

CANCER IN NORTH AMERICA, 1996-2000

VOLUME TWO: MORTALITY

PURPOSE

The Data Evaluation and Publication Committee, a standing committee of the North American Association of Central Cancer Registries (NAACCR), produced this monograph. The NAACCR bylaws charge the Data Evaluation and Publication Committee to gather data from member registries, review, evaluate, and compile the information for publication. This year marks the 13th release of the publication of *Cancer in North America (CINA)* and the 7th monograph to include cancer mortality data. The monograph includes NAACCR member registries, with cancer mortality coverage in Canada, 50 U.S. states, the District of Columbia, and five metropolitan areas in the United States (U.S.). We hope this effort continues to improve the completeness, the timeliness and the quality of data collected by member registries; to promote the use of their cancer registry data; and to provide cancer statistics that are inclusive of all race/ethnic groups and geographic coverage of North America.

MONOGRAPH FORMAT

The *Cancer in North America (CINA), 1996-2000* monograph includes three volumes: Volume One contains cancer incidence data for individual member registries, Volume Two contains cancer mortality data and Volume Three is comprised of NAACCR Combined Incidence Data. Volume Two has four major sections as described below.

VOLUME TWO, SECTION I: Introduction and Technical Notes

This section states the purpose of the monograph, describes the monograph format, and details the various data sources and data definitions. Background information about NAACCR is also provided.

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

All age-adjusted death rates in this section have been prepared using two standard populations, the 2000 U.S. standard and the 1970 U.S. standard.

Similar statistics are presented for the United States and Canada, with one general exception. U.S. cancer statistics are presented with race specificity (except for Hawaii, for which rates are calculated for all races combined) while Canadian statistics are not. Race is not used to differentiate population groups in Canada.

U.S. statistics contain counts of cancer deaths and death rates (average annual age-adjusted death rates) for 1996-2000, by cancer site grouping, sex, and race (all races combined, whites, and blacks), for 56 geographic areas: 50 states, the District of Columbia, and five metropolitan areas in the Surveillance, Epidemiology and End Results (SEER) Program. Age-sex-race-specific population estimates are listed in this section for each geographic area.

Canadian statistics contain counts of cancer deaths and death rates (average annual age-adjusted death rates) for 1996-2000, by cancer site grouping, and sex, for 12 geographic areas: 10 Canadian provinces, and two Canadian territories. Age-sex-specific population estimates are listed in this section for each geographic area.

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

All age-adjusted death rates in this section have been prepared using two standard populations, the 1996 Canadian standard and the World standard. The first is the new standard for Canadian public health statistics, used in *CINA* for the second time this year. The second is the conventional standard for international comparisons of cancer statistics.

Similar statistics are presented for the United States and Canada: counts of cancer deaths and death rates (average annual age-adjusted death rates) for 1996-2000, by cancer site grouping, race (all races, whites, and blacks), and sex, for 56 geographic areas in the U.S. (50 states, the District of Columbia, and five metropolitan areas in the SEER Program) and 12 geographic areas in Canada (10 Canadian provinces, and two Canadian territories). For Canadian registries, rates are presented only for all races combined.

VOLUME TWO, SECTION IV: Cancer Mortality for the United States and Canada

This section contains two sets of special cancer mortality statistics for the United States: (1) Statistics for 10 multi-state regions in the U.S.; and (2) Statistics with extended race and ethnic specificity. Cancer site specificity is limited in some of the tables to selected cancer sites (all cancers combined, colon-rectum, lung, female breast, prostate, cervix, ovary, bladder, non-Hodgkin's lymphomas). All age-adjusted death rates in this section have been prepared using four standard populations, the 2000 U.S. standard, the 1970 U.S. standard, the 1996 Canadian standard, and the World standard.

U.S. statistics contain counts of cancer deaths and death rates (average annual age-adjusted death rates) for 1996-2000, by selected cancer site grouping, sex, and race, for 67 geographic areas: the U.S. as a whole, ten multi-state regions, 50 states, the District of Columbia, and five metropolitan areas in the SEER Program. In some tables, data are provided for American Indian/Alaskan Native and Asian and Pacific Islander race groups as well as for the Hispanic ethnicity group, in addition to all races combined and the White and Black race groups provided in all the tables. Age-sex-race-specific population estimates are listed in this section for the U.S. as a whole, using extended race and ethnic specificity.

Canadian statistics contain counts of cancer deaths and death rates (average annual age-adjusted death rates) for 1996-2000, by selected cancer site grouping and sex, including statistics for 13 geographic areas: Canada as a whole, each of the 10 Canadian provinces, and two Canadian territories.

