

Quantifying the Population Effect of Mammography: Performance and Outcomes – Part I

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Outline

- **Enhancing population level data and research on screening and cancer outcomes**
- **Research evidence on performance and early evidence on outcomes in practice**
 - **Breast Cancer Surveillance Consortium**
 - **International Breast Cancer Surveillance Network**
- **Future perspectives**

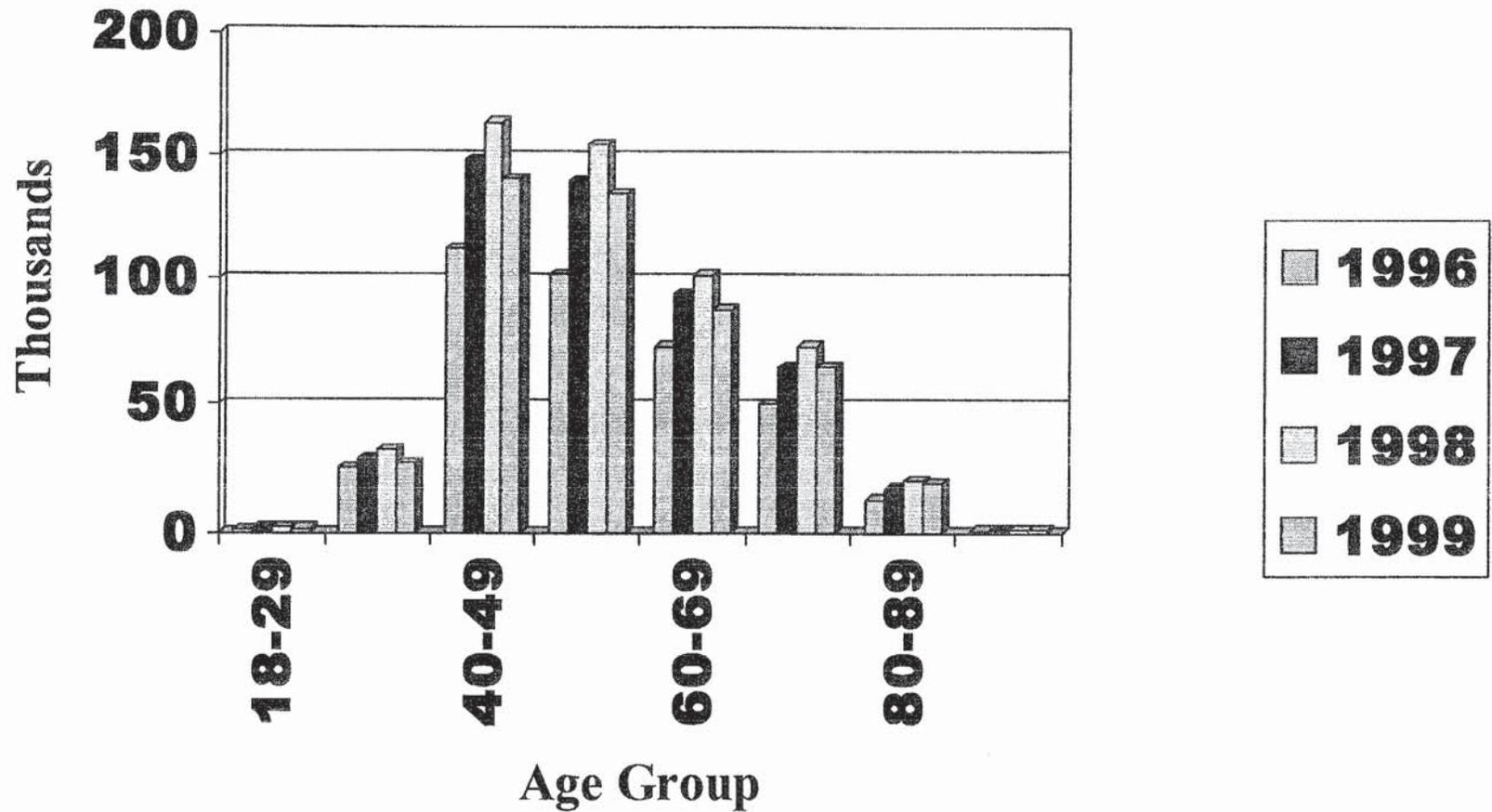
Enhancing Population Level Data and Research on Screening and Outcomes

- **Breast Cancer Surveillance Consortium (BCSC)**
- **International Breast Cancer Screening Network (IBSN)**
- **SEER-Medicare Linked Database**
- **Self-report data on screening**
 - **National Health Interview Survey**
 - **California Health Interview Survey**
- **Web site: appliedresearch.cancer.gov**
 - **Monitoring cancer screening**

