# Cancer in North America, 1997-2001
# Executive Summary

## Cancer Incidence in the United States

### *Coverage*

NAACCR's combined incidence rates for the United States represent the experience of 54.7 percent of the U.S. population, including 54.5 percent of Whites, 51.3 percent of Blacks, and 67.6 percent of people of other races. The latest annual aggregation of timely, accurate, and complete cancer case reports from 28 states and five metropolitan areas provides a continuing opportunity to analyze differences in the burden of cancer incidence throughout the nation.

The five most common cancers in the U.S. are cancers of the prostate, breast, lung, colorectal, 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 cases of lung cancer and about half of all cases of bladder cancer may be prevented by avoiding exposure to tobacco smoke. Other cases of bladder cancer may be prevented by protecting workers from carcinogens in the workplace by systematically complying with OSHA regulations. Cases of colorectal cancer 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 colorectal malignancies, and has been shown to prevent deaths from colorectal cancer among diverse study populations participating in clinical trials. Mortality and morbidity from breast cancer are substantially decreased by early detection with state-of-the-art screening mammography used at intervals of two years or less. 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 differences 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 2000 U.S. standard population. 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.

### *Differences by Sex and Race*

Age-adjusted incidence rates have been computed by sex and race. 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 differences by sex 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 differences in age-specific cancer incidence reveal clues about differences among various subpopulations 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 differences by sex and race 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 more than a third (35 percent) higher among men than women in the United States. Much of this difference 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. The male disadvantage in cancer incidence is *much greater* among Blacks than Whites (70 percent higher incidence rates versus 31 percent higher incidence rates).

Blacks suffer disproportionately from cancer of the prostate, cancers related to use of tobacco (cancers of the buccal cavity, pharynx, larynx, esophagus, lung), cancers of the liver, stomach, and cervix, and multiple myeloma. The reason for the difference in prostate cancer rates 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 differences in tobacco-related cancer rates 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 is associated with excessive salt in the diet, diets deficient in fruits and vegetables, and infection with Helicobacter Pylori. 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.

Whites suffer disproportionately from several cancers, notably cancers of the breast, bladder, brain and central nervous system, corpus and uterus, leukemias, lymphomas, melanoma of the skin, and ovary. Little is known about the causes of these differences, 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.

*Differences by State or City of Residence*

Large differences in incidence rates are observable across states and municipal areas. Although a proportion of these differences may be attributable to factors exclusive 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 differences (which might affect the incidence of early and aggressive prostate cancer, for example), some are due to differential behaviorial interventions and health care practices that may be replicated from one state to the next. Thus geographic differences 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 colorectal cancer incidence rates are probably those in which systematic colorectal 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 colorectal cancer incidence rate, by finding and facilitating the removal of adenomatous polyps before they develop into malignant neoplasms.

*Children and Adolescents*

For the third 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 0-14 in the U.S. are leukemias, cancers of the brain and central nervous system, lymphomas, soft tissue sarcomas, cancers of the sympathetic nervous system, and neuroblastomas. These five cancer types represent 77 percent of all cancers in children.

Among adolescents ages 15-19 the five most common cancers are lymphomas, leukemias, germ cell tumors, cancers of the central nervous system, and cancers of bone. These five cancer types represent 70 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 | > 90 percent |
| Colon-rectum | Screening ages 50+ & high risk | ~ 100 percent |
| Breast | Screening ages 40+ & high risk | > 30 percent |
| Prostate | Screening ages 50+ & high risk | unknown |

*Age-adjustment*

Cancer death rates for the United States have been computed using the 2000 U.S. standard population.

