



Policy Relevant Modeling Examples From the Cancer Intervention and Surveillance Modeling Network (CISNET)

<http://www.cisnet.cancer.gov/>

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- I. Overview of CISNET**
- II. What was the Impact of Mammography and Adjuvant Therapy on Breast Cancer Mortality: 1975-2000**
- III. How Much can Cancer Control Interventions Reduce Colorectal Cancer Mortality by 2020?**

I. CISNET Overview

Purpose of CISNET

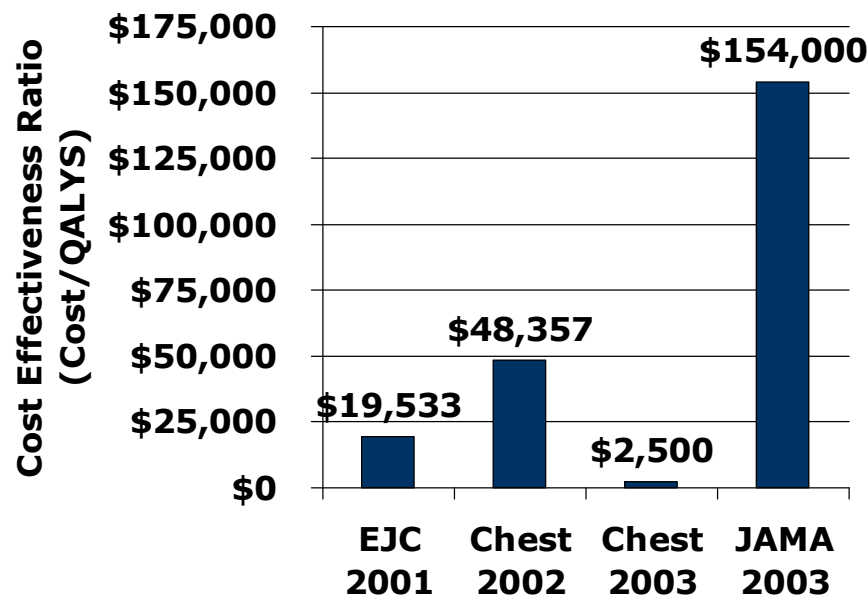


- NCI Sponsored Collaborative Consortium (U01) of Modelers in Breast, Prostate, Colorectal and Lung Cancer
- Focused on bringing the most sophisticated evidence-based decision tools to:
 - ◆ Understand the impact of cancer control interventions (screening, treatment, prevention) on current and future trends in incidence and mortality
 - ◆ Extrapolate evidence from RCT's, epidemiologic, and observational studies to determine the most efficient and cost-effective strategies for implementing technologies in the population
 - ◆ Be responsive to challenges due to the increased pace of technology, by helping to determine which new technologies are the most promising when scaled up to the population level

Comparative Modeling



Older Approach: 4 Independent Studies of the Cost-Effectiveness Of CT Screening for Lung Cancer

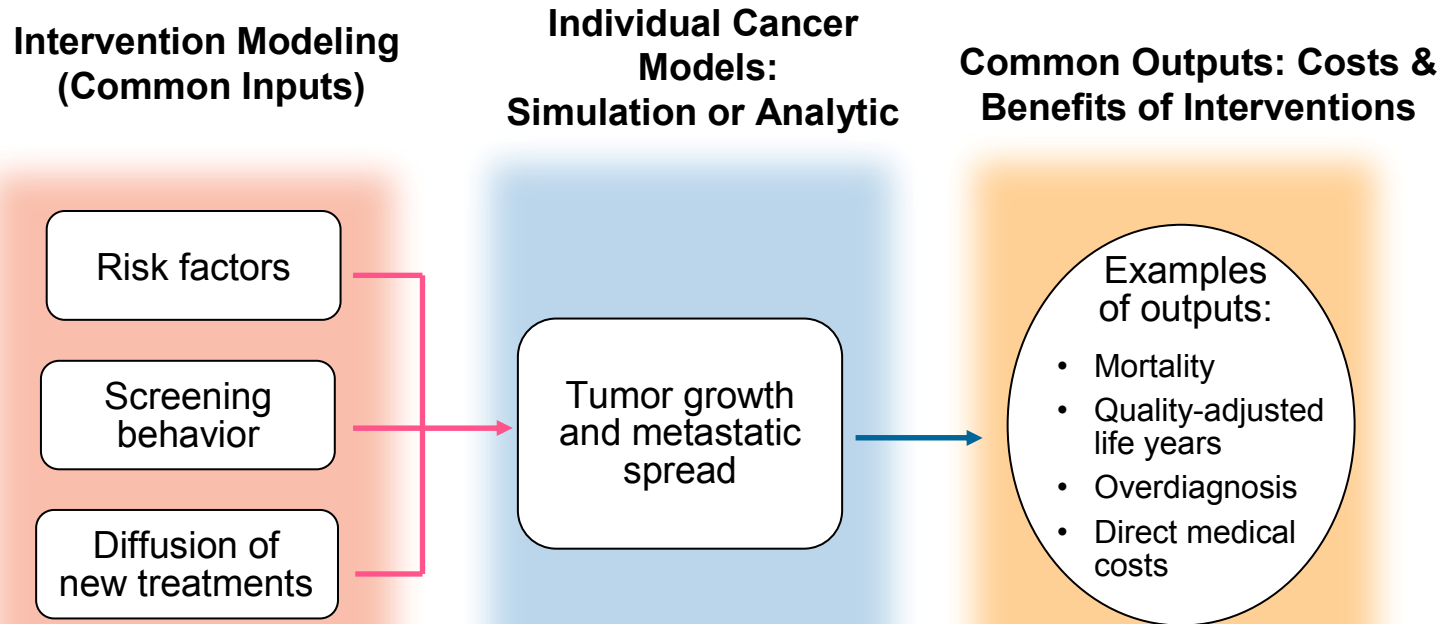


Differences in target population, screening frequency, stage shift, assumptions about lead time and overdiagnosis, sensitivity