Breast Cancer Surveillance Consortium

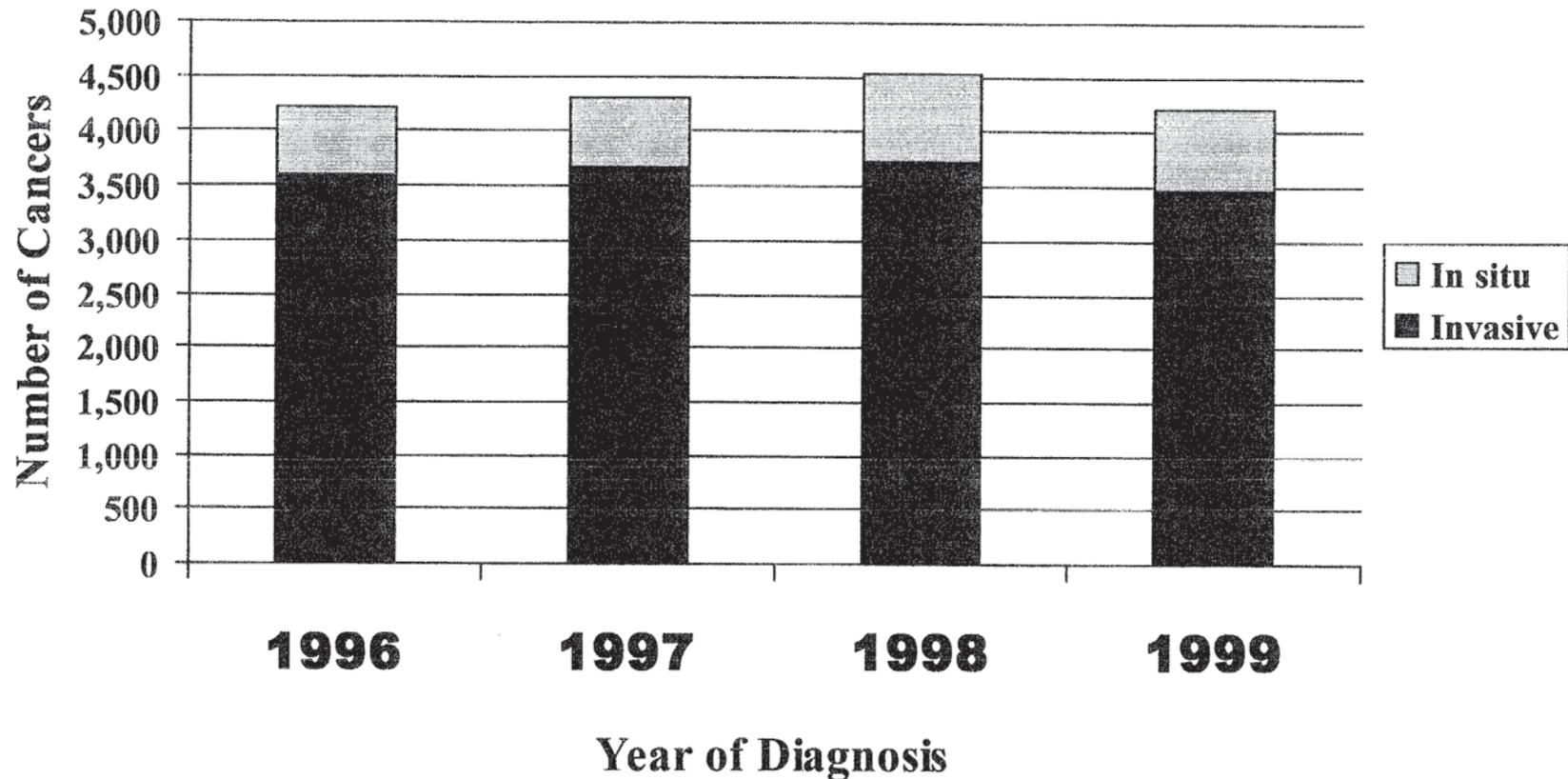
- **Evaluate performance of screening in practice**
 - At individual, health professional and system level
- **Quantify population effect of screening**
- **Track new technologies in screening**
 - Imaging, tissue and molecular markers, proteomics
- **Collaborate with partners**
 - FDA, CDC, GAO, ACR, communities
- **Web site: breastscreening.cancer.gov**