*Differences by Sex and Race*

Age-adjusted cancer death rates have been computed by sex and race. Although differences in age-adjusted cancer death rates are similar to differences 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 mortality-to-incidence (M/I) rate ratios using similarly constructed age-adjusted death and incidence rates. M/I rate ratios have been used 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 mortality-to-incidence comparisons, including use of the M/I rate ratio, is useful in hypothesis generation, but should be followed with more detailed and specific analyses for the proper interpretation of the differences thus found. Two examples are presented to illustrate the potential for hypothesis generation by using NAACCR combined rates, focusing on racial differences in cancer of the female breast and cancer of the cervix.

| **Population** | **Cancer** | **Death Rate*** | **Incidence Rate*** | **M/I Ratio** |
|---|---|---|---|---|
| Black women | Breast | 35.4 | 110.8 | 0.32 |
| White women | Breast | 26.4 | 135.1 | 0.20 |
| | | | | |
| Black women | Cervix | 5.6 | 14.5 | 0.39 |
| White women | Cervix | 2.6 | 9.0 | 0.29 |

* 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 22 percent more likely to develop invasive breast cancer than Black women. As discussed previously, this difference 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 34 percent more likely to die from breast cancer than White women. Thus, superficially, breast cancer appears to be a more fatal disease for Black women (M/I = 0.32) than White women (M/I = 0.20). 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 exploring 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 exploring this hypothesis. (Construction of the latter at the state [central registry] level would require the merging of vital records [death] data with cancer registry [case] data, because only the latter have information on stage of disease at diagnosis. Nonetheless, as state registries mature, such procedures (e.g., merging of data sets) become more doable with less effort.)

**Example 2; Cancer of the Cervix:** In the U.S., Black women are 61 percent more likely to develop invasive cancer of the cervix than White women. This difference 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 215 percent more likely to die from cancer of the cervix than White women. Does one difference explain the other, or does the higher M/I rate ratio for Black women (0.39) versus White women (0.29) suggest as well that invasive cervical cancer is more fatal for Black women than White women? What would explain this observation? Are White women receiving better care for cervical cancer than Black women, or are White women who develop invasive cervical cancer more likely to be diagnosed at earlier 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 addressing this question.

*Differences by Ethnicity*

Hispanics have lower cancer mortality rates than non-Hispanics in the United States, but are more likely to die of stomach and cervical cancers than their non-Hispanic counterparts. The latter cancer profile is suggestive of several determinants: Disproportionately high stomach cancer mortality may be related to excessive salt in the diet, diets deficient in fruits and vegetables, and infection with Helicobacter Pylori. Disproportionately high cervical cancer mortality is almost certainly related to underutilization of modern gynecological care, although differential prevalences of Human Papillomavirus infection may also be at work here. Both conditions may have been obtained in the countries from which recent Hispanic immigrants have traveled, and both may persist for various reasons after immigration to the United States. These conjectures will be subject to exploration and elaboration when Hispanic incidence data for the United States are ready for publication in *Cancer in North America* (see "A Note about Hispanic Cancer Incidence Data in the United States," below).

*Differences by State or City of Residence*

Large differences in mortality rates are observable across states and municipal areas. Generally, they are believed to be explained by the underlying differences 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 90 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.

*Differences 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 fifty percent higher among men than women in Canada. Much of this difference 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.

*Differences by Province*

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

A Note about Hispanic Cancer Incidence Data in the United States

NAACCR is a pioneer in the collection and study of Hispanic cancer data from central cancer registries in the United States. Its Hispanic Expert Panel (of the Collaborative Research Work Group of NAACCR's Data Evaluation and Publication Committee) analyzed misclassification of Hispanic ethnicity in cancer case reports, evaluated the application of Hispanic attribution techniques to information from central cancer registries, and constructed estimated Hispanic Cancer Incidence rates for the United States, based on 86 percent of the nation's Hispanic population. The latter were published in *Cancer in U.S. Hispanics/ Latinos, 1995-2000*, released in December, 2003. Based on progress to date, NAACCR plans to publish Hispanic cancer incidence rates in next year's edition of *Cancer in North America*. Meanwhile, those central registries whose jurisdictions produce the vast majority of Hispanic cancer case reports (slightly more than 20 state and municipal registries) are themselves evaluating *Cancer in U.S. Hispanics/ Latinos, 1995-2000*, to assure the best possible national estimates next year. We look forward to a comprehensive analysis of these incidence data in 2005!

