the aggregate, the disparity between men and women is reduced substantially.

Differentials by Province

Large mortality differentials are observable across provinces, and similar to U.S. data, may be used to explore differential behaviors and health care practices that may be replicated from one province to the next.

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CANCER IN NORTH AMERICA, 1996-2000

VOLUME TWO: MORTALITY

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VOLUMES ONE & THREE: NAACCR COMBINED CANCER INCIDENCE, 1996 - 2000

UNITED STATES:

Data from 34 central cancer registries (29 states and 5 metropolitan areas) met the NAACCR criteria for inclusion the NAACCR U.S. combined cancer statistics. The 29 states were Alaska, Arizona, California, Colorado, Connecticut, Florida, Hawaii, Idaho, Illinois, Iowa, Kentucky, Louisiana, Michigan, Minnesota, Montana, Nebraska, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, Utah, Washington, West Virginia, Wisconsin, and Wyoming. The 5 metropolitan areas were the Greater Bay Area (California), Los Angeles (California), Atlanta (Georgia), Detroit (Michigan), and Seattle (Washington). To meet the criteria, each registry was required to submit five years (1996-2000) of data. Data from each single year of all five years had to pass rigorous criteria for completeness of reporting, non-duplication of records, internal consistency among data items, and low percentage of death-certificate-only cases and cases with missing/unknown race, age, or county. If data from a metropolitan area and its state both met the criteria, only state data were used. Data for the NAACCR U.S. combined cancer incidence statistics cover 68.0% of the total U.S. population, 68.4% of whites, 60.9% of blacks, and 80.6% of all other races combined.

A total of 4,423,130 cancers (all invasive and bladder in situ) were diagnosed in the NAACCR U.S. combined areas in the 5-year period (1996-2000), averaging 884,626 cancers per year or 2,424 per day. A little over half of these cancers occurred in males (51%); slightly less than half (49%) occurred in females.

Common Cancers

- **All races and both sexes combined.** For all races and both sexes combined, the five most commonly diagnosed cancers in the NAACCR U.S. combined areas were cancers of the breast (133,715 cancers per year), prostate (129,653), lung (129,454), colon and rectum (105,829), and bladder (41,188).

- **Female breast cancer.** Breast cancer was the most commonly diagnosed cancer among females for all race groups. It accounted for approximately one third of female cancers among whites (31% of all cancers among white females), blacks (30%), Chinese (28%), Filipinos (36%), and Japanese (34%). The percentage of breast cancer was lower among Vietnamese (23%), Koreans (23%), and American Indians/Alaska Natives (AI/AN) (26%) than that among other race groups.

- **Prostate cancer.** Prostate cancer was the most commonly diagnosed cancer among males for whites (28% of all cancers among white males), blacks (36%), Filipinos (29%), Japanese (27%), Chinese (20%), and AI/AN (20%). It was the third most commonly diagnosed cancer among Vietnamese (13%) and the fourth among Koreans (12%). The percentages for prostate cancer varied greatly by race group.

- **Lung cancer.** For males, lung cancer was the second most commonly diagnosed cancer among whites (16% of all cancers among white males), blacks (18%), Filipinos (19%), Chinese (16%), and AI/AN (18%). It was the most commonly diagnosed cancer among Vietnamese (19%), and Koreans (16%) and the third among Japanese (13%). For females, lung cancer was also one of the top five most commonly diagnosed cancers among all race groups. It accounted for 13% of all female cancers among whites, 13% among blacks, 8% among Filipinos, 9% among Japanese, 11% among Chinese, 9% among Vietnamese, 9% among Koreans, and 12% among AI/AN. The percentages for lung cancer were lower for females than for males among all race groups.

- **Colorectal cancer.** For males, colorectal cancer was the third most commonly diagnosed cancer among whites (12% of all cancers among white males), blacks (10%), Filipinos (13%), Chinese (15%), Koreans (15%), and AI/AN (13%). It was the second most commonly diagnosed male cancer among Japanese (19%) and the fourth among Vietnamese (11%). For females, colorectal cancer was the second most commonly diagnosed cancer among blacks (13%), Filipinos (9%), Japanese (16%), Chinese (15%), Vietnamese (10%), and Koreans (12%) and the third among whites (12%) and AI/AN (11%). The variation in percentages for colorectal cancer among race/sex groups was small.

- **Bladder cancer.** Although bladder cancer was the fifth most commonly diagnosed cancer for all races and both sexes combined, it was one of the five most commonly diagnosed cancers only among white males (7% of all cancers among white males) and Japanese (5%). Bladder cancer was not one of the five most commonly diagnosed cancers among any race group for females.