BCSC: Number of mammograms in 1996-99 by age and year



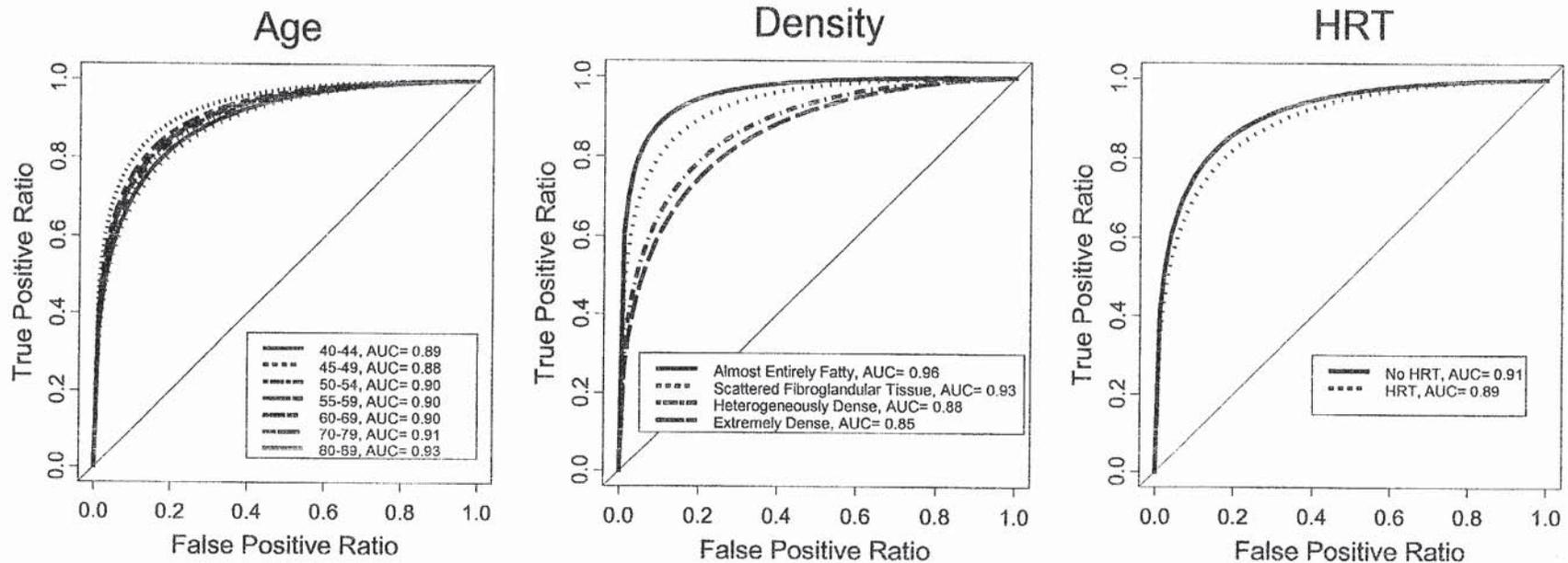
3.9 million mammograms as of July 2001

BCSC: Number of breast cancers in 1996-99 by year and type of disease



21,000 cancers in 1996-99

ROC Curves for Screening Mammograms by age, breast density and HRT use



Carney et al; 2002; submitted; BCSC data

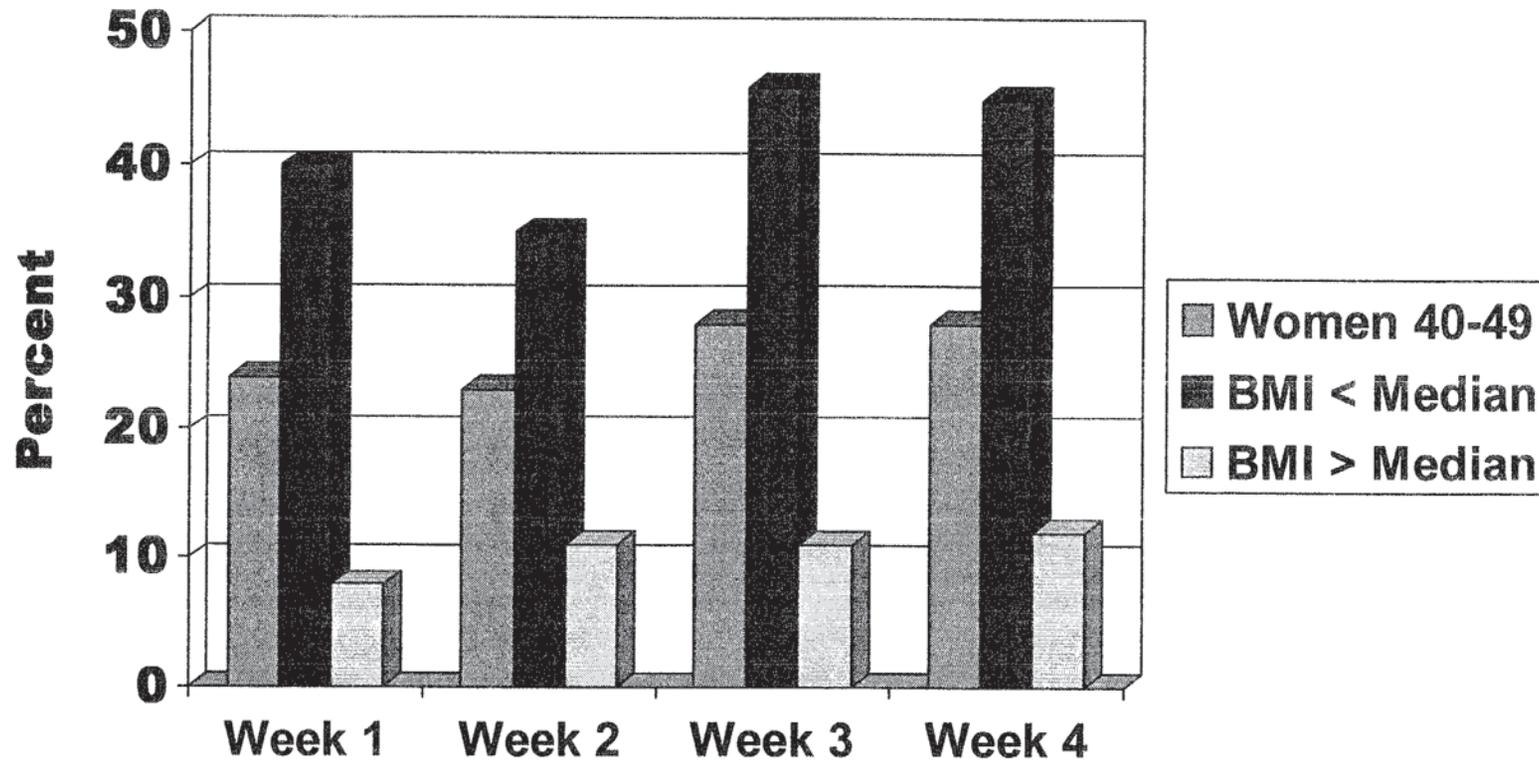
Likelihood of Tumors with Favorable Prognosis for Women on HRT vs not on HRT

Tumor Characteristics	OR*	95% CI
DCIS	1.23	(1.08, 1.40)
Stage 0 or I	1.39	(1.25, 1.55)
Tumor Size \leq 20 mm **	1.32	(1.19, 1.46)
Grade I or II **	1.34	(1.18, 1.51)
ER + **	1.36	(1.21, 1.52)

*Adjusted for age, family history of breast cancer, exam year, and MM registry.