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# CANCER IN NORTH AMERICA, 1997-2001

## VOLUME TWO: MORTALITY

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## VOLUMES ONE & THREE: NAACCR COMBINED CANCER INCIDENCE, 1997 - 2001

UNITED STATES:

Data from 34 central cancer registries (28 states, 5 metropolitan areas, and the District of Columbia) met the NAACCR criteria for inclusion the NAACCR U.S. combined cancer statistics. The 28 states were Alaska, Arizona, Colorado, Florida, Hawaii, Idaho, Illinois, Iowa, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Montana, Nebraska, New Jersey, New Mexico, New York, Oklahoma, Oregon, Rhode Island, South Carolina, 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 (1997-2001) 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 about 54.7% of the total U.S. population, 54.5% of whites, 51.3% of blacks, 67.6% of American Indians/Alaska Natives (AI/AN), and 67.8% of Asians/Pacific Islanders (API).

A total 3,644,549 cancers (all invasive and bladder in situ) were diagnosed in the NAACCR U.S. combined areas in the 5-year period (1997-2001), averaging 728,910 cancers per year or approximately 2,000 cancers 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 prostate (110,560 cancers per year), female breast (108,995), lung (105,429), colon and rectum (86,213), and bladder (33,779).

- **Female breast cancer.** Breast cancer was the most commonly diagnosed cancer among women for every racial population. It accounted for approximately one third of female cancers among whites (31% of all cancers among white women), blacks (30%), Chinese (28%), Filipinos (37%), and Japanese (35%). The percentage of breast cancer was lower among Vietnamese (24%), Koreans (25%), and AI/AN (26%) than that among other racial populations.

- **Prostate cancer.** Prostate cancer was the most commonly diagnosed cancer among men for whites (29% of all cancers among white men), blacks (37%), Filipinos (29%), Japanese (28%), Chinese (21%), and AI/AN (21%). It was the second most commonly diagnosed cancer among Vietnamese (14%) and the fourth among Koreans (13%). The percentages for prostate cancer varied greatly by racial population.

- **Lung cancer.** For men, lung cancer was the second most commonly diagnosed cancer among whites (16% of all cancers among white men), blacks (17%), Filipinos (18%), Chinese (16%), and AI/AN (17%). It was the most commonly diagnosed cancer among Vietnamese (19%), and Koreans (15%) and the third among Japanese (12%). For women, lung cancer was also one of the top five most commonly diagnosed cancers among every racial population. It accounted for 13% of all female cancers among whites, 12% among blacks, 8% among Filipinos, 8% among Japanese, 11% among Chinese, 9% among Vietnamese, 9% among Koreans, and 13% among AI/AN. The percentages for lung cancer were lower for women than for men among all racial populations.

- **Colorectal cancer.** For men, colorectal cancer was the third most commonly diagnosed cancer among whites (12% of all cancers among white men), blacks (10%), Filipinos (13%), Chinese (15%), Koreans (14%), and AI/AN (13%). It was the second most commonly diagnosed male cancer among Japanese (18%) and the fourth among Vietnamese (11%). For women, colorectal cancer was the second most commonly diagnosed cancer among blacks (14%), Filipinos (9%), Japanese (16%), Chinese (15%), Vietnamese (11%), and Koreans (12%) and the third among whites (12%) and AI/AN (12%). 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 males (5%). Bladder cancer was not one of the five most commonly diagnosed cancers among any racial populations for women.

- **Liver cancer.** For men, liver cancer was one of the five most commonly diagnosed cancers only among Vietnamese (13% of all cancers among Vietnamese men), Koreans (10%), Chinese (8%), and Filipinos (4%). It was not one of the five most commonly diagnosed cancers among other racial populations for men or among any racial populations for women.

- **Stomach cancer.** Stomach cancer was the second most commonly diagnosed cancer among Korean men (15% of all cancers among Korean men). Although it was also one of the five most commonly diagnosed cancers among Japanese (7%), Chinese (6%), and Vietnamese (6%) men, the percentages were smaller for these racial populations than for Korean men. Stomach cancer was not one of the five most commonly diagnosed cancers among any racial population for women except Koreans (10% of all cancers among Korean women) and Japanese (6%). It was the third most commonly diagnosed cancer among Korean women and the fourth among Japanese women.