TECHNICAL NOTES

Data Sources

Mortality. Mortality data for 1996 to 2000 for U.S. registries were obtained from the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC), as provided to NCI. For Canadian registries, the mortality data for 1996 to 2000 were obtained from Statistics Canada's Canadian Mortality Data Base (CMDDB). The year 2000 mortality data for Quebec was unavailable and 1996-2000 data for Northwest Territories reflects current geographic boundaries.

Population Estimates. Estimates of the population for the U.S., individual U.S. states, and all SEER areas for 1996 through 2000 were obtained from the SEER program, based on U.S. Bureau of Census population estimates for these years. These population estimates represent a modification of the annual time series of population estimates produced by the Population Estimates Program of the Bureau of the Census with support from the NCI. Please refer to the *SEER Cancer Statistics Review*,

1975-2000¹ and its methodologies for specific documentation regarding modifications made by the NCI to the Census Bureau estimates. The following summarizes these modifications.

The initial modification affects only population estimates for the State of Hawaii. The Epidemiology Program of the Hawaii Cancer Research Center has developed its own set of population estimates, based on sample survey data collected by the Hawaii Department of Health. This effort grew out of a concern that the native Hawaiian population has been vastly undercounted in previous censuses. The "Hawaii-adjustment" to the Bureau of the Census estimates has the net result of reducing the estimated white population and increasing the Asian and Pacific Islander population for the state. The Bureau of the Census estimates for the total population, black population, and American Indian and Alaska Native populations in Hawaii are unaffected.

The population estimates now incorporate bridged single-race estimates that are derived from the original multiple-race categories in the 2000 Census. These bridged estimates are consistent with the four race groups enumerated in the 1990 Census and were produced under a collaborative arrangement between the National Center for Health Statistics and the Census Bureau.

A revised set 1990 through 2000 population estimates was recently obtained by NCI from the Census Bureau. This file contains populations by year, county, race, Hispanic origin, sex, and age. The methodology implemented by the Census Bureau to develop these county estimates is comparable to that used to produce national and state 1990-2000 intercensal estimates and is described on the Census Bureau's website². Thus, statistics published here may differ from those published in previous editions of CINA.

Statistics Canada provided the estimates of the Canadian population for all Canadian provinces and territories, adjusted for census under-coverage and non-permanent residents. The 1996-2000 populations for Northwest Territories reflects current geographic boundaries.

Definitions

Cancer Sites. SEER rules were used to define cancer deaths.³ Only underlying cause of death was used in calculating death rates. Cancer deaths were defined as those coded 140.0 through 208.9 (ICD-9) and C00 through C97 (ICD-10), using *The International Classification of Diseases (Ninth Revision and Tenth Revision; ICD-9 and ICD-10; see below)*. Cancer deaths among non-residents and deaths of unknown sex or age were omitted from all calculations.

Use of ICD-9 and ICD-10 Codes. Effective in 1999 for the United States and 2000 for Canada, causes of death were coded and classified according to the Tenth Revision of the World Health Organization's *International Classification of Diseases (ICD-10)*. The ninth revision (ICD-9) was used in the United States for deaths occurring 1979-98 and in Canada for deaths occurring between 1979-1999. Among the many changes in ICD-10 were increases in classification detail, the shift to an alphanumeric classification

¹ http://www.seer.cancer.gov/csr/1975_2000/
<http://seer.cancer.gov/popdata/methods.pdf>

² <http://eire.census.gov/popest/topics/methodology/usintercensal.php>

³ Ries LAG, Eisner MP, Kosary CL, Hankey BF, Miller BA, Clegg L, Mariotto A, Fay MP, Feuer EJ, Edwards BK (eds). *SEER Cancer Statistics Review, 1975-2000*, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2000, 2003.

system, and a number of changes in the coding rules by which a single cause of death is selected from among the multiple causes reported by physicians as causing or contributing to the death. The change from ICD-9 to ICD-10 caused discontinuities in trends for many causes of death, including cancer. The extent of these discontinuities has been measured by comparability studies in which death records are double coded using both the Ninth and Tenth Revisions, and the results compared.⁴ Overall, approximately 0.7% more deaths are assigned to cancer when ICD-10 is used than when ICD-9 is used. For some cancers, the differences are larger. Accordingly, the death rate for all cancers combined is higher when ICD-10 is used than when ICD-9 is used. This general rule does not hold for specific cancer sites, whose rates may be higher or lower using ICD-10. However, as discontinuities are small, changes in death rates across the years of the (ICD-9/ICD-10) boundary are still interpretable, especially for major cancers sites.

⁴ Anderson, R., Minino, A, Hoyert, D., Rosenberg, H. (2000) Comparability of Cancer Deaths between ICD-9 and ICD-10. National Vital Statistics Reports, 49, 1-32.