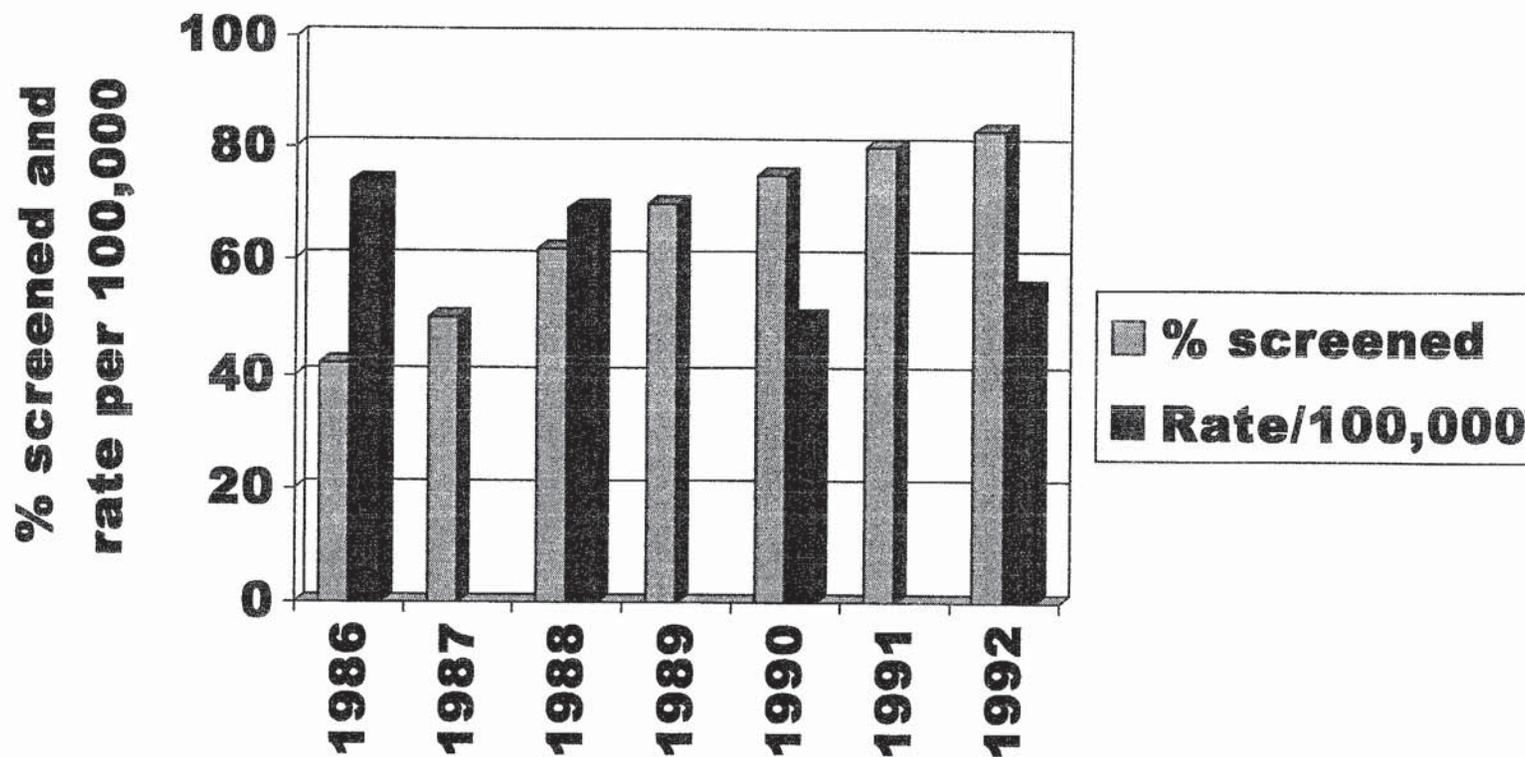
** Invasive cancer only; Kerlikowske et al; 2002, submitted – BCSC data

Increased breast density (extremely dense) in luteal phase of the menstrual cycle



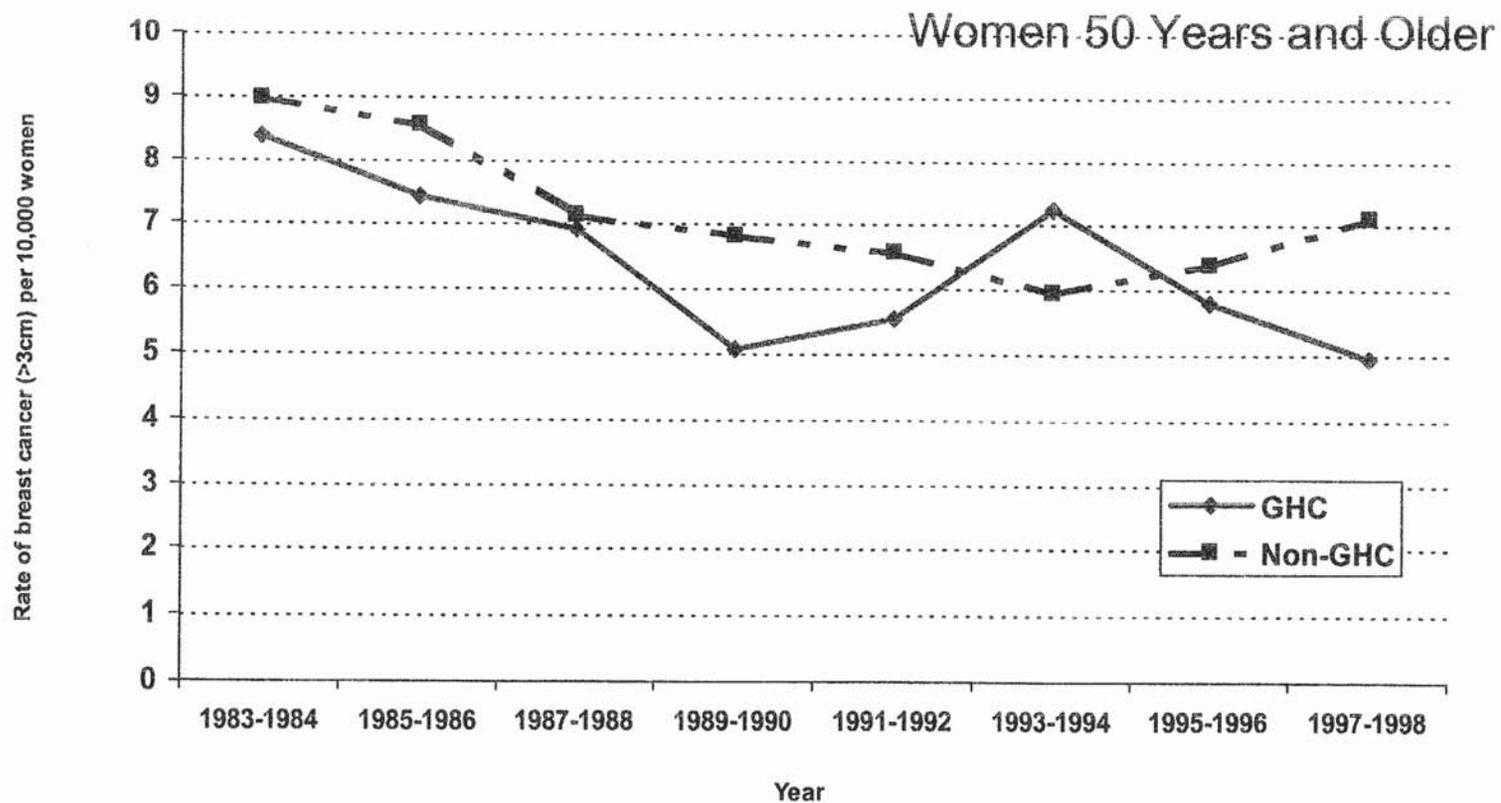
N= 2591 women aged 40-49; White et al, JNCI 1998

