Highlights

Tables

• Rates and counts are presented for all states and regions. Clear differences are seen among the regional rates.

• The effect of the exclusion of some states from the pooled regional rates in USCS can be seen, for example, by the comparison of the predicted and USCS-reported rates for colorectal cancer among males in New England (Table 3). Vermont and Maine, states not reported in USCS, have the highest predicted rates of the six New England states. The predicted regional rate with all states included is 73.4, higher than the 70.2 calculated from the four New England states included in the USCS report.

• In general, greater differences between predicted and reported results are seen for states with smaller populations, such as Alaska, Delaware, North Dakota, New Hampshire, and the District of Columbia

• States that did not contribute data to the USCS report had the greatest impact on prostate cancer rates—the predicted rate for these states is 20% lower than for the contributing states. Rates for breast, other, and total cancer are approximately 12%–15% lower in nonreporting states; lung cancer rates are slightly higher in the nonreporting states.

• Rates in SEER registries are lower than in NPCR registries. It cannot be determined whether this is a real difference in incidence patterns or one due to other causes.

State Maps

• Comparison of male and female predicted incidence rates shows few differences in their geographic patterns. Alaska is notable for its higher ranking for lung and total cancer among women.

• Predicted incidence rates are higher in the Southeast for lung cancer, in the Midwest for colorectal cancer, in the Great Lakes for prostate cancer, and in the Northeast for breast, other, and total cancer.

• Patterns of incidence and mortality are similar except for breast and prostate cancer, sites for which screening may play a major role. Thus patterns of incidence for breast and prostate cancer may reflect the changing intensity of screening rather than any differential in risk factors across the country.

• Relative rate maps show that there is a greater range of rates across the country for lung and colorectal cancers than the others (also seen in Figure 2, page 11).

County Maps

• In addition to the state patterns noted above, these maps identify within-state differences. For example, lung cancer rates among women are higher in northern than southern California.

• The lung cancer excess among women living along the northern Pacific coast, first seen in mortality rates in the 1970s, is more apparent in these county maps.

• Prostate cancer incidence rates are high in the Northwest and New England where mortality rates are high for whites, and in South Carolina where mortality rates are high for blacks.

• The sharp change in colorectal cancer rates predicted at the edge of the western region suggests that the model is unable to identify localized patterns in this large area of low rates.

Summary

Results presented here provide a complete picture of cancer incidence patterns across the U.S. at the regional, state and county level. We hope that they will prove useful in providing a complete picture of the cancer burden at both the national and local levels, in planning cancer control activities, and in stimulating further thought, debate, and research about the associations between cancer rates and geography. While the models utilized have been validated to provide a reasonable fit across the entire nation, the ecologic associations inherent in these models may not fit well in every area. We encourage readers to systematically explore the possible causes of differences between the predicted and observed figures in their areas (e.g., interesting local exceptions to ecologic associations, spikes in screening rates, differences in the population estimates used for this report and the USCS, and registry operation issues).

Experience has shown that cancer patterns tend to change slowly, particularly for the major sites included in this report. This suggests that current cancer incidence patterns would strongly resemble those for 1999 shown in this report, except where rates are perturbed due to the sudden change in screening utilization or diagnostic technology. However, because health planners would prefer projections for the current calendar year and beyond, we are working to extend the models to project forward over time as well as over space. In addition, since registry operations have been expanding in this country since the early 1970s, those studying past trends have had to rely on trends for only a portion of the U.S. We will be investigating the potential of these models to project backward in time to provide truly national trends of cancer incidence. We feel that models of the type developed here have the potential to be extended to serve both of these important needs.

References

American Cancer Society (ACS). *Cancer Facts & Figures, 2003*. Atlanta, GA: American Cancer Society, 2003.

Brewer CA, Hatchard GW, Harrower MA. ColorBrewer in print: A catalog of color schemes for maps. *Cartography and GIS* 2003;30(1):5–32.

Bureau of Health Professions. *Area Resource File Documentation*. Washington, DC: DHHS, Health Resources and Services Administration, 1999.

Butler MA, Beale CL. *Rural-Urban Continuum Codes for Metro and Nonmetro Counties, 1993*. Washington, DC: USDA Economic Research Service Report AGES 9425, 1994.

Carroll RJ, Ruppert D, Stefanski LA. *Measurement Error in Nonlinear Models*. Boca Raton, FL: Chapman & Hall/CRC, 1995.

Clegg LX, Feuer EJ, Midthune DN, Fay MP, Hankey BF. Impact of reporting delay and reporting error on cancer incidence rates and trends. *J Natl Cancer Inst* 2002;94(20):1537–545.

Fleiss JL. *Statistical Methods for Rates and Proportions*, 2nd ed. New York: John Wiley and Sons, 1981.

Frey CM, Feuer EJ, Timmel MJ. Projection of incidence rates to a larger population using ecologic variables. *Stat Med* 1993;13:1755–770.

Kerner JF, Andrews H, Zauber A, Struening E. Geographically-based cancer control: Methods for targeting and evaluating the impact of screening interventions on defined populations. *J Clin Epidemiol* 1988;41:543–53.

GeoLytics, Inc. *Census CD + Maps*. East Brunswick, NJ, 1998.

Mungiole M, Pickle LW, Simonson KH. Application of a weighted head-banging algorithm to mortality data maps. *Stat Med* 1999;18:3201–209.

Pickle LW, Feuer EJ, Edwards BK. Predicting cancer incidence in non-SEER counties. *Proceedings of the Biometrics Section of the 2000 Annual Meeting of the American Statistical Association, 2001;* 45–52

Pickle LW, Su Y. Within-state geographic patterns of health insurance coverage and health risk factors in the U.S. *American Journal of Preventive Medicine* 2002;22(2):75–83.

SAS Institute Inc. *SAS/STAT User's Guide, Version 8*. Cary, NC: SAS Institute Inc., 1999.

Spiegelhalter DJ, Thomas A, Best NG. *WinBUGS Version 1.2 User Manual,* MRC Biostatistics Unit, 1999.

Surveillance, Epidemiology, and End Results (SEER) Program. SEER*Stat Database: Incidence – SEER 14 Regions and SEER 4 New Regions, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2002, based on the November 2001 submission, 2002.

Tucker TC, Howe HL. Measuring the quality of population-based cancer registries: The NAACCR perspective. *J Reg Management* 2001;28(1):41–44.

Tufte ER. *The Visual Display of Quantitative Information*. Cheshire, CT: Graphics Press, 1983.

U.S. Cancer Statistics Working Group. *U.S. Cancer Statistics: 1999 Incidence*. Atlanta, GA: CDC, 2002.

Wingo PA, Landis S, Parker S, Bolden S, Heath CW. Using cancer registry and vital statistics data to estimate the number of new cases and deaths in the United States for the upcoming year. *J Reg Management* 1998;25(2):43–51.

Wingo PA, Jamison PM, Hiatt RA, Weir HK, Gargiullo PM, Hutton M, Lee NC, Hall HI. Building the infrastructure for nationwide cancer surveillance and control—A comparison between The National Program of Cancer Registries (NPCR) and The Surveillance, Epidemiology, and End Results (SEER) Program (United States). *Cancer Causes Control* 2003;14:175–93.