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

- **Hispanic Ethnicity (any race).** An average 18,405 cancers were diagnosed among Hispanic men and 17,947 cancers among Hispanic women in each of the five years (1997-2001) in the NAACCR U.S. combined areas. The five most commonly diagnosed cancers among Hispanic men were cancers of the prostate (29% of all cancers among Hispanic men), colon and rectum (11%), and lung (11%), non-Hodgkin lymphoma (5%) and bladder cancer (4%). The five most commonly diagnosed cancers among Hispanic women were cancers of the breast (29% of all cancers among Hispanic women), colon and rectum (11%), lung (7%), cervix (6%), and corpus and uterine (including uterus, NOS) (6%).

Average Annual Age-adjusted Cancer Incidence Rates

The Cancer in North America monograph presents cancer incidence rates adjusted to the 2000 U.S. population in conformity with the policy set by the United States government in 1998. 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 men than among women.** Overall, the age-adjusted (2000 U.S. population standard) incidence rate for all cancers combined was approximately 35% higher among men (566.1 per 100,000) than among women (420.0 per 100,000). However, the male/female rate ratios varied greatly by racial population: 31% among whites (558.5 per 100,000 for men and 425.8 per 100,000 for women) and 70% among blacks (651.1 per 100,000 for men and 383.5 per 100,000 for women).

- **Higher incidence rate for all cancers combined among blacks than among whites for men but not for women.** The age-adjusted (2000 U.S.) incidence rate for all cancers combined was 17% higher among black males (651.1 per 100,000) than among white males (558.5 per 100,000). In contrast, the rate among black women (383.5 per 100,000) was 10% lower than the rate among white women (425.8 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 men than among white men for cancers of the prostate (57% higher), lung (26%), buccal cavity and pharynx (23%), esophagus (60%), stomach (84%), liver (66%), pancreas (26%), and larynx (58%) and multiple myeloma (95%). The age-adjusted (2000 U.S.) incidence rates among black women were also higher than the rates among white women for cancers of the esophagus (95% higher), stomach (1.2 times), liver (55%), pancreas (40%), and larynx (35%) and multiple myeloma (1.4 times). In addition, the rates were also higher among black women than among white women for cancers of the cervix (61% higher) and colon and rectum (13%). 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 white population than among black population.** Although the overall age-adjusted (2000 U.S.) cancer incidence rates were higher among black population than among white population, the rates for some specific cancer types were higher among whites than among blacks. For men, the rates were higher among whites than blacks for cancers of the bladder (1.2 times higher), brain and other nervous system (81%), thyroid (81%), non-Hodgkin lymphoma (34%), leukemias (37%), and melanoma of the skin (15.2 times). For women, besides cancers of the bladder (51% higher), brain and other nervous system (74%), thyroid (75%), non-Hodgkin lymphoma (47%), leukemia (28%), and melanoma of the skin (13.9 times), incidence rates were also higher for cancers of the breast (22% higher), corpus and uterus (26%), and ovary (45%).

*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 are age-adjusted to the 2000 U.S. standard population and 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 men (466.1 per 100,000) and Detroit (Michigan) had the highest rate for white men (647.5 per 100,000). For white women, Seattle (Washington) had the highest rate (468.5 per 100,000) and Utah had the lowest rates (350.8 per 100,000). The highest rate was 39% higher than the lowest rate for men and 34% higher than the lowest rate for women. The geographic variations in rates were much larger among black population than among white population for both men and women. Among black men, rates ranged from a low of 402.8 per 100,000 in Wyoming to a high of 1,012.0 per 100,000 in Montana. Among black women, rates varied from a low of 247.7 per 100,000 in Utah to a high of 450.9 in Kentucky. The highest rate was 2.5 times the lowest rate for black men and almost 82% greater than the lowest rate for black women.

- **Geographic variations in incidence rates for female breast cancer by race.** For white women, the District of Columbia had the highest age-adjusted (2000 U.S.) incidence rate (164.0 per 100,000) among the NAACCR U.S. combined areas. This rate was 37% higher than the lowest rate (119.3 per 100,000), in West Virginia. For black women, Alaska had the highest breast cancer incidence rate (156.8 per 100,000), which was 96% higher than the lowest rate (79.9 per 100,000), in Hawaii.