Decline in rates of late stage tumors with increase in screening mammography



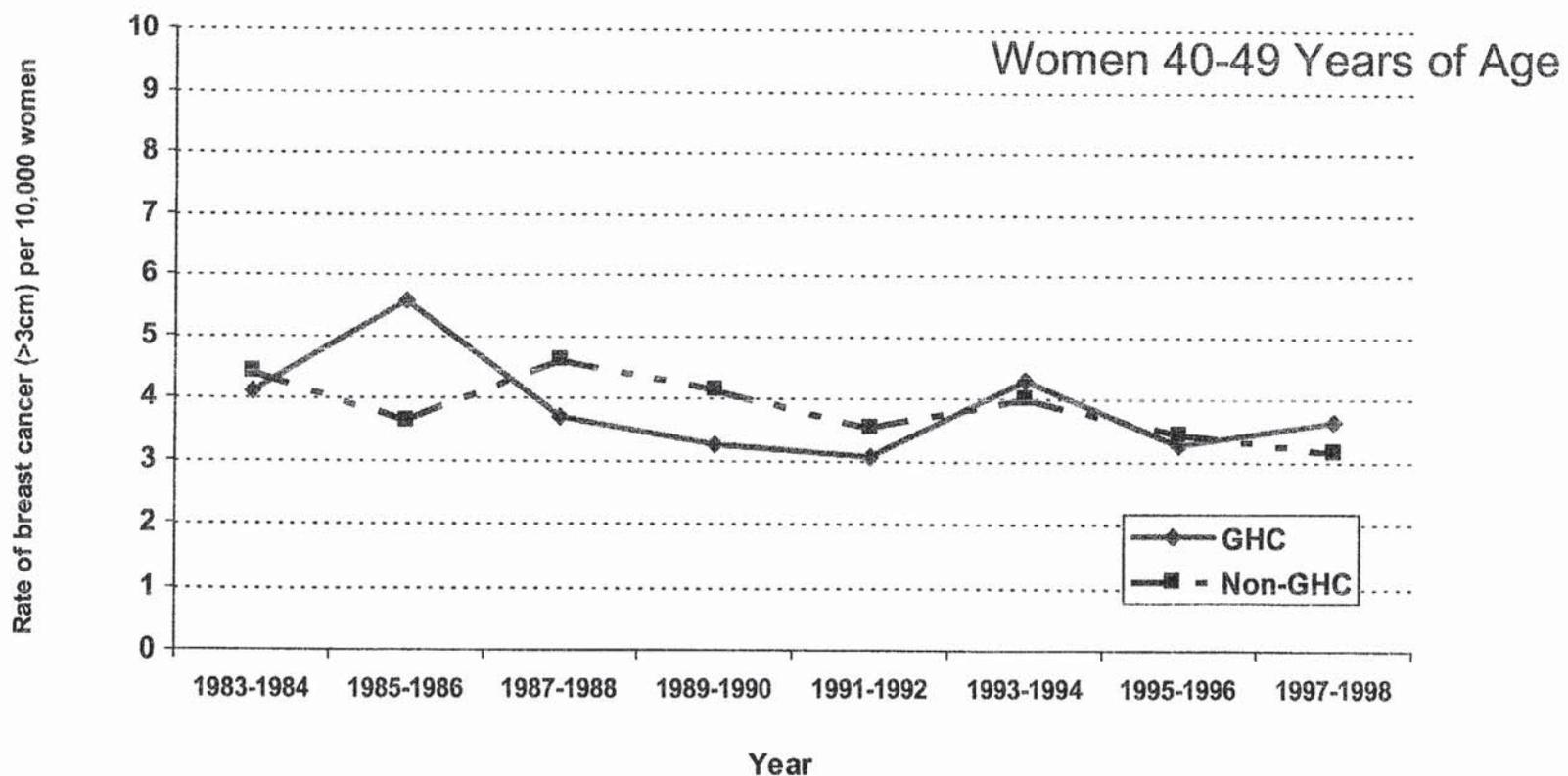
N = 60,000 women enrollees; Taplin et al; CEBP 1997; 6:625-31

Decreasing Late Stage Disease: Tumors \geq 3cm: (through 1998)



GHC update; Taplin et al; 2002; in preparation

Decreasing Late Stage Disease: Tumors ≥ 3 cm (through 1998)



GHC update; Taplin et al; 2002; in preparation

International Breast Cancer Screening Network Countries

- **Six published papers evaluating stage shift and other surrogate endpoints for mortality reduction**
 - Demonstrate shift to earlier stage disease among screened women in all studies
- **In NHS breast screening programme**
 - 21.3% reduction in mortality in 1998 – women 55-69
 - Direct effect of screening -- 6.4%
 - All else (treatment and earlier detection) -- 14.9%
 - Blanks et al; BMJ 2000;321; 665-669

Conclusions

- **Population level data within the BCSC allows quantification of factors likely to improve performance in clinical practice**
 - Improve accuracy and decrease false positives
 - Decrease rate of benign procedures – US/UK comparison
- **Linking data on mammography to cancer outcomes in defined populations allows evaluation of community effectiveness**
 - Can it contribute to information on efficacy?
- **Key need for new statistical methods for evaluating these complex population data at individual patient, health professional and facility or system level**

Response to the Screening Controversy

- **BCSC –quantifying population effect of mammography**
 - Updating analyses on stage shift
 - Exploring changes in mortality in defined populations
 - GHC, Vermont
- **IBSN – focus on the May 2002 meeting of the group**
 - Analyses ongoing in individual countries
 - Evaluation of Women’s Communication Needs
- **Dissemination of data resources:**
 - NHIS, CHIS, SEER-Medicare
- **Research synthesis**

Quantifying the Population Impact of Mammography: Performance and Outcomes

Part II: Statistical Modeling of the Impact of Mammography on Population Trends

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The logo of the National Cancer Institute, featuring the words "NATIONAL", "CANCER", and "INSTITUTE" stacked vertically in a serif font, with a horizontal line underneath the word "INSTITUTE".