Approach Innovated by CISNET: Systematic Comparative Modeling

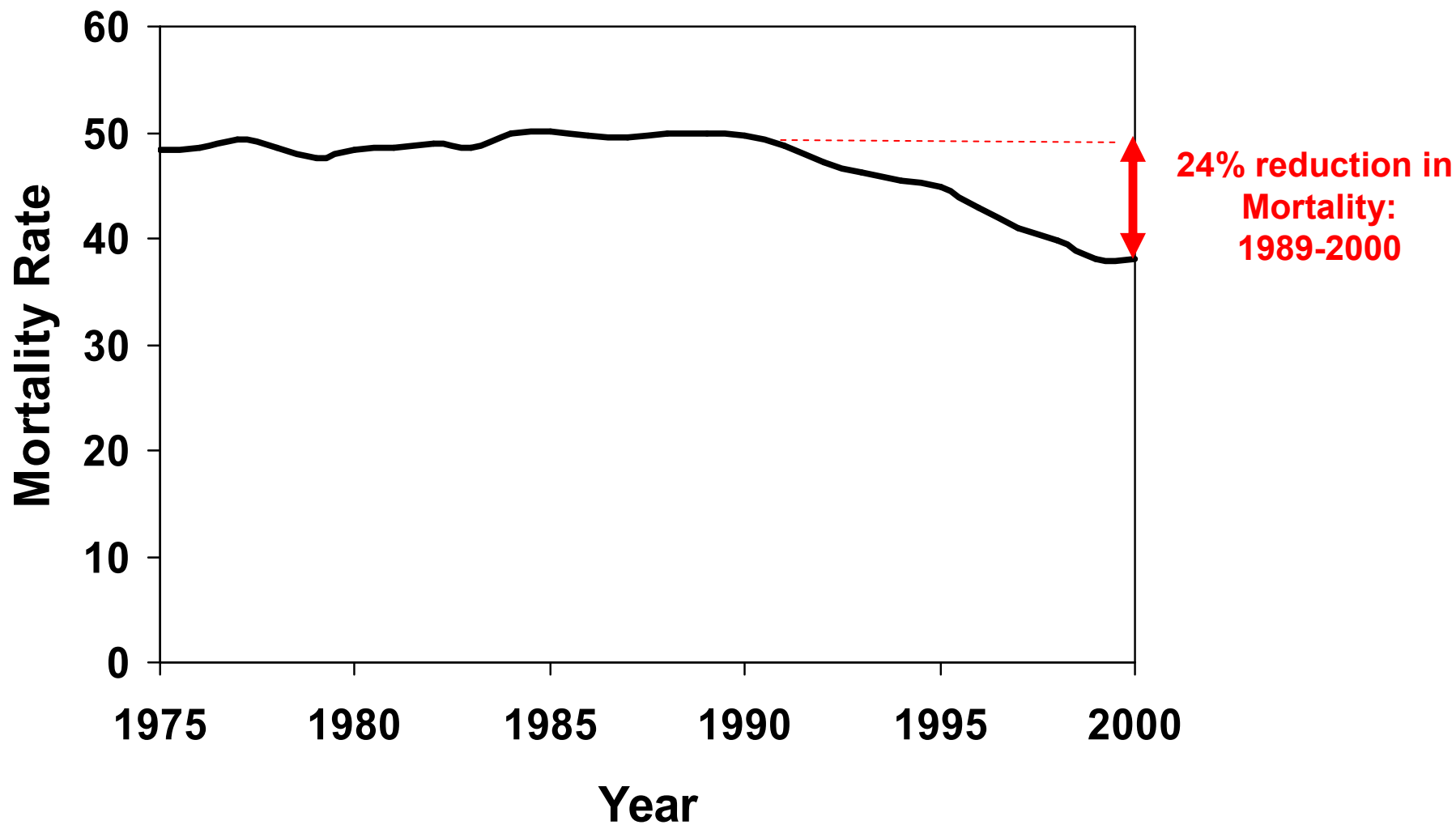
- Central questions to be addressed by groups collaboratively with a common set of inputs and outputs
 - ◆ Reproducibility across models adds credibility to results
 - ◆ Differences points out areas for further study in a systematic way
- Encourages cooperation instead of competition between modelers

Flexible Broad-Based Disease Models



II. What is the Impact of Mammography and Adjuvant Therapy on Breast Cancer Mortality: 1975-2000?

U.S. Breast Cancer Mortality: 1975-2000 Age 30-79



Age Adjusted to 2000 US Standard

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

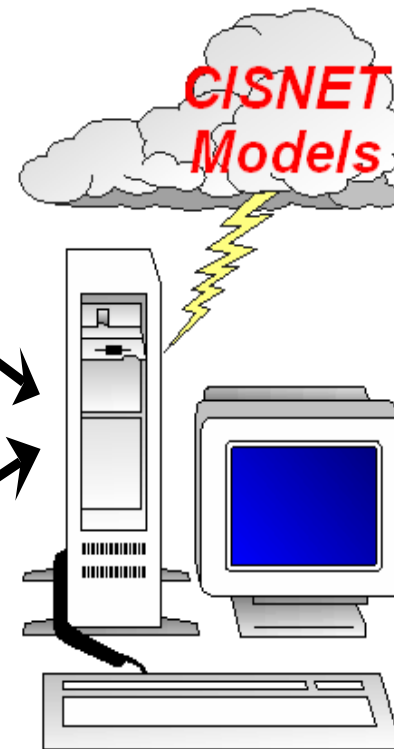


Population Inputs (Common to all models)

- 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

Seven CISNET Grantees Contributing to this Project



Dana Farber (D) – Marvin Zelen

Sandra J. Lee, Hui Huang, Rebecca Gelman

Erasmus University (E) – Dik Habbema

Sita Y.G.L. Tan, Gerrit J. van Oortmarsen, Harry J. de Koning, Rob Boer

Georgetown University (E) – Jeanne Mandelblatt

Clyde B. Schechter, K. Robin Yabroff, William Lawrence, Bin Yi, Jennifer Cullen

MD Anderson (M) – Donald Berry

Lurdes Inoue, Mark Munsell, John Venier, Yu Shen, Greg Ball, Emma Hoy,
Richard L. Theriault, Melissa Bondy