- **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 men (123.2 per 100,000) - 39% lower than the highest rate (202.5 per 100,000), in Detroit (Michigan). For black men, Detroit (Michigan) also had the highest prostate cancer incidence rate (313.1 per 100,000) and Arizona had the lowest rate (156.7 per 100,000). The highest rate was 2.0 times the lowest rate for black men.

- **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 men (139.4 per 100,000) and white women (70.4 per 100,000) while Utah had the lowest lung cancer rates for white men (42.9 per 100,000) and white females (21.9 per 100,000) among the NAACCR U.S. combined areas. The highest rate was 3.2 times the lowest for white men and women. Lung cancer incidence rates (2000 U.S.) varied from a low of 59.5 per 100,000 in Hawaii to a high of 152.2 per 100,000 in Wisconsin for black men and from a low of 32.0 per 100,000 in New Mexico to a high of 80.6 per 100,000 in Kentucky for black women. The highest was approximately 2.5 times the lowest for black men and women.

- **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 men (77.7 per 100,000) and Rhode Island had the highest rate for white women (55.9 per 100,000). The lowest rates were 48.5 per 100,000 in Utah for white men and 36.9 per 100,000 in New Mexico for white women. The highest rate was 60% higher than the lowest rate for white men and 51% higher for white women. Iowa had the highest rate for black men (82.5 per 100,000) and Kentucky had the highest rate for black women (70.7 per 100,000). Rhode Island had the lowest rate for black men (46.2 per 100,000) and New Mexico had the lowest rate black women (29.3 per 100,000). The highest rate was 79% higher than the lowest rate for black men and 1.4 times higher for black women.

- **Geographic variations in incidence rates for cervical cancer by race.** For white women, Los Angeles (California) had the highest age-adjusted (2000 U.S.) rate (12.9 per 100,000) for cervical cancer among the NAACCR U.S. combined areas. This rate was 2.9 times the lowest rate (4.5 per 100,000), in the District of Columbia. In contrast, Illinois had the highest cervical cancer incidence rate (17.4 per 100,000) among black women. The rate was 2.7 times the lowest rate (6.4 per 100,000) for black women, in Colorado.

- **Geographic variations in incidence rates for ovarian cancer by race.** New Jersey had the highest age-adjusted (2000 U.S.) incidence rate for white women (17.0 per 100,000) and West Virginia had the highest rates for black women (12.8 per 100,000) among the NAACCR U.S. combined areas. For white women, the highest rate was 47% higher than the lowest rate (11.6 per 100,000), in the District of Columbia. For black women, the highest rate was 2.4 times the lowest rate (5.3 per 100,000), in Massachusetts.

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 4,708 cancers were diagnosed among children (ages 0 to 14 years) and 2,149 cancers among adolescents (ages 15-19 years) in each of the five years (1997-2001) in the NAACCR U.S. combined areas. The five most commonly diagnosed cancers among children were leukemia (31% of all cancers among children), cancer of the central nervous system (CNS) (21%), lymphoma (11%), soft tissue sarcoma (STS) (7%) and cancer of the sympathetic nervous system (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 leukemia (13%), germ cell tumors (13%), cancers of the CNS (10%) and bone (8%).

- **Whites.** An average 3,819 cancers were diagnosed among white children and 1,792 cancers among white adolescents in each of the five years (1997-2001) 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 CNS (21%), lymphoma (11%), cancer of the sympathetic nervous system (7%), and STS (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 26% of all cancers in this age group. Leukemias (13%) were the second most commonly diagnosed cancer, followed by Germ cell tumors (13%), cancer of the CNS (10%) and bone (8%).

- **Blacks.** An average 531 cancers were diagnosed among black children and 213 cancers among black adolescents in each of the five years (1997-2001) 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 CNS (21%) and lymphoma (11%). Instead of cancer of the sympathetic nervous system, the fourth most commonly diagnosed cancer among black children was STS (10%) and the fifth was renal tumors (9%). 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 27% of all cancers in this age group. Other commonly diagnosed cancers were leukemia (15%), STS (12%), cancer of the CNS (10%) and germ cell tumors (9%).