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CANCER
INSTITUTE

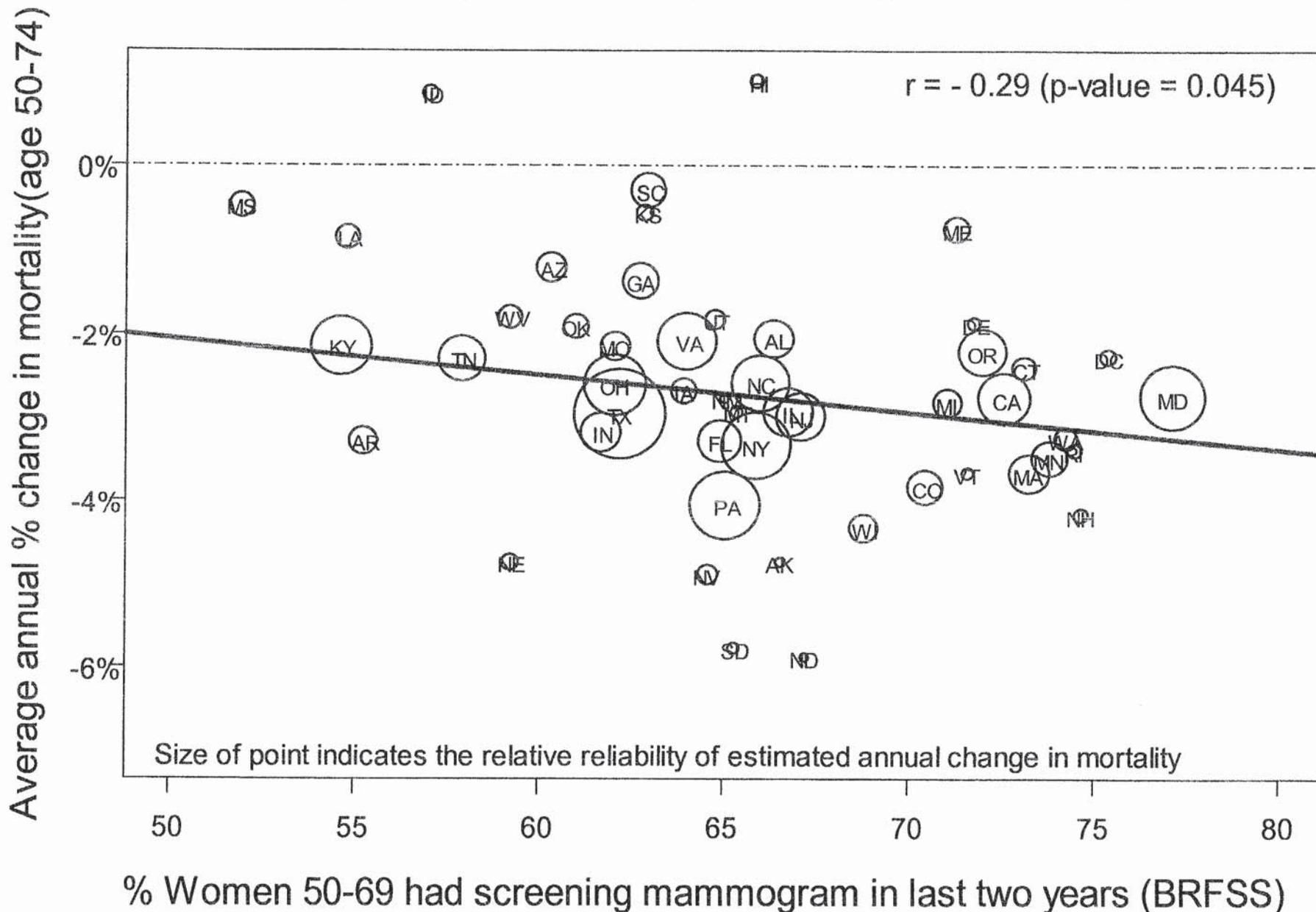
Outline

- **Ecologic Regression**
- **A “Back of the Envelope” Calculation of the Impact of the Observed Stage Shift on Breast Cancer Mortality**
- **Cancer Intervention and Surveillance Modeling Network (CISNET)**

I. Ecologic Regression

- **Trends in Breast Cancer Mortality by State vs. Mammography Rates**
- **Trends in Breast Cancer Mortality by SEER Health Service Area Aggregates vs. Percent Local/DCIS**
 - **With Adjustment for Percent Getting Adjuvant Therapy**
- **International Comparisons**

Trends in Breast Cancer Mortality (1992-99) vs. Mammography Screening Rates (1991-93) by State