- **Liver cancer.** For males, liver cancer was one of the five most commonly diagnosed cancers only among Vietnamese (14% of all male cancers among Vietnamese), Koreans (10%), Chinese (8%), and Filipinos (4%). It was not one of the five most commonly diagnosed cancers among other race groups for males or among any race group for females.

- **Stomach cancer.** Stomach cancer was the second most commonly diagnosed cancer among Korean males (15% of all cancers among Korean males). Although it was also one of the five most commonly diagnosed cancers among Japanese (8%), Chinese (6%), Vietnamese (7%), and AI/AN (4%) for males, the percentages were smaller for these race groups than for Korean males. Stomach cancer was not one of the five most commonly diagnosed cancers among any race group for females except Koreans (10% of all cancers among Korean females) and Japanese (5%). It was the third most commonly diagnosed cancer among Korean females and the fifth among Japanese females.

- **Cervical cancer.** Vietnamese women had the highest percentage (9% of all cancers among Vietnamese women) of cervical cancer than any other race group. Although cervical cancer was one of the five most commonly diagnosed cancers among blacks (4%) and Koreans (6%), the percentages for these race groups were lower than that for Vietnamese women.

- **Hispanic Ethnicity (any race).** An average of 21,174 cancers were diagnosed among Hispanic males and 21,070 cancers among Hispanic females in each of the five years (1996-2000) in the NAACCR U.S. combined areas. The five most commonly diagnosed cancers among Hispanic males were cancers of the prostate (27% of all cancers among Hispanic males), colon and rectum (12%), and lung (11%), non-Hodgkin's lymphoma (6%) and bladder cancer (4%). The five most commonly diagnosed cancers among Hispanic females were cancers of the breast (29% of all cancers among Hispanic females), colon and rectum (11%), lung (7%), cervix (6%), and uterine corpus (including uterus, NOS) (6%).

Average Annual Age-adjusted Cancer Incidence Rates

This is the second *Cancer in North America* monograph that presents cancer incidence rates adjusted to the 2000 U.S. population standard in conformity with the policy set by the United States government in 1998. For all cancers combined, incidence rates adjusted to the 2000 U.S. population standard were approximately 20% higher than incidence rates adjusted to the 1970 U.S. population standard among the major race/sex groups. However, for specific cancer types and geographic areas, the rates adjusted to the 2000 U.S. population standard were higher than those adjusted to the 1970 U.S population standard by varying percentages. Rates based on fewer than 16 cases were not used for the following comparisons.

Comparisons of incidence rates by race/sex group

- **Higher incidence rate for all cancers combined among males than among females.** Overall, the age-adjusted (2000 U.S.) incidence rate for all cancers combined was approximately 33% higher among males (560.0 per 100,000) than among females (419.9 per 100,000). However, the male/female rate ratios varied greatly by race group: 30% among whites (551.5 per 100,000 for males and 424.7 per 100,000 for females) and 67% among blacks (647.0 per 100,000 for males and 387.9 per 100,000 for females).

- **Higher incidence rate for all cancers combined among blacks than among whites for males but not for females.** The age-adjusted (2000 U.S.) incidence rate for all cancers combined was 17% higher among black males (647.0 per 100,000) than among white males (551.5 per 100,000). In contrast, the

rate among black females (387.9 per 100,000) was 9% lower than the rate among white females (424.7 per 100,000).

- **Higher incidence rates for specific cancer types among blacks than among whites.** The age-adjusted (2000 U.S.) incidence rates were higher among black males than among white males for cancers of the prostate (57% higher), lung (30%), buccal cavity and pharynx (27%), esophagus (63%), stomach (82%), liver (70%), pancreas (32%), and larynx (61%) and multiple myeloma (97%). The age-adjusted (2000 U.S.) incidence rates among black females were also higher than the rates among white females for cancers of the esophagus (1.0 time higher), stomach (1.1 times), liver (58%), pancreas (44%), larynx (53%), and multiple myeloma (1.3 times). In addition, the rates were also higher among black females than among white females for cancers of the cervix (55% higher) and colon and rectum (12%). The rates for cancers of the lung and buccal cavity and pharynx were similar among white females and black females.

- **Higher incidence rates for specific cancer types among whites than among blacks.** Although the overall age-adjusted (2000 U.S.) cancer incidence rates were higher among blacks than among whites, the rates for some specific cancer types were higher among whites than among blacks. For males, the rates were higher among whites than blacks for cancers of the bladder (1.2 times higher) and brain and other nervous system (79%), non-Hodgkin's lymphoma (34%), leukemias (35%), and melanoma of the skin (16 times). For females, besides cancers of the bladder (48% higher) and brain and other nervous system (67%), and non-Hodgkin's lymphoma (51%), leukemia (29%), and melanoma of the skin (13 times), incidence rates were also higher for cancers of the breast (19% higher), uterine corpus (including uterus, NOS) (33%), and ovary (52%).

