

Technical Notes

Overview and Definitions

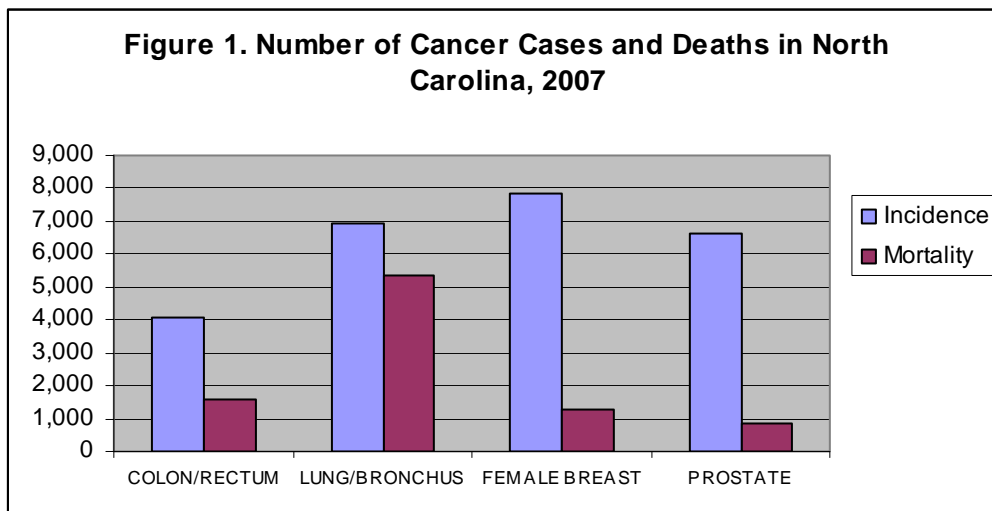
This report presents frequency counts, age-specific rates, and age-adjusted rates to describe newly diagnosed cases of cancer and mortality due to cancer.

Cancer Incidence and Mortality

Cancer incidence is the number of newly diagnosed cancer cases whereas cancer mortality is the number of deaths due to cancer. Cancer incidence and mortality in 2007 for the top four cancers, colon/rectum, lung/bronchus, female breast, and prostate cancers are presented in Figure 1.

We assume that death certificates provide complete and accurate data on all causes of death. However, the accuracy of recording the cause of death varies for many cancers. For example, at the time of death, the history of cancer may not be known by the physician, or is considered not to have contributed to the death. Nonetheless, mortality data have been historically used widely to analyze cancer risk in populations.

Instances of under-reporting of cancer incidence have occurred. For some cancers (e.g., Multiple Myeloma), under-reporting may lead to more cancer deaths being shown than incidence cases for some age groups. Also, survival following a cancer diagnosis varies by cancer site. In populations with low use of health care services (e.g., rural and minority populations), more cancers are diagnosed at advanced stages when therapies are less successful; or the cases may not be diagnosed until death.



Differences in Reporting Cancer Incidence and Mortality Data

Many people living near the Virginia border go outside North Carolina for health care. It is known that Norfolk and Danville, Virginia attract patients for secondary and tertiary care. The State of North Carolina has an exchange agreement with all 50 states for exchanging death certificates, but only has an exchange agreement for cancer incidence data with 26 states, including our border states of Virginia, Tennessee and South Carolina.

Because death certificate data are available more quickly than incidence data, the 2007 mortality data include deaths of North Carolina residents who died in other states, but the incidence data may not include all cases diagnosed out-of-state. However, even with an exchange agreement in place, the interchange of Vital Records among states is voluntary and varies. Each year, it is known that some states have not properly exchanged resident mortality records with other states. Therefore, annual North Carolina resident cancer mortality statistics may miss some resident deaths occurring in other states and U.S. territories.

Some counties have been found to under-report their cancer incidence due to poor case-finding procedures. These counties, especially rural counties where small hospitals do not have the services of trained tumor registrars, may have inadequate case finding. This results in incomplete reporting of new cancer cases. Death data are considered to be complete. This also contributes to what appears to be an excess of deaths compared to the number of cases for some cancer sites in some of the rural counties.

