

The Cancer Intervention and Surveillance Modeling Network (CISNET)

<http://cisnet.cancer.gov>

Overview



CISNET is a consortium of NCI-sponsored investigators who use statistical/simulation modeling to examine the impact of prevention, screening, and treatment on cancer incidence and mortality. These models then can project future trends and help determine optimal cancer control strategies. Established in 2000, CISNET comprises five cancer site groups: breast, prostate, colorectal, lung, and esophageal.

Approaches to Modeling

- **Flexible broad-based disease models**—These models incorporate the natural history of disease processes and overlay the full range of cancer control interventions.
- **Multicohort modeling**—This type of modeling captures a range of birth cohorts and the changing risk factor profiles, screening behavior, and treatments used by each cohort as it ages.
- **Making the results of modeling efforts more transparent**—This is achieved through:
 - Comparative modeling—Independent modeling efforts often yield disparate results that are difficult to reconcile. A comparative modeling approach explores differences between models in a systematic way. In “base case” collaborations, a set of common population inputs is used across all models (e.g., dissemination patterns of screening and treatment, mortality from noncancer causes), and common sets

of intermediate and final outputs are developed. Results then are compared across models.

- Standardized model documentation—Model profiles are standardized descriptions that facilitate the comparison of models and their results. Users can read documentation about a single model or side-by-side descriptions that contrast how models address different components of the process. Journal articles seldom contain extensive model descriptions; links from publications to model profiles provide a more complete model description. <http://cisnet.cancer.gov/profiles>

CISNET was cited by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) Task Force on Good Modeling Practices for its role in establishing a forum that enables modelers to compare results and articulate reasons for discrepancies.

Working With Researchers and Policymakers

The CISNET infrastructure serves as a tool to inform evidence-based policy decisions, cancer control planning, and research priority setting. Examples include:

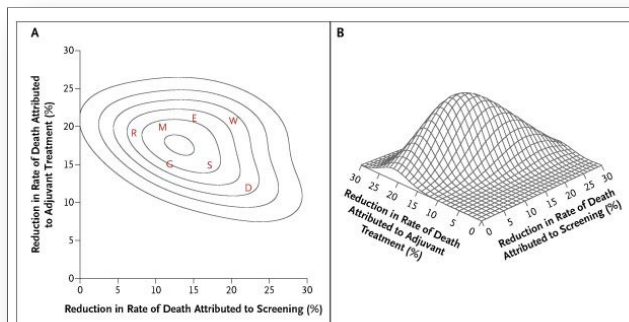
- **Colorectal Cancer Mortality Projections Web Site**—This interactive site allows users to examine future trends in colorectal cancer mortality and potential impacts of cancer control efforts. The site also features descriptions of and links to the Healthy People 2010 goals relevant to colorectal cancer. <http://cisnet.cancer.gov/projections/colorectal>

- **Collaborating with the U.S. Preventive Services Task Force (USPSTF)** (Zauber et al., 2008; Mandelblatt et al., 2009)—CISNET models serve as a resource for USPSTF evidence review panels as they revise screening guidelines for breast and colorectal cancers.
- **Centers for Medicare and Medicaid Services (CMS) Reports on the Cost-Effectiveness of Immunochemical Fecal Occult Blood Tests (iFOBT) and DNA Stool Testing**—These reports to the CMS represent a joint effort with CISNET to analyze the cost-effectiveness of new screening tests for colorectal cancer and help inform CMS coverage decisions. http://cisnet.cancer.gov/colorectal/highlights/cms_report.html
- **Impact of Mammography and Adjuvant Therapy on the Decline in U.S. Breast Cancer Mortality: 1975–2000** (Berry et al., 2005, and CISNET Breast Cancer Collaborators, 2006)—These reports represent a joint effort among seven CISNET breast cancer groups that used a comparative modeling approach to determine the contributions of mammography and adjuvant therapy to the decline in breast cancer mortality in the United States. The group used population data to describe the dissemination and usage patterns of mammography and adjuvant therapy

that occurred in the United States over time. The usage patterns then were coupled with seven independent modelers' syntheses of all available information on the benefits of these advances. Although the benefits of adjuvant therapy were more settled, controversy regarding the benefits of mammography screening persisted due to uneven results and continuing criticism of the controlled trials on which the mortality benefits had been based. The authors make the case that each factor accounted for one-half of the historic 24 percent decrease in mortality that was observed between 1990 and 2000. Typically, results based on observational data are validated using controlled trials. However, in this case, observational data (combined in a novel way using seven different models) helped to confirm mammography benefits when controlled trial results alone could not settle the debate.