Geographic variations in cancer incidence rates

Age-adjusted incidence rates varied widely by geographic area. These variations could relate to cancer risks, the prevalence of cancer screening, and other factors. Rates based on fewer than 16 cases were not used for the following comparisons.

- **Geographic variations in incidence rates for all cancers combined by race/sex group.** The age-adjusted (2000 U.S.) incidence rates for all cancers combined varied among the NAACCR U.S. combined areas. Arizona had the lowest rate for white males (473.9 per 100,000) and Rhode Island had the highest rate for white males (641.8 per 100,000). For white females, Seattle in Washington (467.3 per 100,000) and Rhode Island (467.1 per 100,000) had the highest rates. The highest rate was approximately 35% higher than the lowest rate for both white males and white females. The geographic variations in rates were much larger among blacks than among whites for both males and females. Among black males, rates ranged from a low of 449.3 per 100,000 in Hawaii to a high of 1,053.4 per 100,000 in Montana. Among black females, rates varied from a low of 224.2 per 100,000 in Utah to a high of 447.5 in Kentucky. The highest was 2.3 times the lowest for black males and almost 2.0 times for black females.

- **Geographic variations in incidence rates for female breast cancer by race.** For white females, the Greater Bay Area in California had the highest age-adjusted (2000 U.S.) incidence rate (155.7 per 100,000) among the NAACCR U.S. combined areas. This rate was 31% higher than the lowest rate (118.7 per 100,000), in Utah. For black females, Alaska had the highest breast cancer incidence rate (147.6 per 100,000), which was 64% higher than the lowest rate (89.8 per 100,000), in Rhode Island.

- **Geographic variations in incidence rates for prostate cancer by race.** Arizona had the lowest prostate cancer incidence rate (2000 U.S.) among the NAACCR U.S. combined areas for white males (126.4 per 100,000). This rate was 35% lower than the highest rate (195.6 per 100,000), in Detroit in Michigan. For black males, Detroit also had the highest prostate cancer incidence rate (316.2 per 100,000) and Arizona had the lowest rate (161.1 per 100,000). The highest rate was 2.0 times the lowest rate for black males.

- **Geographic variations in incidence rates for lung cancer by race/sex group.** Kentucky had the highest lung cancer incidence rates (2000 U.S.) for white males (138.3 per 100,000) and white females (68.1 per 100,000) while Utah had the lowest lung cancer rates for white males (41.8 per 100,000) and white females (22.2 per 100,000) among the NAACCR U.S. combined areas. The highest rate was 3.3 times the lowest for white males and 3.1 times for white females. Lung cancer incidence rates (2000 U.S.) varied from a low of 84.4 per 100,000 in New Mexico and Hawaii to a high of 152.0 per 100,000 in Kentucky for black males and from a low of 31.6 per 100,000 in New Mexico to a high of 80.5 per 100,000 in Kentucky for black females. The highest was 80% higher than the lowest for black males and almost 2.5 times the lowest for black females.

- **Geographic variations in incidence rates for colorectal cancer by race/sex group.** The age-adjusted (2000 U.S.) incidence rates for colorectal cancer also varied widely among the NAACCR U.S. combined areas. New Jersey had the highest rate for white males (79.6 per 100,000) and Rhode Island had the highest rate for white females (56.8 per 100,000). The lowest rates were 49.2 per 100,000 in Utah for white males and 36.2 per 100,000 in New Mexico for white females. The highest rate was 62% higher than the lowest rate for white males and 57% higher for white females. West Virginia had the highest rate for black males (92.6 per 100,000) and Kentucky had the highest rate for black females (68.4 per 100,000). Arizona had the lowest rate for black males (57.7 per 100,000) and New Mexico had the lowest rate black females (31.7 per 100,000). The highest rate was 60% higher than the lowest rate for black males and 2.2 times higher for black females.

- **Geographic variations in incidence rates for cervical cancer by race.** For white females, Los Angeles in California had the highest age-adjusted (2000 U.S.) rate (13.2 per 100,000) for cervical cancer among the NAACCR U.S. combined areas. This rate was 2 times the lowest rate (6.6 per 100,000), in Minnesota. In contrast, Florida had the highest cervical cancer incidence rate (18.5 per 100,000) among black females. The highest rate was 2.4 times the lowest rate (7.6 per 100,000) for black females, in Colorado.

- **Geographic variations in incidence rates for ovarian cancer by race.** Seattle in Washington had the highest age-adjusted (2000 U.S.) incidence rate for both white females (21.0 per 100,000) and black females (14.3 per 100,000) among the NAACCR U.S. combined areas. For white females, the highest rate was 50% higher than the lowest rate (14.0 per 100,000), in Louisiana. For black females, the highest rate was 2.5 times the lowest rate (5.8 per 100,000), in Arizona.