Death Rates. Rates for all races were calculated per 100,000 population and age-adjusted by the direct method to the 2000 U.S. and 1970 U.S., the 1996 Canadian (Cdn.) and the World⁵ population standards for both U.S. and Canadian registries. Rates for U.S. whites and blacks were age-adjusted to 2000 and 1970 U.S. and World standards only. The death rates were five-year person-year averages for the period 1996 through 2000 for both the U.S. and Canada. The age distributions of the four population standards are presented below:

AGE GROUP	2000 U.S.	1970 U.S.	1996 CDN.	WORLD
0-4	6,913.5	8,441.6	6,623.5	12,000
5-9	7,253.3	9,820.4	6,798.5	10,000
10-14	7,303.2	10,230.4	6,771.5	9,000
15-19	7,216.9	9,384.5	6,784.1	9,000
20-24	6,647.8	8,056.1	6,776.1	8,000
25-29	6,452.9	6,632.0	7,291.4	8,000
30-34	7,104.4	5,624.9	8,703.0	6,000
35-39	8,076.2	5,465.6	8,851.0	6,000
40-44	8,185.1	5,895.8	8,005.5	6,000
45-49	7,211.8	5,962.2	7,184.7	6,000
50-54	6,271.6	5,464.3	5,581.2	5,000
55-59	4,845.4	4,907.7	4,486.8	4,000
60-64	3,879.3	4,240.3	4,070.5	4,000
65-69	3,426.4	3,440.6	3,785.8	3,000
70-74	3,177.3	2,678.9	3,258.9	2,000
75-79	2,699.9	1,887.1	2,323.1	1,000
80-84	1,784.2	1,124.1	1,542.4	500
85+	1,550.8	743.5	1,161.7	500
Total	100,000.0	100,000.0	100,000.0	100,000

Race-specific Rates. Counts and rates are presented for all races, and for whites and blacks when the number of deaths was more than five. Cases of unknown race are included in the all races category only. Canadian data are presented for all races only, as are the data for Hawaii.

Standard Errors. Standard errors (S.E.) of the rates were calculated using the formula:

$$S.E. = \sqrt{\sum \frac{w_j^2 n_j}{p_j^2}}$$

⁵ Waterhouse J, Muir C, Correa P, Powell J (eds). *Cancer Incidence in Five Continents, Volume III*. Lyon, France: International Agency for Research on Cancer, IARC Scientific Publications No. 15, 1976.

where w_j = the fraction of the standard population in age_j group (5-year age interval), n_j = number of deaths in that age group, and p_j = person-years denominator.⁶ For many registries, the S.E. of the rates are small, as the population covered is large. However, for registries which cover a small population, the S.E. may be substantial.

Comparison of Rates. The standard errors of adjusted rates can be used to evaluate the statistical significance of rate differences among comparable populations in the various individual registries. For example, if the adjusted rates in two populations are R_1 and R_2 and their standard errors are $S.E._1$ and $S.E._2$, an approximate confidence interval for the rate ratio can be calculated using the following formula:

$$(R_1/R_2)^{1 \pm z/x}$$

where $x = (R_1 - R_2) / \sqrt{(S.E._1^2 + S.E._2^2)}$ and $z = 1.96$ for 95% confidence limits.⁷ If this interval does not include one, the two rates are statistically significantly different at a p value of 0.05. This test can be inaccurate for rates based on fewer than 16 deaths.

It should be emphasized that this kind of comparison of adjusted rates must be undertaken with caution as misleading conclusions may be drawn if the ratios of the age-specific rates in the two populations are not constant in all age groups. In these circumstances, the rate ratios will vary according to the standard population used.⁸

Before comparing rates among the registries, it is important to consider whether the groups are comparable by race, (i.e., percent other races or percent unknown race and other demographic factors). Interpretation without consideration of these factors may contribute to misleading and inaccurate conclusions.

Cell Suppression. Rates and counts are suppressed in table cells for which fewer than six deaths were reported for specific cancer sites.

NAACCR MISSION

The North American Association of Central Cancer Registries, Inc. (NAACCR) is a professional organization that develops and promotes uniform data standards for cancer registration; provides education and training; certifies population-based registries; aggregates and publishes data from central cancer registries; and promotes the use of cancer surveillance data and systems for cancer control and epidemiologic research, public health programs, and patient care to reduce the burden of cancer in North America.

⁶ Breslow NE, Day NE. *Statistical Methods in Cancer Research, Vol. II*. Lyon, France: IARC, 1987, p. 59.

⁷ Parkin DM, Muir CS, Whelan SL (eds). *Cancer Incidence in Five Continents, Volume VI*. Lyon, France: IARC, 1992, p. 869.

⁸ Esteve J, Benhamou E, Raymond L. *Statistical Methods in Cancer Research, Volume V*. Lyon, France: IARC Publication No. 128, 1994.

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