Methodology for Projecting Cancer Incidence in Virginia

Background

Nationwide, nearly 590,000 people were estimated to have died from cancer in 2014—or 1,600 per day—making cancer the second leading cause of death (after heart disease) in the U.S.[a] Since cancer is known to be closely associated with age, future cancer incidence depends on both the size of the population as well as its age profile. As Virginia's population is growing, and is growing older, this project aimed to examine how many people in the Commonwealth may be diagnosed with cancer over the next few decades.

Data

This report draws upon data collected by the Cancer Registry at the Virginia Department of Health from 2001-2010. These are incidence data for each reportable tumor, and are arranged geographically according to the patient's place of residence[b] at the time of diagnosis. Cancer incidence refers to initial diagnosis or treatment of malignant tumors, they may include multiple primary cancers occurring in one patient.

The input data from the Virginia Cancer Registry include 2001-2010 age-specific incidence rates for lung cancer, female breast cancer, and prostate cancer, as well as for all sites (meaning all types), at the state and locality levels. The projected population at risk for 2020, 2030, and 2040 are from the official Virginia Population Projections[c], developed by the Weldon Cooper Center for Public Service (WCC) in 2012.

Assumptions

We assume that age-specific cancer incidence rates would be constant over time; in other words, the proportion of the population (measured per 100,000) in a given age bracket (say, 60-64) diagnosed with a new cancer in the period of 2001-2010 remains unchanged for the following three decades. This means we did not account for potential future rate changes, which could arise

[a] Cancer Facts and Figures 2015, The American Cancer Society.
[b] VCR database includes data collected for all Virginia residents, including those who were diagnosed elsewhere as it receives reports from all border states (Kentucky, Maryland, North Carolina, Tennessee, West Virginia, and Washington, D.C.) and from select other states, including Florida, Georgia, New York, Pennsylvania, and South Carolina.
[c] For more information, check http://www.coopercenter.org/demographics/virginia-population-projections

from technological advances in cancer diagnosis, improvements in access to medical services and facilities (such as health insurance, transportation), and increased public awareness about cancer leading to evolution in lifestyles, all of which could benefit cancer prevention, enable better screening or allow earlier diagnoses. While some factors may increase diagnoses, hence raising incidence rates, others, such as prevention, may reduce them — the aggregate effect of these multiple factors on cancer incidence could work in either direction and is difficult to predict, therefore we assume that the age-specific pattern will remain relatively unchanged at least for the near future.

Methodology

The locality-level rates from the Virginia Cancer Registry data were applied to the projected population at risk for each decade in order to compute the expected number of cancer cases in each locality. The main elements of our calculations are listed below.

- ***Population at Risk***

Using the population counts for 2000, 2010 and projections for 2020, 2030 and 2040, we constructed the aggregate population size for each entire decade. We assume the growth in each year is one-tenth of the total growth over the decade, and this uniform distribution is used to estimate the population in the years 2011, 2021 and 2031. For example, the 10 year aggregate population for age group 60-64 over 2011-2020 was calculated as

$$\text{Population at Risk}_{60-64}^{2011-2020} = \frac{(2011\ \text{Estimate}_{60-64} + \text{WCC 2020 Projection}_{60-64})}{2} * 10\ \text{years}$$

- ***Cancer Incidence***

For each age group, projected cancer incidence was derived by multiplying the observed age-specific incidence rate for 2001-2010 from the Virginia Cancer Registry to the projected population at risk for that age group. For instance,

$$\text{Projected Cancer Incidence}_{60-64}^{2011-2020} = \frac{\text{Incidence Rate}_{60-64}^{2001-2010} * \text{Population at Risk}_{60-64}^{2011-2020}}{100{,}000}$$

We summed all age groups to derive the locality-specific cancer incidence. The sum of the numbers for all the localities yielded the state totals for Virginia.

- ***Crude Cancer Incidence Rate***

In addition, crude incidence rates were calculated based on the observed and projected incidence.

For example,

$$\text{Projected Crude Incidence Rate}^{2011-2020} = \frac{\text{Projected Number of New Cases}^{2011-2020}}{\text{Population at Risk}^{2011-2020}} * 100{,}000$$

Crude rates can be used to examine the local burden of cancer. They reflect the number of new cancer cases expected to be diagnosed per 100,000 people in a particular geographic unit. Crude rates for 2001-2010 were constructed in the same way to enable comparison across decades. They are different from the age-adjusted incidence rates.

As with all projections, these numbers have a certain degree of uncertainty. Accuracy at larger geographic levels—and for the near future—are believed to be highly valuable and useful.

Pending funding, the Demographics Research Group will develop additional projections for Virginia of incidence of other cancer types, and of deaths from cancer over the three decades. In addition, three-decade projections of cancer incidence and deaths for the nation overall and for the 50 states can be developed, if funding is available.