Cancers among Children (ages 0-14) and Adolescents (ages 15-19)

Common cancers among children and adolescents

- **All races and both sexes combined.** An average of 5,781 cancers were diagnosed among children and 2,640 cancers among adolescents in each of the five years (1996-2000) in the NAACCR U.S. combined areas. The five most commonly diagnosed cancers among children were leukemia (32% of all cancers among children), cancer of the central nervous system (21%), lymphoma (11%), cancer of the sympathetic nervous system (7%), and soft tissue sarcoma (7%). The five most commonly diagnosed cancers among adolescents differed from those among children. Lymphoma was the most commonly diagnosed cancer among adolescents, accounting for 25% of all cancers in this age group. Other commonly diagnosed cancers were germ cell tumors (14%), leukemia (13%), and cancers of the central nervous system (10%) and bone (7%).

- **Whites.** An average of 4,746 cancers were diagnosed among white children and 2,209 cancers among white adolescents in each of the five years (1996-2000) in the NAACCR U.S. combined areas. The five most commonly diagnosed cancers among white children were leukemia (32% of all cancers among white children), cancer of the central nervous system (21%), lymphoma (11%), cancer of the sympathetic nervous system (7%), and soft tissue sarcoma (7%). The five most commonly diagnosed cancers among

white adolescents differed from those among white children. Lymphoma was the most commonly diagnosed cancer among white adolescents, accounting for 25% of all cancers in this age group. Germ cell tumors (15%) were the second most commonly diagnosed cancer, followed by leukemia (13%), and cancer of the central nervous system (10%) and bone (7%).

- **Blacks.** An average of 637 cancers were diagnosed among black children and 256 cancers among black adolescents in each of the five years (1996-2000) in the NAACCR U.S. combined areas. The three most commonly diagnosed cancers among black children were leukemia (24% of all cancers among black children), cancer of the central nervous system (22%) and lymphoma (11%). Instead of cancer of the sympathetic nervous system, the fourth most commonly diagnosed cancer among black children was renal tumors (10%) and the fifth was soft tissue sarcoma (10%). The five most commonly diagnosed cancers among black adolescents differed from those among black children. Lymphoma was the most commonly diagnosed cancer among adolescents, accounting for 26% of all cancers in this age group. Other commonly diagnosed cancers were leukemia (14%), soft tissue sarcoma (12%), cancer of the central nervous system (11%) and germ cell tumors (11%).

Comparisons of cancer incidence rates among children (ages 0-14) and adolescents (15-19) by race/sex group.

Rates based on fewer than 16 cases were not used for the following comparisons.

- **Higher incidence rates among male children than among female children.** Overall, the age-adjusted (2000 U.S.) incidence rate for all cancers combined was 12% higher among male children (151.3 per million) than among female children (135.0 per million). The male/female rate ratios were about the same for white and black children. For most specific cancer types the age-adjusted (2000 U.S.) incidence rates were higher for male children than female children.

- **Higher incidence rates among female children than among male children.** For renal tumors and germ cell tumors, female children had higher incidence rates than male children.

- **Higher incidence rates for all cancers combined among whites than among blacks.** Unlike cancer incidence rates for all ages combined, the age-adjusted (2000 U.S.) incidence rates for all cancers combined among children were 38% higher for white males (157.4 per million) than for black males (113.7 per million) and 41% higher for white females (141.1 per million) than for black females (100.3 per million). Among adolescents, the rate was 53% higher for white males (217.8 per million) than for black males (142.8 per million) and 46% higher for white females (201.2 per million) than for black females (138.0 per million).

- **Higher incidence rates for renal tumors among blacks than among whites.** Although the age-adjusted (2000 U.S.) incidence rates for all cancers combined and most specific cancer types were higher among white children than among black children, the rate for renal tumors was 18% higher among black children than among white children for males and 29% higher for females. The rates were also higher among black adolescents than among white adolescents (42% higher in males and 1.8 times higher in females).

- **Higher incidence rates for all cancers combined among children aged 0-4 and adolescents (ages 15-19) than among those in the other two age groups.** Overall, age-specific incidence rates for all cancers combined were higher among children aged 0-4 and adolescents than among children aged 5-9 and aged 10-14. The same pattern was also seen among both whites and blacks.

VOLUME TWO: MORTALITY, 1996 - 2000

Mortality data for the fifty U.S. states, the District of Columbia, and five SEER metropolitan areas were obtained from the National Center for Health Statistics, via the National Cancer Institute. Mortality data for the ten Canadian provinces and two Canadian territories were provided by Statistics Canada.