In the last few years, more cases are being diagnosed and treated outside of a hospital, in physician offices. This is particularly true for cancers of the skin and prostate, as well as some lymphoma and leukemia cases. Although physicians are required to report all cases to the CCR, many of them do not have the staff to do so. Physicians associated with a hospital will often report cases via a hospital registrar, but those not affiliated with a hospital may not report cases to the CCR. As a result, reporting for some cancers is known to be incomplete. Due to recent efforts by the CCR to improve the completeness of reporting by physician offices and pathology laboratories, the incidence of melanoma and prostate cancers has increased.

Incidence Rates

Two types of rates are presented in this report: age-adjusted and age-specific, each of which has a specific purpose. Both rates are expressed in this report as annual or five-year rates per 100,000 population.

Age-Adjusted Rates

An age-adjusted rate accurately describes the cancer experience that the population would have had if it had exactly the same age distribution as the comparison or standard population. Age-adjusted rates provide a single, summary rate for each area. The direct method for 18 year age groups was used to calculate all age-adjusted rates in this report by multiplying each age-specific

rate by the number of people within that age group in the standard population and then summing these products, and dividing by the total population in the standard population. The age groups used in the report Age-adjusted rates should not be compared with any other type of rate or be used as absolute measurements of vital events; their sole purpose is to provide summary rates that can be compared between populations that have different age structures. The standard population used in the calculation was the 2000 United States Census population. Incidence and mortality rates for 2007 used the bridged-race population estimates obtained from the National Center for Health Statistics, available online at http://www.cdc.gov/nchs/nvss/bridged_race.htm. Incidence reports published prior to 2005 were calculated using the State Demographer's population estimates. Hence, rates from previous diagnosis years are not comparable.

Age-Specific Rates

The age-specific cancer incidence is the number of cancer cases that occur in the age groups from 0-4 to 85+. Age-specific rates are used to compare rates between different population groups of the same age and to examine age patterns for particular cancers. As expected, age-specific rates have a general tendency to increase with age. More than half of cancer cases occur among persons age 65 and older (Figure 2). North Carolina has attracted a large number of retirement-age people over the last decade. Understanding migration patterns is important for interpreting the data and is one reason for showing the data by age group. The largest concentrations of older-age residents are in the mountain counties, along the coast, and in the sandhills (along the mid-southern border).

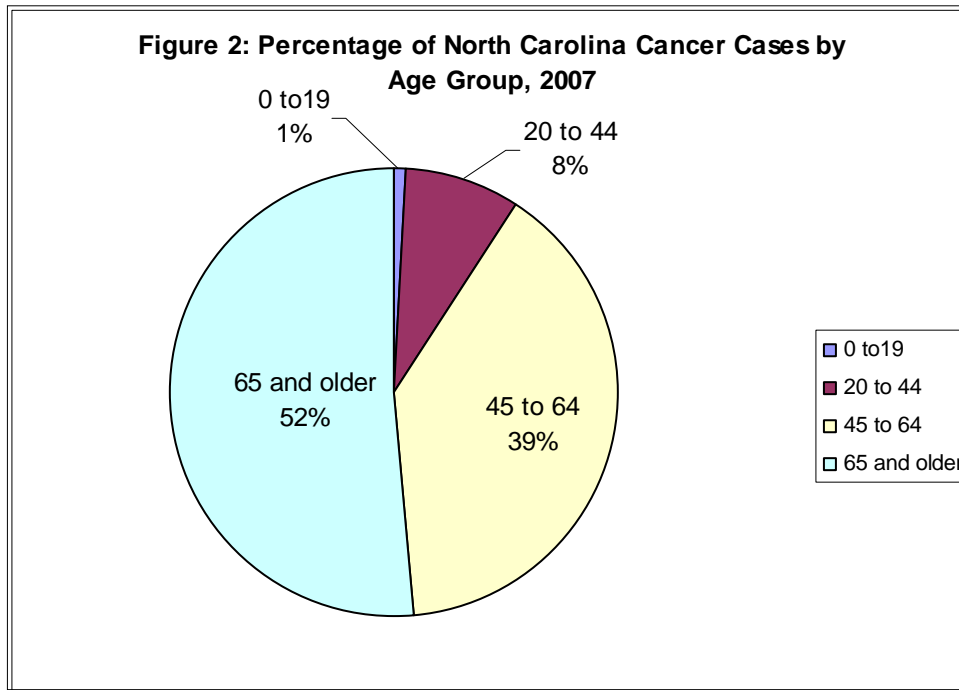
Cancer patterns vary by age group. Children have a very different pattern of cancer than do adults. Leukemia, brain cancer, endocrine, and lymphomas are the main cancer in people under age 20. In general, North Carolina's pediatric cancer patterns are quite consistent with national patterns.