Stanford University (S) – Sylvia Plevritis

Bronislava Signal, Peter Salzman, Peter Glynn, Jarrett Rosenberg, Sanatan Rai

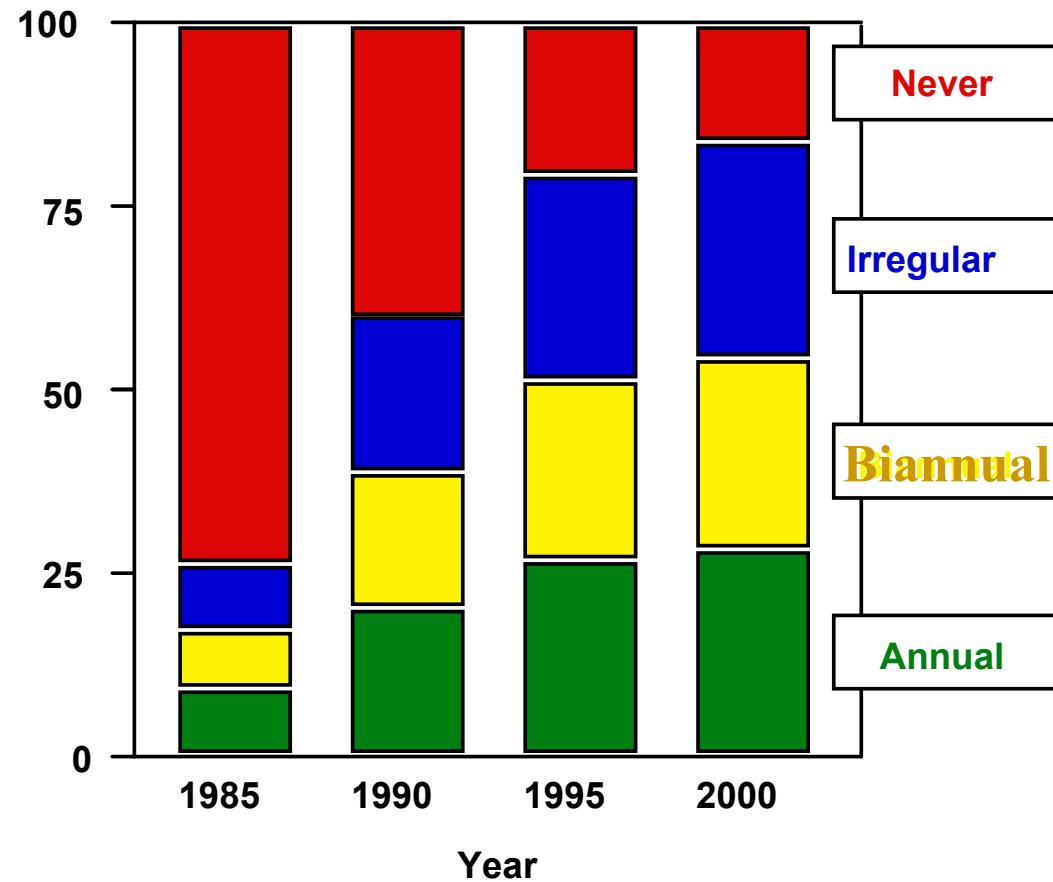
University of Rochester (R) – Andrei Yakovlev

Alexander V. Zorin, Leonid G. Hanin

University of Wisconsin (W) – Dennis Fryback

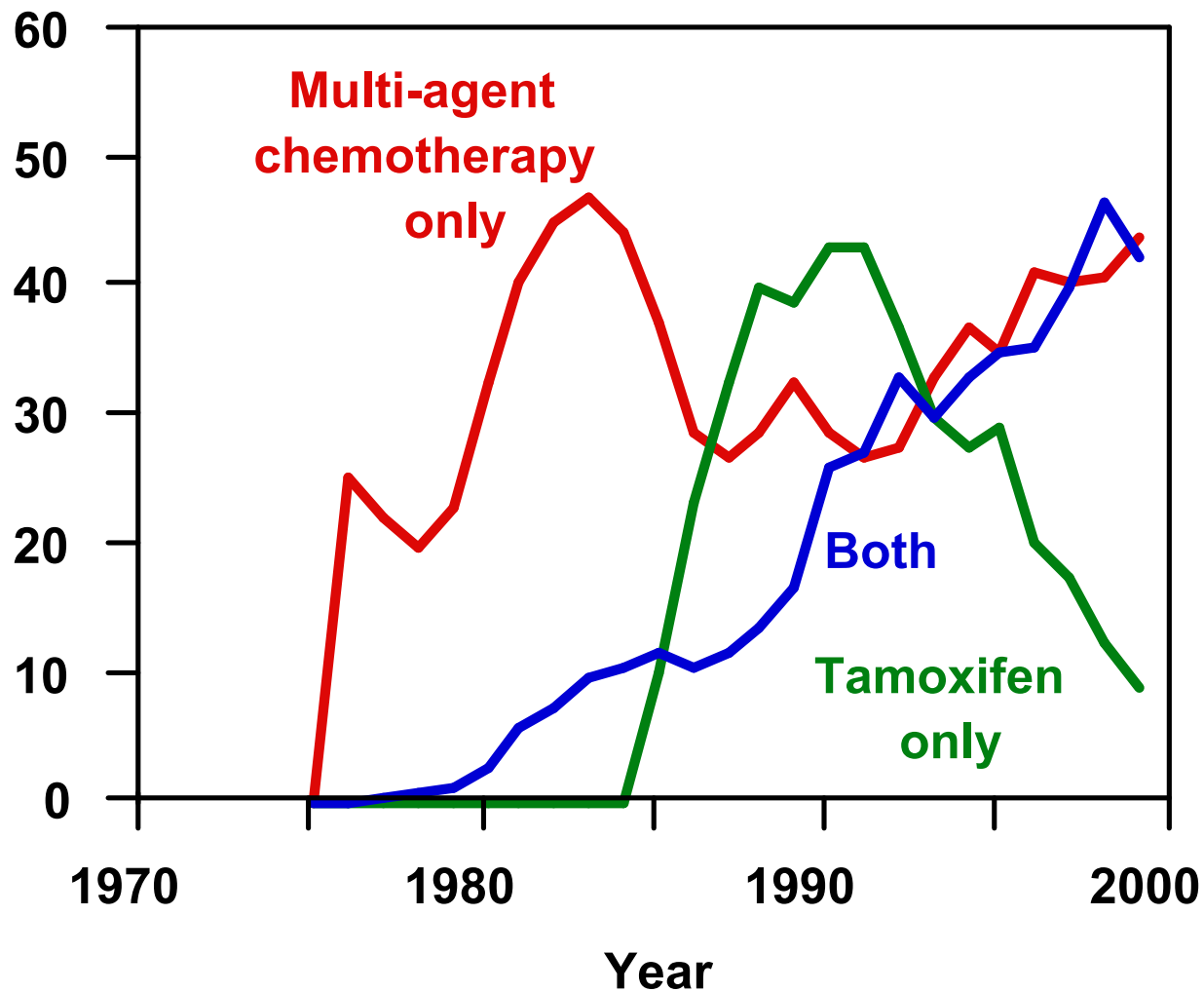
Marjorie A. Rosenberg, Amy Trentham-Dietz, Patrick L. Remington,
Natasha K. Stout, Vipat Kuruchittham