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

Rates are age-adjusted to the 2000 U.S. standard population and 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 11% higher among boys (153.3 per million) than among girls (138.1 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 boys than girls.

- **Higher incidence rates among females than among males.** For renal tumors, germ cell tumors and carcinomas females had higher incidence rates than males.

- **Higher incidence rates for all cancers combined among white population than among black population**. Unlike cancer incidence rates for all ages combined, the age-adjusted (2000 U.S.) incidence rates for all cancers combined among children were 45% higher for white males (160.2 per million) than for black males (110.8 per million) and 44% higher for white females (144.8 per million) than for black females (100.4 per million). Among adolescents, the rate was 51% higher for white males (218.8 per million) than for black males (144.5 per million) and 62% higher for white females (204.9 per million) than for black females (126.8 per million).

- **Higher incidence rates for renal tumors among black children than among white children**. Although the age-adjusted (2000 U.S.) incidence rates for all cancers combined and most specific cancer types were higher for white children than for black children, the rate for renal tumors was 11% higher among black children (8.4 per million) than among white children (7.6 per million) for males and 22% higher for females (11.0 vs. 9.0).

- **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 white and black populations.

## VOLUME TWO: MORTALITY, 1997 - 2001

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, the Centers for Disease Control and Prevention, via the National Cancer Institute. Mortality data for the ten Canadian provinces and three Canadian territories were provided by Statistics Canada.

Age-adjusted (2000 U.S.) cancer death rates for all races were slightly higher in Canada (259.0 per 100,000 for men and 169.2 per 100,000 for women) than in the United States (251.1 per 100,000 for men and 166.7 per 100,000 for women).

UNITED STATES:

A total 2,737,842 persons in the U.S. died of cancer in the five-year period (1997-2001), averaging more than half a million (547,568) per year, or 1,500 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 (154,225 deaths per year), colon and rectum (57,026), female breast (41,618), prostate (31,723), and pancreas (28,845).

- **Lung cancer**. For men, lung cancer was the leading cause of death 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 API. Lung cancer also accounted for 25% of the total cancer deaths among white women. The percentage of lung cancer deaths among white women was higher than that among black women (20%), AI/AN women (23%), and API women (18%).

- **Prostate cancer**. Prostate cancer was the second leading cause of death from cancer among white men (11% of all cancer deaths among white men) and black men (16%), third among AI/AN men (8%), and fifth among API men (6%). The percentage of prostate cancer deaths was much lower for API men than that for men of any other race.

- **Female breast cancer**. Breast cancer was the second leading cause of death from cancer among women for whites (16% of all cancer deaths among white men), blacks (19%), AI/AN (13%), and API (14%). The percentage of deaths from breast cancer was higher among black women than that among women of any other race.

- **Colorectal cancer**. Colorectal cancer was the second or third leading cause of deaths from cancer and accounted for approximately 10%-12% of total cancer deaths among all race/sex populations.

- **Pancreatic cancer.** Pancreatic cancer was the fourth leading cause of cancer deaths among whites, black men and women and among AI/AN women and the sixth among API men and fifth among API women, accounting for approximately 5%-6% of the total cancer deaths among these race/sex populations. Among AI/AN men, pancreatic cancer ranked seventh.

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

- **Stomach cancer**. Stomach cancer was the fourth leading cause of death from cancer among API men and women, accounting for 7% of the total cancer deaths. Among black men, stomach cancer was the fifth leading cause of death from cancer, accounting for 4% of the total cancer deaths. It was not one of the five leading causes of cancer deaths among other race/sex populations.

- **Hispanic origin (any race).** An average 10,793 Hispanic men and 9,593 Hispanic women died of cancer in each of the five years (1997-2001). The five leading causes of deaths from cancer among Hispanic men were cancers of the lung (22% of all cancer deaths among Hispanic men), colon and rectum (10%), prostate (10%), liver (6%), and stomach (6%). Breast cancer was the most common cause of cancer deaths among Hispanic women, accounting for 17% of all female deaths from cancer. Other leading causes of deaths from cancer among Hispanic women were cancers of the lung (13%), colon and rectum (10%), pancreas (6%), and ovary (5%).