Young adults (20-44) have a different pattern of cancer than do children. In this age group, lymphomas are even more common, as are some digestive and reproductive tissue cancers. All of these cancers are quite rare and cancer rates in these ages are generally lower than for other age groups.

In the middle ages (45-64), cancer rates begin to rise, and the common cancers (lung, breast, and colon) emerge. The incursion of these cancers into younger age groups is the subject of considerable research at this time. All cancer rates are at a maximum in the 70+ age categories. Prostate cancer is almost exclusively a disease of older men.

These age-specific patterns offer significant direction for screening priorities. For most cancers, the prospect for a normal life expectancy is good when the diagnosis is made early in the disease process. North Carolina legislation and federal programs are focused on increasing the access to screening services in this state. Older and underprivileged people are priority groups for these programs.

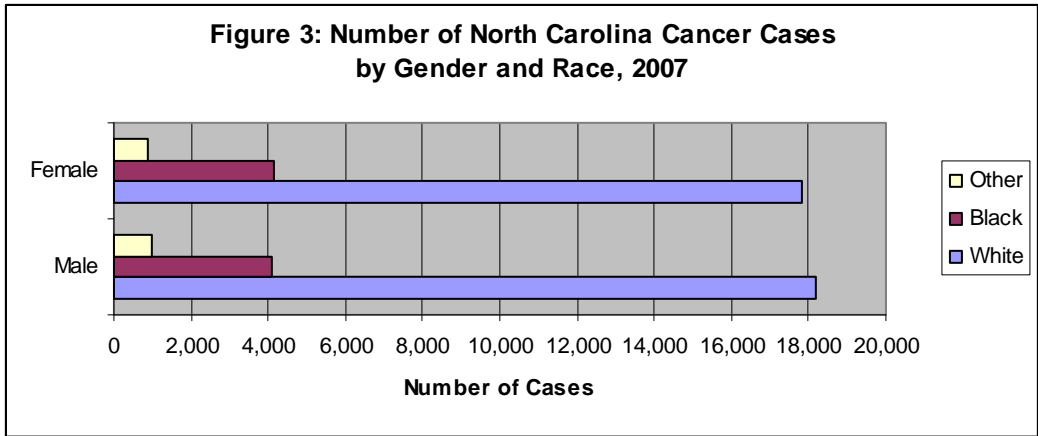
Age-specific cancer incidence and rates are presented in Table 10. The age-specific incidence rates demonstrate how cancer is a disease primarily of the older population.



Race/Gender Specific Cases and Rates

The race/gender-specific cancer incidence is the number of cancer cases that occurred in each race/gender group. See Figure 3.

These data are provided because race is an important factor in interpreting cancer patterns in North Carolina. Cancer rates vary by race, race distributions vary across the state, and health care use has been found to vary by race. Because cancer risk is strongly associated with lifestyle and behavior, differences among ethnic and cultural groups can provide clues to factors involved in the development of cancer such as dietary patterns, alcohol use, and sexual and reproductive behaviors involved in the development of cancer. Cancer cases by gender and race are presented in Tables 2-4.