Modeled Mammography Screening Over Time, Women Ages 30-79



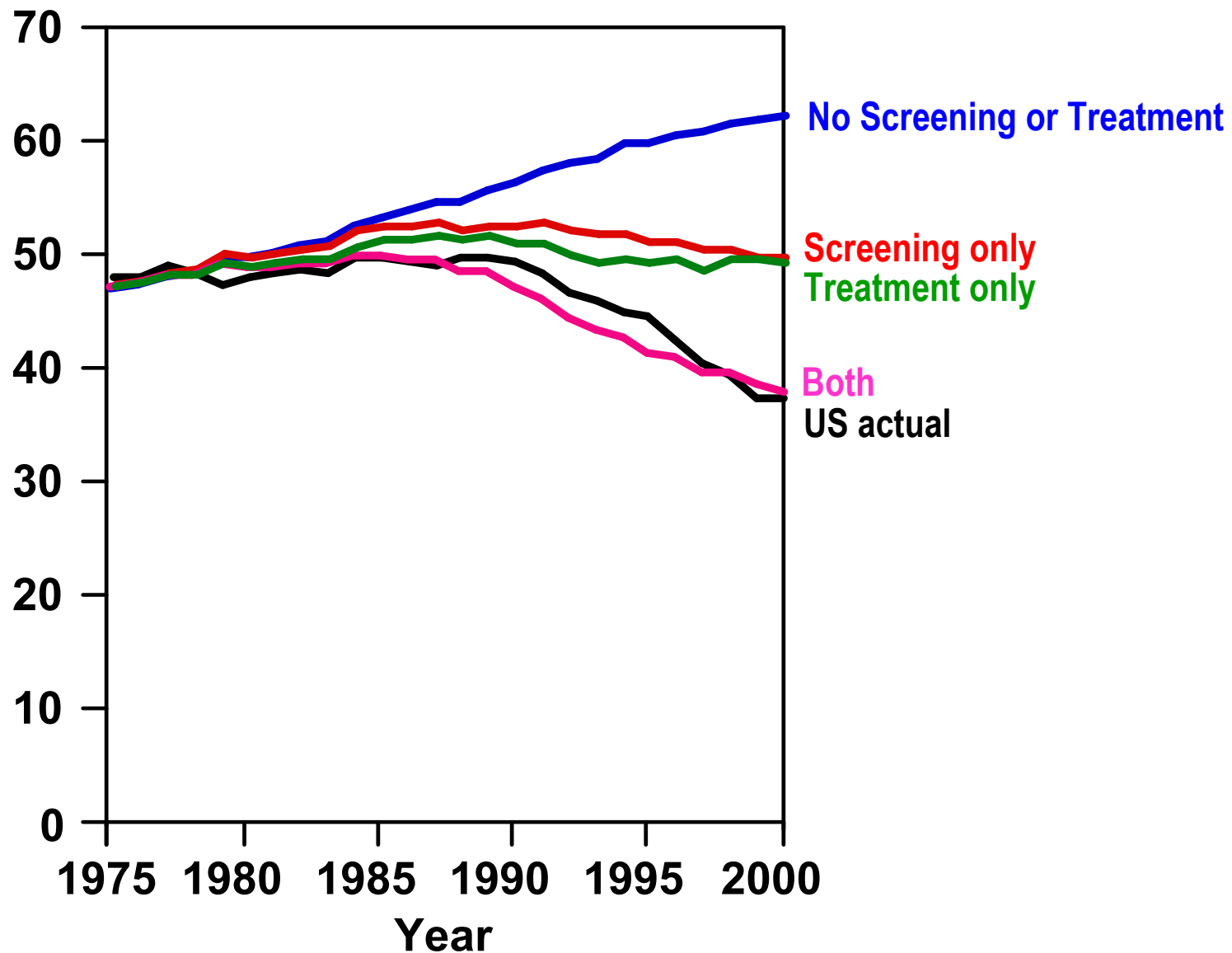
Cronin et al. Cancer Causes and Control (2005):
National Health Interview Surveys (age at first mammogram)
Breast Cancer Surveillance Consortium (time between mammograms) -
<http://breastscreening.cancer.gov/>

Dissemination of Adjuvant Therapy for Women age 50-69 with Node Positive Stage II or IIIA



Source: Mariotto et al. JNCI (2002) -- SEER Data and Patterns of Care Studies

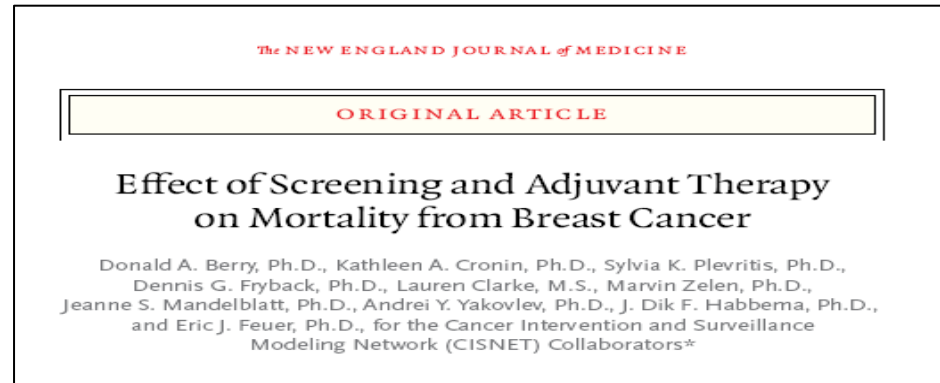
One Group's Mortality Rate per 100,000 Women 30-79 under Various Scenarios