II. A "Back of the Envelope" Calculation of the Impact of the Observed Stage Shift on Breast Cancer Mortality

SEER Incidence by Size and Stage

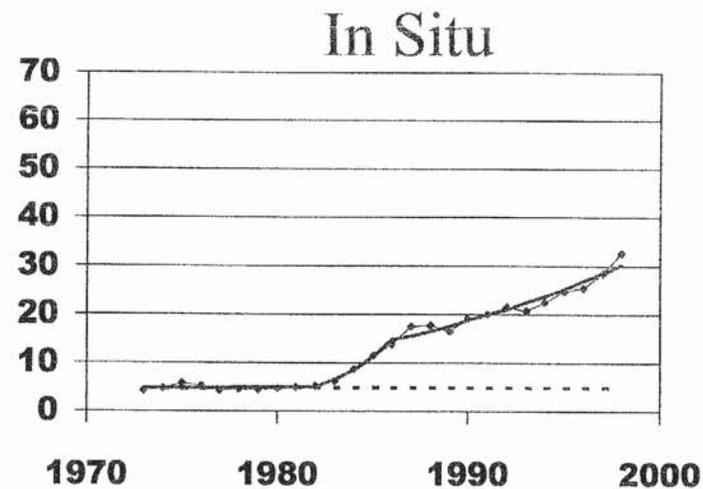
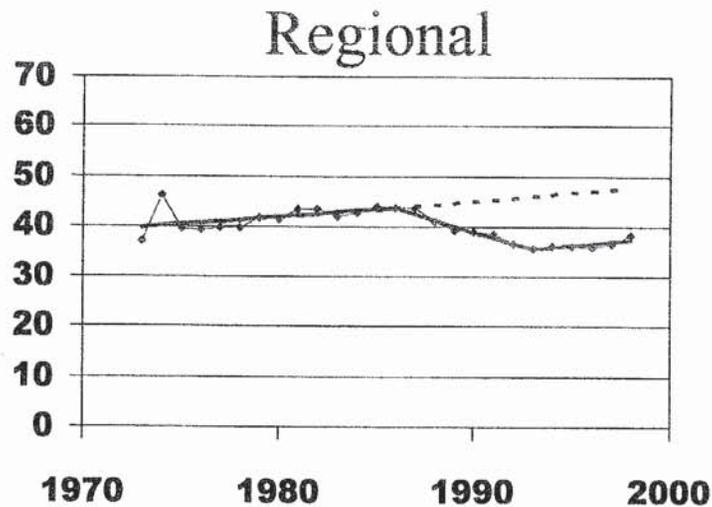
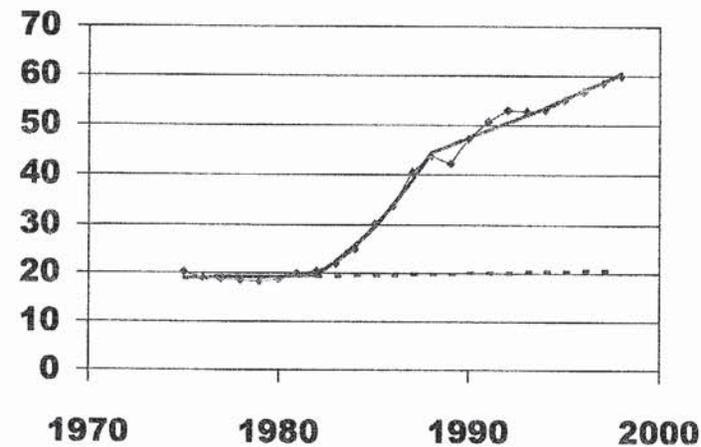
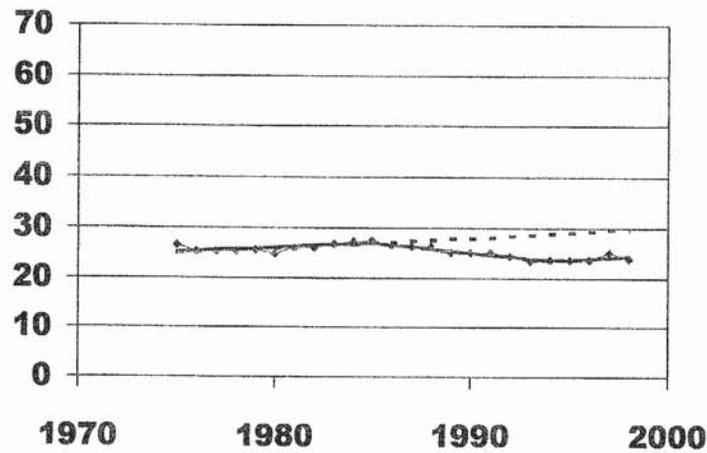
Avoided Cases