Reliability of Rates

Precautions should always be taken when comparing rates. Both the size of the numbers and the characteristics of the population are important indicators of a rate’s real value. Rates based on small numbers of events over a given period of time or for sparsely populated geographic areas should be viewed with caution. These rates show considerable variation from year to year, thus limiting their usefulness in comparisons and estimation of rare occurrences. See the section titled “Small Numbers” on page 8.

Age-adjusted rates offer a standard method to compare cancer risk across geographic areas or time periods. However, there are limitations to their use and one should be familiar with these types of rates before using them. As already mentioned, age-adjusted rates are to be used only for comparison purposes and only if the same standard population was used in the calculation. This publication uses the 2000 U.S. Census as the standard population.

For assistance in interpreting these data, please contact the CCR statistical staff at (919) 715-4574.

Morphology (Cell Type) and Behavior

The specific morphology codes for these primary site categories have been provided in the Appendix in the table “Primary Site Definitions” to clarify counting of these cases. The lymphoma category includes all lymphoma cases with the morphology codes shown regardless of body site. Data on basal and squamous cell skin cancers are not collected by the CCR unless they have spread to tissue beyond the original site. Malignant melanoma may occur at many different body sites; however, this report focuses on melanoma of the skin. Please note that lymphomas are not grouped consistently by all researchers.

In these data, only malignant tumors are included with one exception. Data on benign central nervous system and brain and unspecified types are also reported to the CCR and are included in

this report. Only invasive cervical cancer cases are included. Also, in situ cancers except those of the urinary bladder and female breast are excluded in the report.

Stage at Diagnosis

The stage at diagnosis indicates how far the cancer has spread and is important in treatment and prognosis. The codes for the listed stages have been provided in Appendix E to clarify counting of these cases. All cancers that were staged regional direct extension only, regional lymph nodes only, regional direct extension and regional lymph nodes, and regional NOS have been grouped together in one group called 'Regional'.

To find more information on the staging definitions and methodology please refer the SEER Summary Staging Manual available at <http://seer.cancer.gov/tools/ssm/intro.pdf>.

Limitations of Data

The user should be cautious when making county-to-county comparisons of the data in this report. Under-reporting in areas close to neighboring states and under-reporting for cancers that may not be diagnosed in hospitals must be considered when interpreting cancer incidence data. In addition, comparison of rates (computed with the number of cases and population data) can be easily misinterpreted. The age distributions and racial percentages in counties vary considerably.

Consider a comparison of Transylvania and Onslow counties. In 2007 over 24% percent of the Transylvania County population was at least 65 years old, while less than 7% percent of the Onslow County population was 65 and over. A larger proportion of the Transylvania County population can be expected to have cancer than the Onslow County population just because of the difference in the age pattern for these two counties. The use of age-adjusted rates will facilitate comparisons of risk.

On the other hand, almost 64% percent of Hertford County's population was comprised of minorities while over 98% percent of Ashe County's population is white. This difference in the racial composition of the populations of the two counties can also have a marked influence on the patterns of cancer incidence and mortality. Age-adjusted rates control for differences in the age structures of populations, but they do not control for differences in racial composition.

Interpretations of melanoma and prostate cancer data should be treated with caution since the thoroughness of case-finding is suspect due to the likelihood that cases may be treated outside of hospitals and not reported to the CCR. Reporting has increased from physician offices across the state, but is not complete.

Small Numbers

Small numbers of cases are a problem for statistical reports of health data. Even for the most common cancers, some counties can expect to have only one or two cases in a year. For example, Hyde County, which has a very small population, can expect to have only two cases of female lung cancer each year (based on state lung cancer rates). Between 2003 and 2007, there were 12 cases of female lung cancer in Tyrrell County reported to the CCR. The majority of the cases were reported in 2007. It would appear that the county had an excessive amount of lung cancer in females in 2007. However, over the five-year period, the county averages to what was expected.