Publications



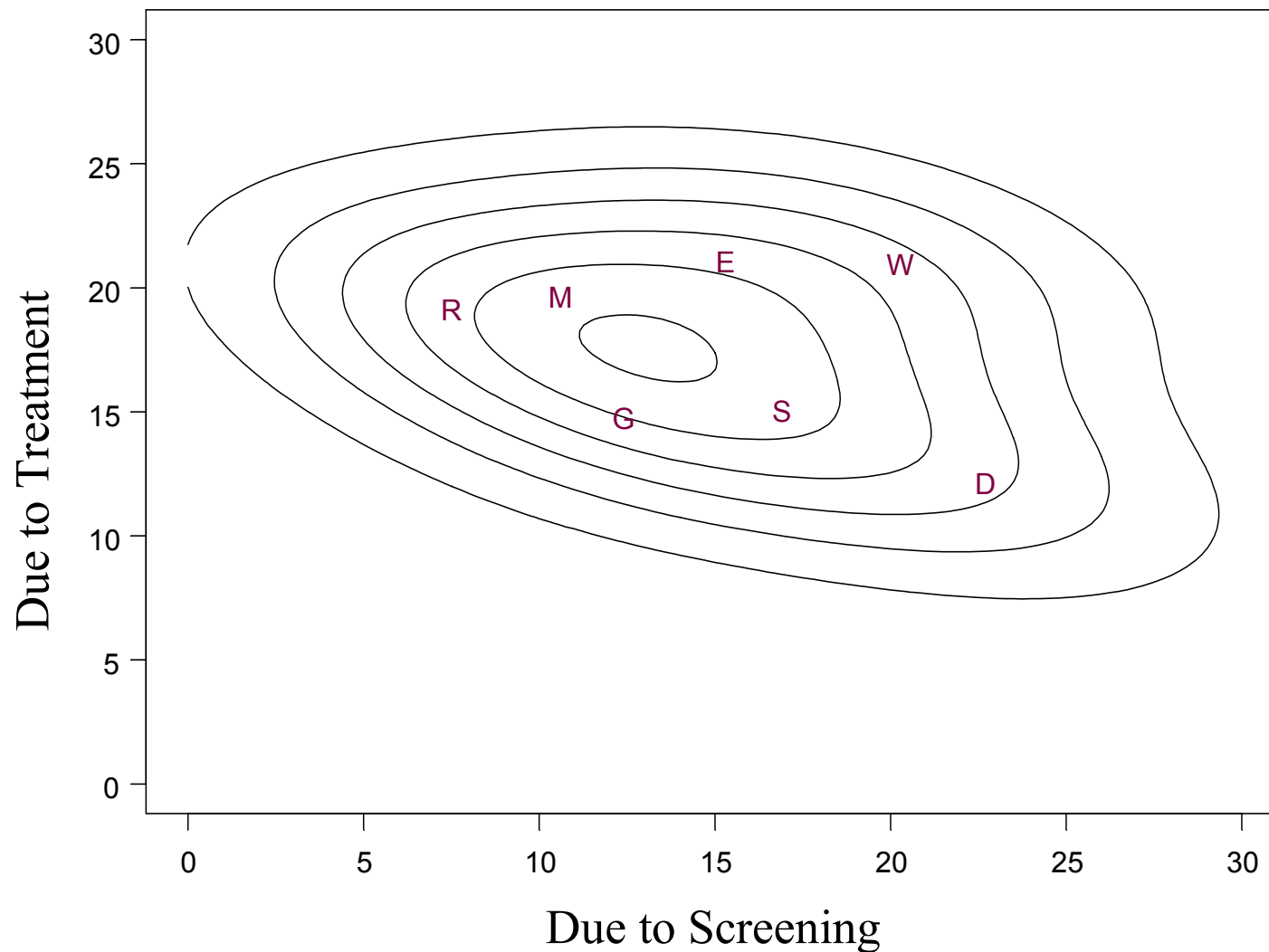
- Berry et al. NEJM 2005
 - ◆ Effect of Screening and Adjuvant Therapy on Mortality from Breast Cancer



- JNCI Monograph #36, 2006
 - ◆ 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



Percent reduction in the rate of death among U.S. women age 30-79 due to adjuvant therapy and to screening mammography



Berry et al. NEJM, Oct. 2005

Conclusions and Press Coverage



“What seems most important is that each team found at least some benefit from mammograms. The likelihood that they are beneficial seems a lot more solid today than it did four years ago, although the size of the benefit remains in dispute”