- Age-adjusted (2000 U.S.) cancer death rates for all races were slightly higher in the United States (255.5 per 100,000 for males and 168.3 per 100,000 for females) than in Canada (243.2 per 100,000 for males and 160.1 per 100,000 for females).

UNITED STATES:

A total 2,723,650 persons in the U.S. died of cancer in the five-year period (1996-2000), averaging more than half a million (544,730) per year, or 1,492 per day. A little over half of the cancer deaths occurred among males (52%); slightly less than half (48%) occurred among females.

Common Cancers

- **All races and both sexes combined.** For all races and both sexes combined, the five leading causes of deaths from cancer in the United States were cancers of the lung (153,412 deaths per year), colon and rectum (57,015), breast (42,331), prostate (32,404), and pancreas (28,336).

- **Lung cancer.** For males, lung cancer was the leading cause of deaths from cancer for all races combined. It accounted for approximately one third of all cancer deaths among whites, blacks, and AI/AN and 26% among Asians/Pacific Islanders (Asian/PI). Lung cancer also accounted for 25% of the total cancer deaths among white females. The percentage of lung cancer deaths among white females was higher than that among black females (20%), AI/AN females (22%), and Asian/PI females (18%).

- **Prostate cancer.** Prostate cancer was the second leading cause of deaths from cancer among white males (11% of all cancer deaths among white males) and black males (17%), third among AI/AN males (9%), and fifth among Asian/PI males (6%). The percentage of prostate cancer deaths was much lower for Asian/PI males than that for any other race group.

- **Female breast cancer.** Breast cancer was the second leading cause of deaths from cancer among females for whites (16% of all cancer deaths among white females), blacks (19%), AI/AN (14%), and Asian/PI (14%). The percentage of deaths from breast cancer was higher among blacks than that among any other race group.

- **Colorectal cancer.** Colorectal cancer was the third leading cause of deaths from cancer for all races combined in both males and females. It accounted for approximately 10% to 12% of total cancer deaths among all race/sex groups.

- **Pancreatic cancer.** Pancreatic cancer was the fourth leading cause of cancer deaths among whites, blacks, and AI/AN for both males and females and among Asian/PI females. It accounted for approximately 5% to 6% of the total cancer deaths among these race/sex groups.

- **Ovarian cancer.** Ovarian cancer was the fifth leading cause of deaths from cancer among whites (5% of all cancer deaths among white females), blacks (4%), and AI/AN (4%). It was not one of the five leading causes of cancer deaths among any other race group.

- **Stomach cancer.** Stomach cancer accounted for 8% of deaths from cancer among Asian/PI males and 4% among black males. It was not one of the five leading causes of cancer deaths among other race/sex groups.

- **Hispanic origin (any race).** An average of 10,333 Hispanic males and 9,188 Hispanic females died of cancer in each of the five years (1996-2000). The five leading causes of deaths from cancer among Hispanic males were cancers of the lung (22% of all cancer deaths among Hispanic males), prostate (10%), colon and rectum (10%), liver (6%), and stomach (6%). Breast cancer was the most common cause of cancer deaths among Hispanic females, accounting for 17% of all female deaths from cancer. Other leading causes of deaths from cancer among Hispanic females were cancers of the lung (13%), colon and rectum (10%), pancreas (6%), and ovary (5%).

- **Non-Hispanic origin (any race).** An average of 271,513 non-Hispanic males and 250,791 non-Hispanic females died of cancer in each of the five years (1996-2000). The three leading causes of deaths from cancer among non-Hispanic males were the same as those among Hispanic males: cancers of the lung (32% of all cancer deaths among non-Hispanic males), prostate (11%), and colon and rectum (10%), but the percentage for lung cancer was much higher compared with that among Hispanic males (22%). The fourth and fifth leading causes of deaths from cancer among non-Hispanic males were pancreatic cancer (5%) and non-Hodgkin's lymphoma (4%). Unlike the order for Hispanic females, the leading causes of deaths from cancer for non-Hispanic females was lung cancer (24%), followed by cancer of the breast (16%). The third through fifth leading causes of cancer deaths were same as among Hispanic female - cancers of the colon and rectum (11%), pancreas (6%), and ovary (5%).

- **Cervical cancer.** An average of 4,357 women in the U.S. died of cervical cancer in each of the five years (1996-2000). With early detection and prompt treatment, nearly all of these deaths could have been prevented.

Average Annual Age-adjusted Cancer Death Rates

This is the second *Cancer in North America* monograph that presents cancer death rates adjusted to the 2000 U.S. population standard, in conformity with the policy set by the United States government in 1998. Death rates adjusted to the 2000 U.S. population standard were higher than those adjusted to the 1970 U.S. population standard. For all cancers combined, death rates adjusted to the 2000 U.S. population standard were about 23% to 30% higher than death rates adjusted to the 1970 U.S. population standard among the race/sex groups presented in this monograph. However, for specific cancer types and geographic areas, the rates adjusted to the 2000 U.S. population standard were higher by varying percentages. Rates based on fewer than 16 cases were not used for the following comparisons.