All statistics are subject to chance variation. Rates based on a very small number of events over a specified period of time or for a sparsely populated geographic area should be of particular concern and caution. When the number of events is small, multiple-year summary rates will provide a much better measurement of risk. Expanding the period of time studied enlarges the absolute numbers and adds more credence to a statement regarding a rate.

Interpretation

This descriptive report is intended to serve as a baseline report for future reference. Because of the limitations described above, this publication should not be regarded as a definitive description of the cancer incidence in North Carolina. With additional training of hospital staff, collaboration from neighboring states, and increased physician and pathology laboratories reporting, the problems of under-reporting have declined. Although there are important limitations in the use of these data, the observed number of cases within a gender group in a specific county can be used for:

- ◆ Planning and evaluating health services at the county level;
- ◆ Identifying high cancer incidence within a county;
- ◆ Educating the public;
- ◆ Motivating facilities such as hospitals and physicians to report incidence data accurately and in a timely manner; and
- ◆ Encouraging more hospitals to organize tumor registries to provide better service to their cancer patients.

Comparison to National Data

This report was prepared to provide data for evaluation of cancer incidence and mortality patterns in North Carolina. The Annual Report to the Nation on the Status of Cancer, 1975-2006, produced by the North American Association of Cancer Registries (NAACCR), the National Cancer Institute (NCI) and the National Program of Cancer Registries (NPCR) at www.cdc.gov/cancer/npcr is available for comparison with North Carolina's observed incidence cases for 2006 and previous years.

Available Cancer Information

Cancer is the second leading cause of death (first being heart disease) in the United States. This increase is largely the result of the aging of the population and the decline in mortality from other causes of death (e.g., heart disease and stroke). In 2007, cancer was the second leading cause of death in North Carolina. It is estimated that by the year 2015, cancer will be the leading cause of death in the United States.

Cancer is expected to strike one in three people sometime during their lifetime. For more information about cancer, contact a local office of the American Cancer Society or call 1-800-ACS-2345. Many communities also have hospital-based cancer programs through which local data and/or cancer-related services may be obtained. In many counties, local health departments have active cancer control programs. Another source of information on cancer is the Cancer Information Service, 1-800-4CANCER (1-800-422-6237) which is a national program funded by the National Cancer Institute that provides cancer information.

The CCR produces other reports on cancer in North Carolina, many of which are available on the web site at www.schs.state.nc.us/SCHS/CCR. A notable one is the American Cancer Society's *South Atlantic Division Cancer Facts and Figures* available on the web site at http://health.state.ga.us/pdfs/chronic/cancer/ACSSAD_CF&F08.pdf. Also, other units with the State Center for Health Statistics (SCHS) publish many reports on other diseases and on health care measures. For more information about other reports from the CCR please call (919) 715-4574. For information from other programs of the SCHS, please call (919) 733-4728, or write:

State Center for Health Statistics
1908 Mail Service Center
Raleigh, NC 27699-1908

Support for Cancer Research and Control

The CCR is actively involved with cancer research programs at universities in North Carolina, as well as with federal agencies and research institutes located within the state. One feature of this participation is the rapid identification of cancer patients for projects that are designed to collect information before the patient's first course of treatment is completed (e.g., genetic studies). Several organizations in North Carolina work to prevent cancer or to provide for early detection. Others work to promote a higher quality of life for cancer patients undergoing treatment and for cancer survivors. Still others are working to understand and reduce the racial/ethnic gaps in cancer diagnosis and mortality.

The state Comprehensive Cancer Control Program and the Breast and Cervical Cancer Control Program are located in the Chronic Disease and Injury Section of the North Carolina Division of Public Health and are state agencies committed to reducing the cancer burden among North Carolinians. The CCR provides statistical and data analysis support for these programs. Also, the CCR is associated with organizations such as the American Cancer Society and the state's Advisory Committee for Cancer Coordination and Control.