Excess Cases

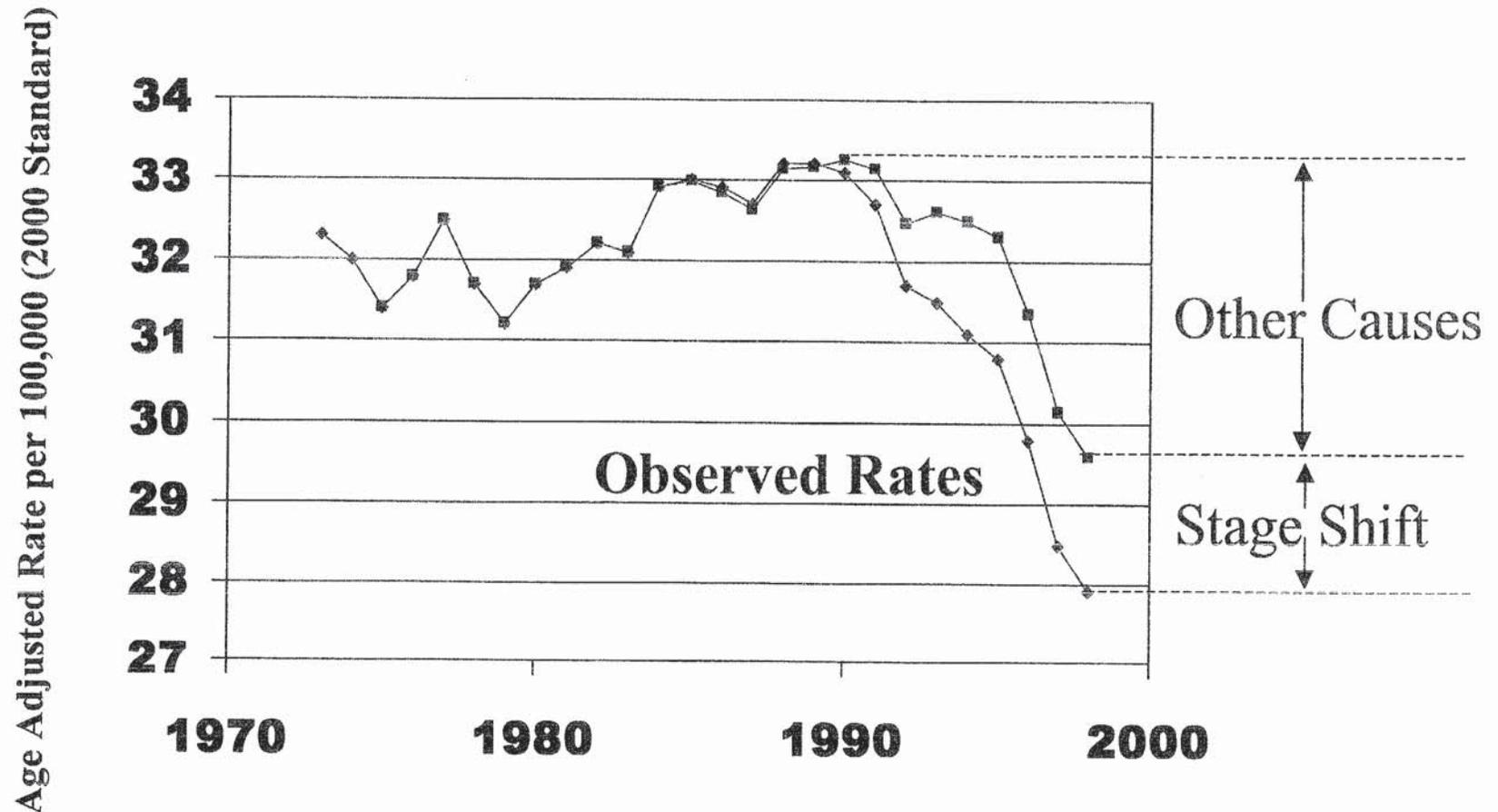
Localized ≥ 2 cm

Localized < 2 cm

Age Adjusted Rate per 100,000 (2000 Standard)



Projected Impact of the Observed Stage Shift on US Breast Cancer Mortality



Observed stage shift shows a net beneficial impact on mortality (exact magnitude of the impact should not be derived from this model)

III. CISNET Overview

- **Cooperative Agreement RFA**
 - First Round Funded Sept. 2000 for up to 4 years:7 Breast, 1 Prostate,1 Colorectal
 - Second Round to be Funded Summer 2002, Prostate, Colorectal, Lung
- **Purpose:**
 - Model the Impact of Cancer Control Interventions (Screening, Treatment, Primary Prevention) on Current and Future Trends
 - Optimal Cancer Control Planning
- **Natural History Models**
 - Incorporate Pre-Clinical Natural History of Disease into Population Planning Models

Funded CISNET Grantees

BREAST GRANTEES

- **Donald A. Berry - The University of Texas M.D. Anderson Cancer**
- **Dennis G. Fryback - University of Wisconsin - Madison**
- **J. Dik, F. Habbema - Department of Public Health, Erasmus University**
- **Jeanne S. Mandelblatt - Georgetown University Medical Center**
- **Sylvia Plevritis - Stanford University**
- **Andrei Y. Yakovlev - Huntsman Cancer Institute, University of Utah**
- **Marvin Zelen - Dana-Farber Cancer Institute**

COLORECTAL GRANTEE

- **Karen Kuntz – Harvard School of Public Health**

PROSTATE GRANTEE

- **Ruth Etzioni – Fred Hutchinson Cancer Research Center**

CISNET Base Question:

What is the Impact of Mammography, Adjuvant Therapy, and the Combination on U.S. Breast Cancer Mortality: 1975-2000?

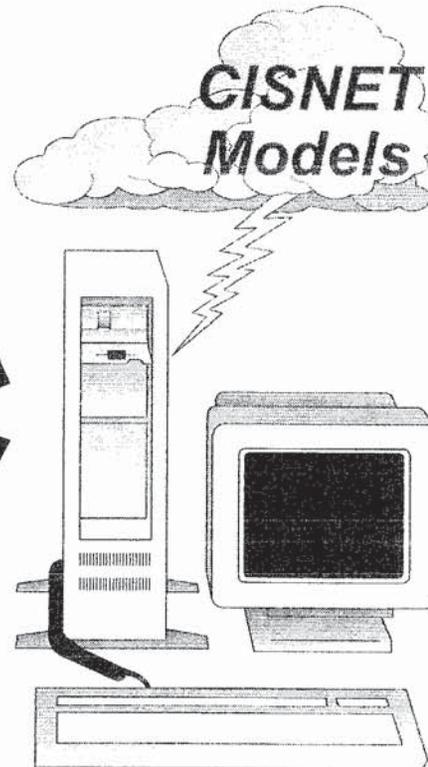
Population Inputs

(Common to all models)

- Dissemination of Adjuvant Therapy
- Dissemination of Mammography
- Change in Background Risk
- Mortality from Other Causes

Model Specific Inputs and Assumptions

- Efficacy of Treatment
- Tumor Growth Rates and Metastatic Spread
- Operating Characteristics of Screening (e.g., Sensitivity, Lead Time, Overdiagnosis)
- Post Diagnosis Survival by Tumor Characteristics



Predicted Incidence

**Predicted Mortality
For**

- Treatment Alone
- Screening Alone
- Treatment and Screening

Conclusions

- Because it is unlikely that in the current environment new randomized trials of screening can be launched alternative approaches must be explored
- Population data and modeling represent an imperfect, yet intriguing, approach to evaluate the community effectiveness of interventions and a partitioning of population trends
- CISNET provides a robust comparative approach to population modeling

Response to the Screening Controversy

- **Continue to refine ecologic analyses**
- **The CISNET Consortium had agreed to speed up its efforts to obtain preliminary results by November 2002**
- **The results of the base question analysis will be published in a JNCI Monograph**