- **Higher death rates among males than among females.** Overall, the age-adjusted (2000 U.S.) death rate for all cancers combined was approximately 52% higher among males (255.5 per 100,000) than among females (168.3 per 100,000). However, the sex differences in the death rates varied by race group. The largest sex difference was seen among blacks. The rate for black males was 79% higher than the rate for black females. The smallest sex differences were seen among whites and AI/AN. The rates for males were approximately 49% higher than the rates for females among both whites and AI/AN.

- **Higher death rates for all cancers combined among blacks than among any other race group.** For all cancers combined, the age-adjusted (2000 U.S.) death rate among black males (356.2 per 100,000) was 43% higher than the rate among white males (249.5 per 100,000), 2.1 times the rate among AI/AN males (172.3 per 100,000) and 2.3 times the rate among Asian/PI males (154.8 per 100,000). The age-adjusted (2000 U.S.) death rate for all cancers combined among black females (198.6 per 100,000) was 19% higher than the rate among white females (166.9 per 100,000), 72% higher than the rate among AI/AN females (115.8 per 100,000), and 95% higher than the rate among Asian/PI females (102.0 per 100,000).

- **Higher death rates for specific cancer types among black males than among males in other race groups.** Deaths from cancers of the prostate, lung, colon and rectum, and pancreas accounted for much of the elevation in the death rate for all cancers combined among black males compared with the rates among males in other race groups. The age-adjusted (2000 U.S.) death rate for prostate cancer among

black males (73.0 per 100,000) was more than twice the rate among white males (30.2 per 100,000), more than three-fold the rate among AI/AN males (21.9 per 100,000), and more than five-fold the rate among Asian/PI males (13.9 per 100,000). In addition, age-adjusted (2000 U.S.) death rates were also higher among black males than among males in any other race group for cancers of the esophagus, stomach, larynx, and buccal cavity and pharynx. The death rate for liver cancer among black males was higher than the rates among white and AI/AN males only.

- **Higher death rates for specific cancer types among black females than among females in other race groups.** Cancers of the colon and rectum, breast, pancreas, and cervix accounted for much of theelevation in the death rate for all cancers combined among black females compared with the rates among females in other race groups. The age-adjusted (2000 U.S.) death rate for cancer of the cervix among black females (5.9 per 100,000) was more than twice the rates among white females (2.7 per 100,000), AI/AN females (2.9 per 100,000), and Asian/PI females (2.9 per 100,000). In addition, death rates were also higher among black females than those among females in any other race group for cancers of the esophagus, uterine corpus (including uterus NOS), and bladder. The death rate for stomach cancer among black females was higher than the rates among females in any other race group except Asians/PI.

- **Higher death rates for specific cancer types among whites than among other race groups.** The age-adjusted (2000 U.S.) death rates for cancer of the brain and non-Hodgkin's lymphoma were higher among whites than among any other race group for both males and females. The death rate for bladder cancer was higher among whites than among any other race group only for males.

- **Lower death rates for all cancers combined among Asian/PI than among other race groups.** For all cancers combined, the age-adjusted (2000 U.S.) death rate was 10% lower among Asian/PI males than among AI/AN males, 38% lower than among white males, and 57% lower than among black males. The rate among Asian/PI females was 12% lower than the rate among AI/AN females, 39% lower than the rate among white females and 49% lower than the rate among black females.

- **Higher death rates for cancers of the liver and stomach among Asian/PI than among other race groups.** The age-adjusted (2000 U.S.) death rate for liver cancer among Asian/PI males (14.1 per 100,000) was more than two times the rates among white males (4.9 per 100,000) and AI/AN males (6.1 per 100,000) and 1.7 times the rate among black males (8.4 per 100,000). The death rate for liver cancer among Asian/PI females (5.5 per 100,000) was 2.9 times the rate among white females (1.9 per 100,000), 1.7 times the rate among AI/AN females (3.3 per 100,000) and 1.8 times the rate among black females (3.0 per 100,000). The death rate for stomach cancer among Asian/PI males (12.5 per 100,000) was more than twice the rate among white males (6.1 per 100,000) and 1.8 times the rate among AI/AN males (7.0 per 100,000). For females, the death rate for stomach cancer among Asians/PI (7.4 per 100,000) was more 2.6 times the rate for white females (2.9 per 100,000), 1.1 times the rate for black females (6.5 per 100,000), and almost 2 times the rate for AI/AN females (4.2 per 100,000).