- **Lead Time and Overdiagnosis in Prostate-Specific Antigen (PSA) Screening: Importance of Methods and Context** (Draisma et al., 2009)—Overdiagnosis and lead time are two important yet unobservable quantities that serve as significant measures of the potential harms and benefits associated with PSA screening. Prior to this study, published estimates of these two quantities varied widely. This report represents an effort by the CISNET prostate cancer groups to use three independently developed mathematical models of prostate cancer progression (the Erasmus Medical Center “MISCAN” model, the Fred Hutchinson Cancer Research Center [FHCRC] model, and the University of Michigan model) to determine estimates of overdiagnosis and lead time under standardized definitions and conditions. Prior to this effort, the MISCAN model was calibrated to data from the Netherlands section of the European Randomized Study of Screening for Prostate Cancer (ERSPC), where screening is practiced quite differently than in the United States. The results from this model varied significantly from the two other models, which were calibrated to U.S. PSA screening patterns and prostate cancer incidence data. With the original Rotterdam ERSPC data, the MISCAN model estimated that the mean lead time was 7.9 years, and the overdiagnosis frequency was 66 percent of screen-detected cancers. When

The breast cancer team's effort has added important evidence to address the controversial questions regarding mammography and demonstrates the potential role of statistical modeling of observational data in public health policy and decisionmaking.



Sample graphs: Estimated joint distribution of the reduction in the rate of death from breast cancer among U.S. women 30–79 years of age attributed to adjuvant treatment and to screening mammography (Berry et al., 2005).

this model was calibrated to U.S. SEER data, the mean lead time was 6.9 years, and the overdiagnosis frequency was 42 percent. These latter estimates were much closer to the estimates produced by the FHCRC and University of Michigan models, which estimated mean lead times ranging from 5.4–6.9 years, and overdiagnosis frequencies ranging from 23–42 percent. This led the authors to conclude that both the definitions and populations used to estimate lead time and overdiagnosis can have a significant effect on study results and should be specified clearly prior to conducting research.

Selected Publications

Berry DA, Cronin KA, Plevritis SK, Fryback DG, Clarke L, Zelen M, Mandelblatt JS, Yakovlev AY, Habbema JD, Feuer EJ; Cancer Intervention and Surveillance Modeling Network (CISNET) Collaborators. Effect of screening and adjuvant therapy on mortality from breast cancer. *N Engl J Med* 2005 Oct 27;353(17):1784-92.

Cancer Intervention and Surveillance Modeling Network (CISNET) Breast Cancer Collaborators. The impact of mammography and adjuvant therapy on U.S. breast cancer mortality (1975-2000): collective results from the Cancer Intervention and Surveillance Modeling Network. *J Natl Cancer Inst Monogr* 2006;36:1-126.

Draisma G, Etzioni R, Tsodikov A, Mariotto A, Wever E, Gulati R, Feuer E, de Koning H. Lead time and overdiagnosis in prostate-specific antigen screening: importance of methods and context. *J Natl Cancer Inst* 2009 Mar 18;101(6):374-83.

Levy DT, Nikolayev L, Mumford EA, Compton C. The Healthy People 2010 smoking prevalence and tobacco control objectives: results from the *SimSmoke* tobacco control policy simulation model (United States). *Cancer Causes Control* 2005 May;16(4):359-71.

Mandelblatt JS, Cronin KA, Bailey S, Berry DA, de Koning HJ, Draisma G, Huang H, Lee SJ, Munsell M, Plevritis SK, Ravdin P, Schechter CB, Sigal B, Stoto MA, Stout NK, van Ravesteyn NT, Venier J, Zelen M, Feuer EJ; Breast Cancer Working Group of the Cancer Intervention and Surveillance Modeling Network. Effects of mammography screening under different screening schedules: model estimates of potential benefits and harms. *Ann Intern Med* 2009 Nov 17;151(10):738-47.

Vogelaar I, van Ballegooijen M, Schrag D, Boer R, Winawer SJ, Habbema JD, Zauber AG. How much can current interventions reduce colorectal cancer mortality in the U.S.? Mortality projections for scenarios of risk-factor modification, screening, and treatment. *Cancer* 2006 Oct 1;107(7):1624-33.

Zauber AG, Lansdorf-Vogelaar I, Knudsen AB, Wilschut J, van Ballegooijen M, Kuntz KM. Evaluating test strategies for colorectal cancer screening: a decision analysis for the U.S. Preventive Services Task Force. *Ann Intern Med* 2008 Nov 4;149(9):659-69.

For a complete CISNET publication listing, see <http://cisnet.cancer.gov/publications>.

Collaborative Opportunities

CISNET invites inquiries from outside groups regarding collaborations on cancer control issues amenable to modeling (<http://cisnet.cancer.gov/working/contact.html>). CISNET initiated a series of Webinars to encourage discussion with colleagues in the fields of advocacy, public policy, legislative affairs, cancer control planning, and clinical science on the potential of CISNET's decision support tools to guide evidence-based policies/guidelines and cancer control planning. http://cisnet.cancer.gov/webinars/crc_02282008.html

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