- **Non-Hispanic origin (any race).** An average 272,847 non-Hispanic men and 252,864 non-Hispanic women died of cancer in each of the five years (1997-2001). The three leading causes of death from cancer among non-Hispanic men were the same as those among Hispanic men: cancers of the lung (32% of all cancer deaths among non-Hispanic men), prostate (11%) and colon and rectum (10%), but the percentage for lung cancer was much higher compared with that among Hispanic men (22%). The fourth and fifth leading causes of deaths from cancer among non-Hispanic men were pancreatic cancer (5%) and non-Hodgkin lymphoma (4%). Unlike the order among Hispanic women, the leading causes of deaths from cancer among non-Hispanic women was lung cancer (25%), followed by cancer of the breast (16%). The third through fifth leading causes of cancer deaths were same as among Hispanic women - cancers of the colon and rectum (11%), pancreas (6%), and ovary (5%).

- **Cervical cancer.** An average 4,267 women in the U.S. died of cervical cancer in each of the five years (1997-2001). With early detection and prompt treatment, nearly all of these deaths could have been prevented.

Average Annual Age-adjusted Cancer Death Rates

Rates are age-adjusted to the 2000 U.S. standard population and 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 death rate (2000 U.S.) for all cancers combined was approximately 50% higher among men (251.1 per 100,000) than among women (166.7 per 100,000). However, the sex differences in the death rates varied by race group. The largest sex difference was seen among black population; about 77% (The rate for black men was 77% higher than the rate for black women). The smallest sex differences were seen among whites and AI/AN. The rates for men were approximately 48% higher than the rates for women among both white and AI/AN populations.

- **Higher death rates for all cancers combined among black population than among any other racial population.** For all cancers combined, the age-adjusted (2000 U.S.) death rate among black men (347.3 per 100,000) was 41% higher than the rate among white men (245.5 per 100,000), 2.1 times the rate among AI/AN men (167.0 per 100,000) and 2.3 times the rate among API men (151.2 per 100,000). The age-adjusted (2000 U.S.) death rate for all cancers combined among black women (196.5 per 100,000) was 19% higher than the rate among white women (165.5 per 100,000), 73% higher than the rate among AI/AN women (113.4 per 100,000), and 96% higher than the rate among API women (100.5 per 100,000).

- **Higher death rates for specific cancer types among black men than among men in other racial populations.** 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 men compared with the rates among men in other racial populations. The age-adjusted (2000 U.S.) death rate for prostate cancer among black males (70.4 per 100,000) was more than twice the rate among white males (28.8 per 100,000), more than three-fold the rate among AI/AN men (20.2 per 100,000) and more than five-fold the rate among API men (13.0 per 100,000). In addition, age-adjusted (2000 U.S.) death rates were also higher among black men than among males in any other racial populations for cancers of the esophagus, stomach, larynx, and buccal cavity and pharynx. The death rate for liver cancer among black men was higher than the rates among white and AI/AN men only.

- **Higher death rates for specific cancer types among black women than among women in other racial populations.** Cancers of the colon and rectum, breast, pancreas, and cervix accounted for much of the elevation in the death rate for all cancers combined among black women compared with the rates among women in other racial populations. The age-adjusted (2000 U.S.) death rate for cancer of the cervix among black women (5.6 per 100,000) was more than twice the rates among white women (2.6 per 100,000), AI/AN women (2.8 per 100,000), and API women (2.8 per 100,000). In addition, death rates were also higher among black women than those among women in any other racial populations for cancers of the esophagus, corpus and uterus, and bladder. The death rate for stomach cancer among black women was higher than the rates among women in any other racial populations except API.

- **Higher death rates for specific cancer types among whites than among other racial populations.** The age-adjusted (2000 U.S.) death rates for cancer of the brain and non-Hodgkin lymphoma were higher among whites than among any other racial populations for both men and women. The death rate for bladder cancer was higher among whites than among any other racial population only for men.