- **Higher death rates for all cancers combined among non-Hispanics than among Hispanics.** For all cancers combined, the age-adjusted (2000 U.S.) death rate among non-Hispanic males (258.5 per 100,000) was 47% higher than the death rate among Hispanic males (176.2 per 100,000). The death rate (2000 U.S.) for all cancers combined among non-Hispanic females (170.7 per 100,000) was 53% higher than the rate among Hispanic females (111.5 per 100,000).

- **Higher death rates for specific cancer types among non-Hispanics than among Hispanics.** The age-adjusted (2000 U.S.) death rates were higher among non-Hispanic males than those among Hispanic males for cancers of the lung (1 time higher), esophagus (66%), colon and rectum (43%), pancreas (34%), prostate (36%), and bladder (50%), and leukemia (53%). The age-adjusted (2000 U.S.) death rates among non-Hispanic females were also higher than the rates among Hispanic females for cancers of the esophagus (64% higher), colon and rectum (60%), pancreas (27%), lung (1.8 times), bladder (1 time), and kidney (22%), non-Hodgkin's lymphoma (29%), and leukemia (40%).

- **Higher death rates for stomach cancer and cervical cancer among Hispanics than among non-Hispanics.** The age-adjusted (2000 U.S.) death rate for stomach cancer was 49% higher among Hispanic males (10.0 per 100,000) than that among non-Hispanic males (6.7 per 100,000) and 69% higher among Hispanic females (5.4 per 100,000) than among non-Hispanic females (3.2 per 100,000). The age-adjusted (2000 U.S.) death rate for cervical cancer was 31% higher among Hispanic females than non-Hispanic females.

- **Geographic variations in death rates.** Cancer death rates by census division region and state showed geographic variations. In general, death rates for all cancers combined were highest in the East-South-Central Division and lowest in the Mountain Division.

CANADA:

The 2000 data for Quebec and the 1996 to 2000 data for Nunavut were not included in the Canadian mortality analysis. A total of 286,007 persons in Canada died of cancer during the five-year period (1996 - 2000), averaging about 57,201 per year, or 157 per day. More than half of the Canadian cancer deaths occurred among males (53%); slightly less than half (47%) occurred among females.

Common Cancers

- **All races and both sexes combined.** For all races and both sexes combined, the five leading causes of cancer deaths in Canada were cancers of the lung (15,074 deaths per year), colon and rectum (7,249), breast (4,683), prostate (3,474), and pancreas (2,826).

- **Sex difference.** An average of 30,565 Canadian males and 26,636 Canadian females died of cancer in each of the five years (1996-2000). The five leading causes of deaths from cancer among males were cancers of the lung (30% of the total cancer deaths among males), colon and rectum (12%), prostate (11%), and pancreas (5%), and non-Hodgkin's lymphoma (4%). The five leading causes of deaths from cancer among females were cancers of the lung (22%), breast (17%), colon and rectum (13%), pancreas (5%), and ovary (5%).

- **Cervical cancer.** An average of 401 Canadian women died of cervical cancer in each of the five years (1996-2000). Because of the widespread availability and proven efficacy of the Pap test and effective treatments for cancer of the cervix, deaths from cervical cancer are largely preventable.

Average Annual Age-adjusted Cancer Death Rates

Rates based on fewer than 16 cases were not used for the following comparisons.

- **Higher death rate among males than among females.** Overall, the age-adjusted death rate (1996 Canadian population) for all cancers combined was 52% higher among males (243.2 per 100,000) than among females (160.1 per 100,000).

- **Geographic variations in death rates.** In general, rates for all cancers combined were higher for eastern provinces (Quebec, Nova Scotia, Newfoundland, New Brunswick, and Prince Edward Island) than for western provinces (British Columbia and Alberta).

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Louisiana Tumor Registry

NAACCR

1996-2000

Participating Registries

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TABLE OF CONTENTS

SECTION I: Introduction and Technical Notes I-1

SECTION II: Registry-specific Cancer Mortality by Race and Sex,
Age-adjusted to the 2000 U.S. and 1970 U.S. Population Standards

UNITED STATES REGISTRIES

Alabama II-1
Alaska II-5
Arizona II-9
Arkansas II-13
California II-17
CA: Greater Bay Area II-21
CA: Los Angeles II-25
Colorado II-29
Connecticut II-33
Delaware II-37
District of Columbia II-41
Florida II-45
Georgia II-49
GA: Metropolitan Atlanta II-53
Hawaii II-57
Idaho II-59
Illinois II-63
Indiana II-67
Iowa II-71
Kansas II-75
Kentucky II-79
Louisiana II-83
Maine II-87
Maryland II-91
Massachusetts II-95
Michigan II-99
MI: Metropolitan Detroit II-103
Minnesota II-107
Mississippi II-111
Missouri II-115
Montana II-119
Nebraska II-123
Nevada II-127
New Hampshire II-131
New Jersey II-135
New Mexico II-139
New York II-143