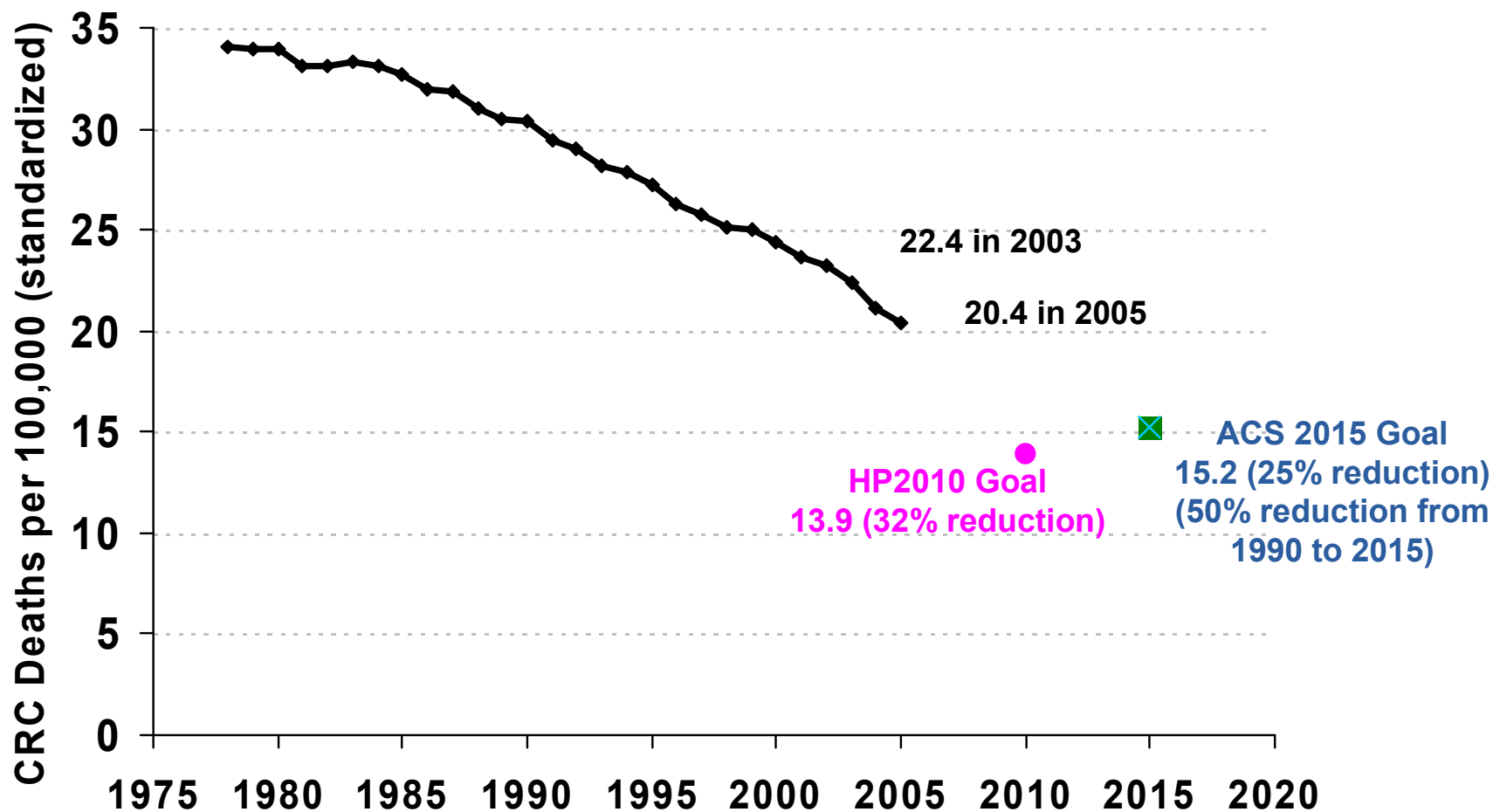
New York Times Editorial Oct. 22, 2005

Observational data and modeling provided additional evidence to help answer a question that RCT's had not completely settled

**III. How much can cancer
control interventions reduce
colorectal cancer mortality by
2020?**

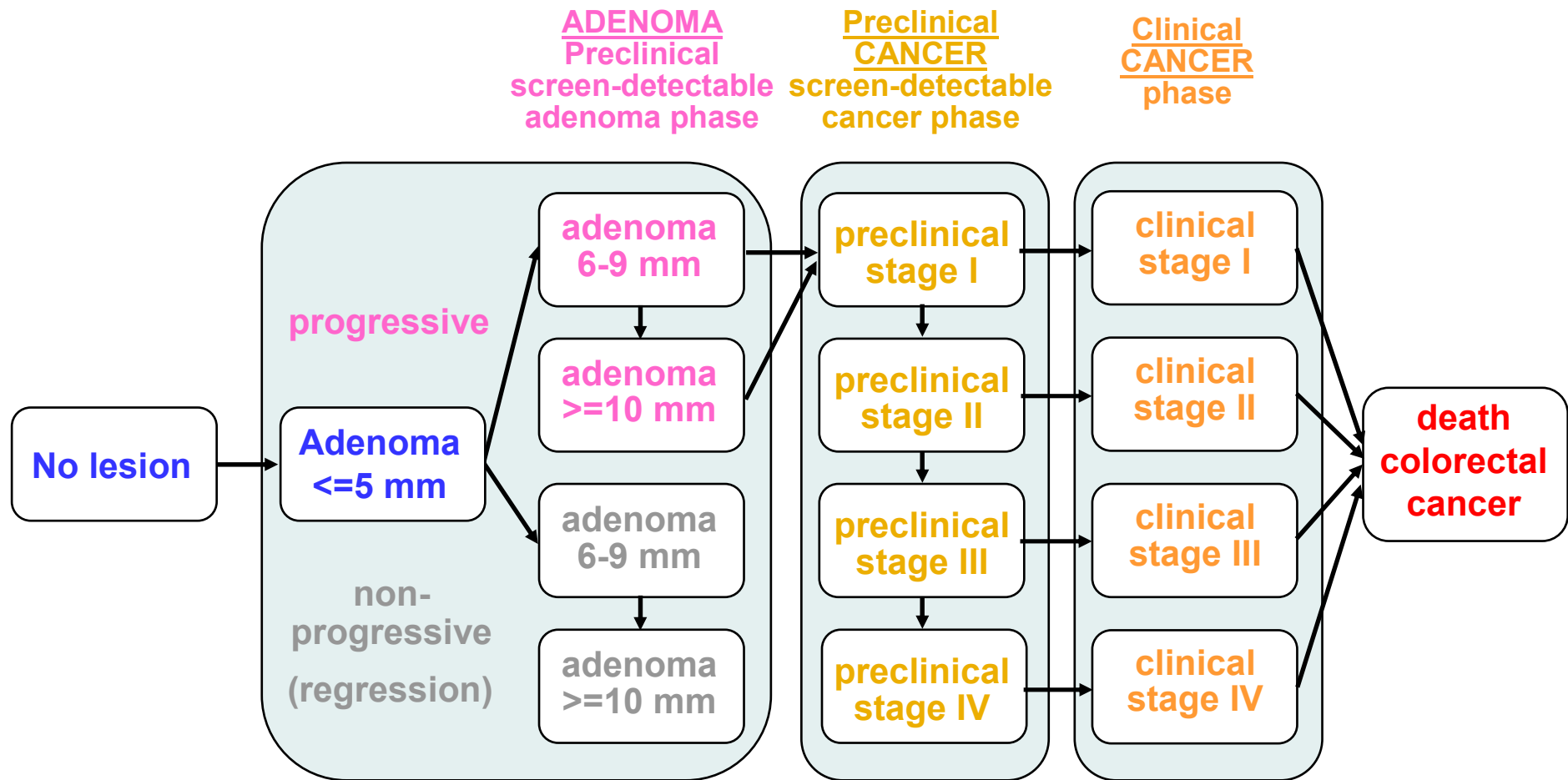
Colorectal Cancer Mortality – White Men

Healthy People 2010 goal



- HP 2010 - WF (14.1 to 13.9: 1.4%) BM (30.4 to 13.9 : 54%) BF (21.2 to 13.9: 34%)
- ACS 2015 – WF(14.1 to 10.1: 28%) BM(30.4 to 18.8: 38%) BF(21.2 to 13.3: 37%)

Natural History of Colorectal Cancer



Datasources:

Adenoma
Autopsy studies
Colonoscopy studies

Preclinical Cancer
Dwell time

Clinical Cancer
SEER Incidence

Death
US Mortality

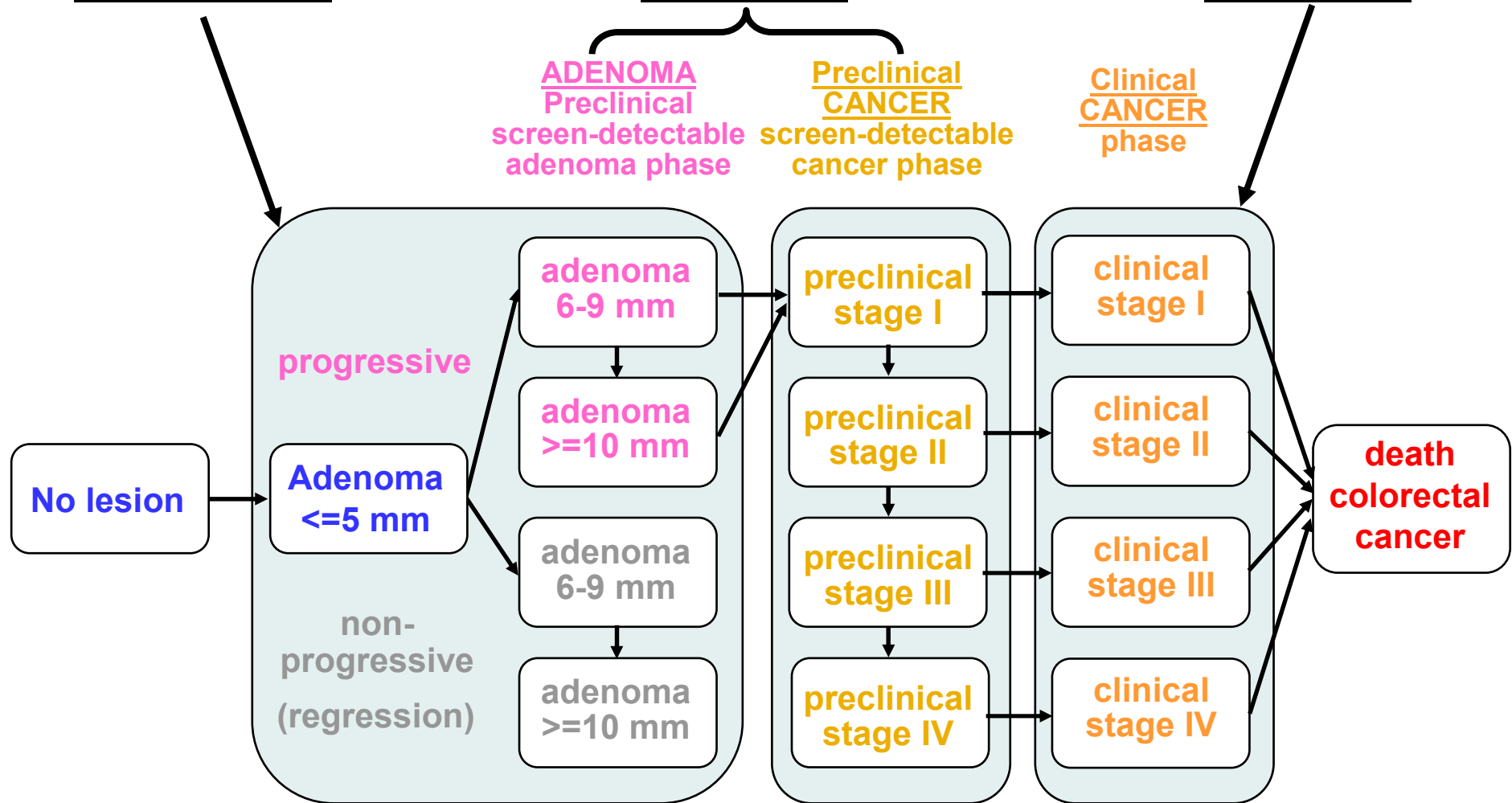
Interventions on Colorectal Cancer



Risk Factors

Screening

Treatment



Datasources:

Adenoma
Autopsy studies
Colonoscopy studies

Preclinical Cancer
Dwell time

Clinical Cancer
SEER Incidence

Death
US Mortality

Upstream Factors Modeled: Colorectal Cancer



- Risk Factors:
 - ◆ Smoking, Obesity, Red Meat
 - ◆ Physical Activity, Multivitamin Use, Aspirin, Fruit and Vegetable Consumption, Hormone Replacement Therapy

- Screening:
 - ◆ FOBT, Endoscopy (Sigmoidoscopy / Colonoscopy)

- Treatment:
 - ◆ Stage II & III Adjuvant Chemo, Stage IV Chemo

Explicit HP2010 Goals



- Risk Factors:
 - ◆ Smoking, Obesity, Red Meat
 - ◆ Physical Activity, Multivitamin Use, Aspirin, Fruit and Vegetable Consumption, Hormone Replacement Therapy

- Screening:
 - ◆ FOBT, Endoscopy (Sigmoidoscopy / Colonoscopy)

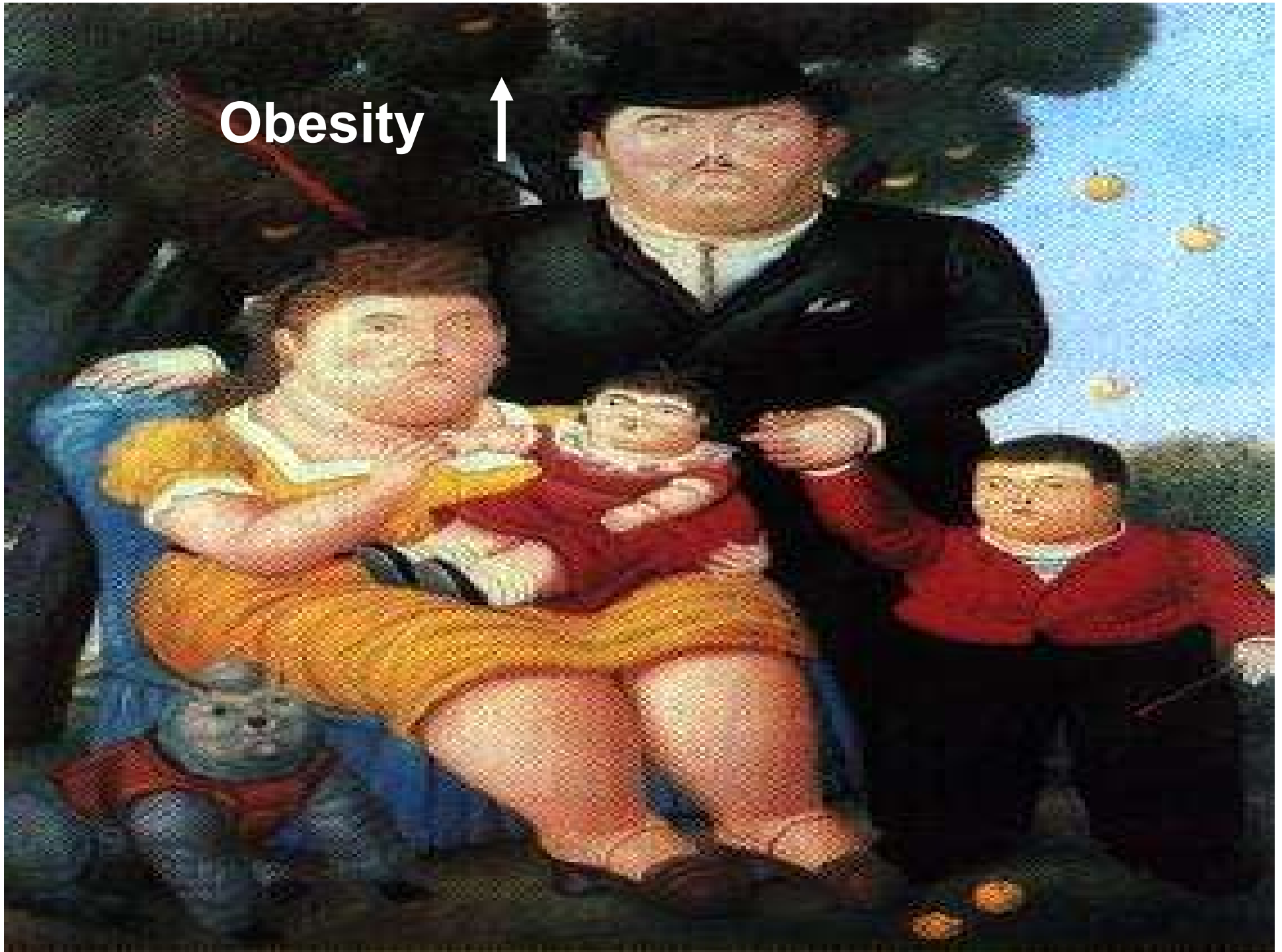
- Treatment:
 - ◆ Stage III Adjuvant Chemo, Stage IV Chemo