- **Lower death rates for all cancers combined among API than among other racial populations**. For all cancers combined, the age-adjusted (2000 U.S.) death rate was 9% lower among API men than among AI/AN men, 38% lower than among white men, and 56% lower than among black men. The rate among API women was 11% lower than the rate among AI/AN women, 39% lower than the rate among white women and 49% lower than the rate among black women.

- **Higher death rates for cancers of the liver and stomach among API than among other racial populations.** The age-adjusted (2000 U.S.) death rate for liver cancer among API men (13.7 per 100,000) was more than two times the rates among white men (5.0 per 100,000) and AI/AN men (6.6 per 100,000) and 1.7 times the rate among black males (8.3 per 100,000). The death rate for liver cancer among API women (5.4 per 100,000) was 2.8 times the rate among white women (1.9 per 100,000), 1.7 times the rate among AI/AN women (3.2 per 100,000) and 1.7 times the rate among black women (3.1 per 100,000). The death rate for stomach cancer among API men (11.9 per 100,000) was more than twice the rate among white men (5.8 per 100,000) and 1.6 times the rate among AI/AN men (7.3 per 100,000). For women, the death rate for stomach cancer among API (7.0 per 100,000) was 2.5 times the rate for white women (2.8 per 100,000), 1.1 times the rate for black women (6.3 per 100,000), and 1.7 times the rate for AI/AN women (4.1 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 men (254.9 per 100,000) was 47% higher than the death rate for Hispanic men (173.2 per 100,000). The death rate (2000 U.S.) for all cancers combined among non-Hispanic women (169.7 per 100,000) was 54% higher than the rate among Hispanic women (110.2 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 men than those among Hispanic men for cancers of the lung (1 time higher), esophagus (72%) colon and rectum (43%), pancreas (35%), prostate (35%), and bladder (95%), and leukemia (55%). The age-adjusted (2000 U.S.) death rates among non-Hispanic women were also higher than the rates among Hispanic women for cancers of the esophagus (80% higher), colon and rectum (56%), pancreas (26%), lung (1.9 times), bladder (85%), and kidney (22%), non-Hodgkin lymphoma (30%), and leukemia (40%).

- **Higher death rates for cancers of the stomach, liver and cervical cancer among Hispanics than among non-Hispanics.** The age-adjusted (2000 U.S.) death rates were higher among Hispanic men than those among non-Hispanic men for cancers of the stomach (1.5 times higher) and liver (74%). The age-adjusted (2000 U.S.) death rates were higher among Hispanic women than those among non-Hispanic women for cancers of the stomach (71%), liver (90%), and cervix uteri (29%).

- **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:

A total of 307,303 persons in Canada died of cancer during the five-year period (1997 - 2001), averaging 61,461 per year, or approximately 168 per day. More than half of the Canadian cancer deaths occurred among men (53%); slightly less than half (47%) occurred among women. Note: The 2000 and 2001 data for Quebec are not included in the Canada mortality analysis found in volume 2, section IV.

Common Cancers

- **All races and both sexes combined.** For all races and both sexes combined, the most common cancer death in Canada were cancers of the lung (16,207 deaths per year), colon and rectum (7,728), female breast (4,881), prostate (3,686), and pancreas (3,038).

- **Sex difference.** An average 32,858 Canadian men and 28,603 Canadian women died of cancer in each of the five years (1997-2001). The five leading causes of deaths from cancer among men were cancers of the lung (30% of the total cancer deaths among men), colon and rectum (12%), prostate (11%), and pancreas (5%), and non-Hodgkin lymphoma (4%). The five leading causes of deaths from cancer among women were cancers of the lung (22%), breast (17%), colon and rectum (13%), pancreas (5%), and ovary (5%).

- **Cervical cancer.** On average, 409 Canadian women died of cervical cancer in each of the five years (1997-2001). 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 are age-adjusted to the 2000 U.S. standard population and 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 death rate (1996 Canadian population) for all cancers combined was 51% higher among men (238.8 per 100,000) than among women (157.9 per 100,000).

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

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