North Carolina II-147
North Dakota II-151
Ohio II-155
Oklahoma II-159
Oregon II-163
Pennsylvania II-167
Rhode Island II-171
South Carolina II-175
South Dakota II-179
Tennessee II-183
Texas II-187
Utah II-191
Vermont II-195
Virginia II-199
Washington II-203
WA: Seattle/Puget Sound II-207
West Virginia II-211
Wisconsin II-215
Wyoming II-219

CANADIAN REGISTRIES

Alberta II-223
British Columbia II-225
Manitoba II-227
New Brunswick II-229
Newfoundland II-231
Northwest Territories II-233
Nova Scotia II-235
Ontario II-237
Prince Edward Island II-239
Quebec II-241
Saskatchewan II-243
Yukon II-245

SECTION III: Registry-specific Cancer Mortality by Sex, Age-adjusted to the 1996 Canadian and World Population Standards

UNITED STATES REGISTRIES

Alabama III-1
Alaska III-2
Arizona III-3
Arkansas III-4
California III-5
CA: Greater Bay Area III-6
CA: Los Angeles III-7

Contents

Colorado III-8
Connecticut III-9
Delaware III-10
District of Columbia III-11
Florida III-12
Georgia III-13
GA: Metropolitan Atlanta III-14
Hawaii III-15
Idaho III-16
Illinois III-17
Indiana III-18
Iowa III-19
Kansas III-20
Kentucky III-21
Louisiana III-22
Maine III-23
Maryland III-24
Massachusetts III-25
Michigan III-26
MI: Metropolitan Detroit III-27
Minnesota III-28
Mississippi III-29
Missouri III-30
Montana III-31
Nebraska III-32
Nevada III-33
New Hampshire III-34
New Jersey III-35
New Mexico III-36
New York III-37
North Carolina III-38
North Dakota III-39
Ohio III-40
Oklahoma III-41
Oregon III-42
Pennsylvania III-43
Rhode Island III-44
South Carolina III-45
South Dakota III-46
Tennessee III-47
Texas III-48
Utah III-49
Vermont III-50
Virginia III-51

Washington III-52
WA: Seattle/Puget Sound III-53
West Virginia III-54
Wisconsin III-55
Wyoming III-56

CANADIAN REGISTRIES
Alberta III-57
British Columbia III-58
Manitoba III-59
New Brunswick III-60
Newfoundland III-61
Northwest Territories III-62
Nova Scotia III-63
Ontario III-64
Prince Edward Island III-65
Quebec III-66
Saskatchewan III-67
Yukon III-68

SECTION IV: Cancer Mortality for the United States and Canada
United States
Populations for the United States IV-1
All Races (2000 U.S. and 1970 U.S. populations) IV-4
All Races (1996 Canadian and World populations) IV-5
Comparison of Selected Site-Specific Death Rates by Registry,
All Races, Males (2000 U.S. population) IV-6
All Races, Males (1970 U.S. population) IV-8
All Races, Females (2000 U.S. population) IV-10
All Races, Females (1970 U.S. population) IV-12
White (2000 U.S. and 1970 U.S. populations) IV-15
Comparison of Selected Site-Specific Death Rates by Registry,
White, Males (2000 U.S. population) IV-16
White, Males (1970 U.S. population) IV-18
White, Females (2000 U.S. population) IV-20
White, Females (1970 U.S. population) IV-22
Blacks (2000 U.S. and 1970 U.S. populations) IV-25
Comparison of Selected Site-Specific Death Rates by Registry,
Black, Males (2000 U.S. population) IV-26
Black, Males (1970 U.S. population) IV-28
Black, Females (2000 U.S. population) IV-30
Black, Females (1970 U.S. population) IV-32

Contents

American Indians/Alaska Natives (2000 U.S. and 1970 U.S. populations) IV-35
Asians/Pacific Islanders (2000 U.S. and 1970 U.S. populations) IV-36
Hispanic Ethnicity (2000 U.S. and 1970 U.S. populations) IV-37
Non-Hispanic Ethnicity (2000 U.S. and 1970 U.S. populations) IV-38

Canada
Populations for Canada IV-39
All Races (2000 U.S. and 1970 U.S. populations) IV-40
All Races (1996 Canadian and World populations) IV-41
Comparison of Selected Site-Specific Death Rates by Registry,
All Races, Males (2000 U.S. population) IV-42
All Races, Males (1996 Canadian population) IV-43
All Races, Females (2000 U.S. population) IV-44
All Races, Females (1996 Canadian population) IV-45

APPENDIX: SEER Site Groups for Mortality Data Based on ICD-9 and ICD-10 . . . . . A-1