Scenarios Modeled for 2005-2020 for Upstream Factors – Colorectal Cancer



<i>SCENARIO</i>	<i>DESCRIPTION</i>
CONSERVATIVE	Upstream factors remain at levels achieved in 2005
PROJECTED TRENDS	Continuation of past trends
HP2010 UPSTREAM GOALS MET	Use continued trends for factors with no explicit upstream goals
OPTIMISTIC	Difficult but feasible “best case” levels of upstream factors

Obesity

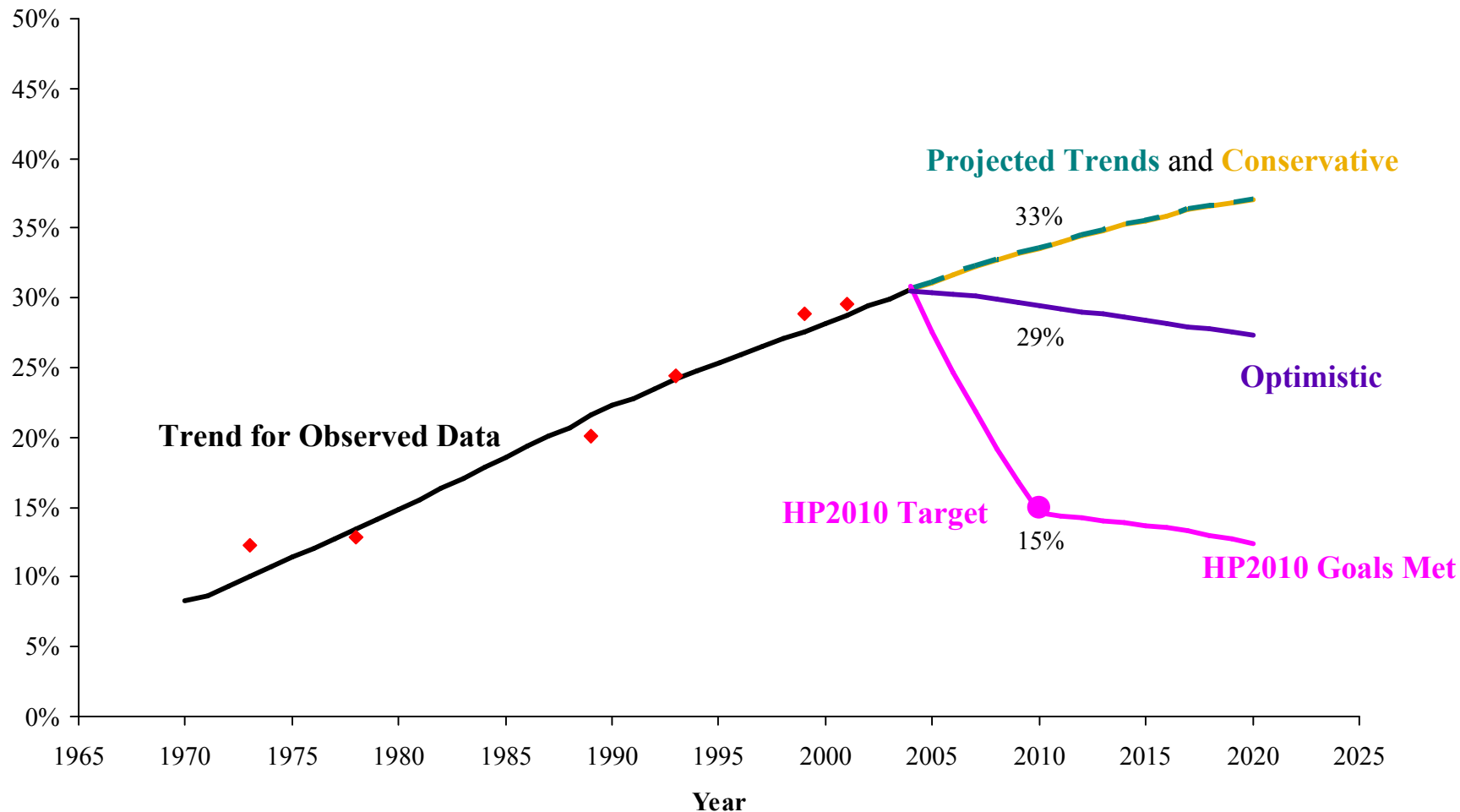


Risk Factor Example: Obesity

Percent of White Men (Age 25-84) who are Obese (BMI ≥ 30 kg/m²)



(RR = 1.33)



Data Source: NHANES Surveys

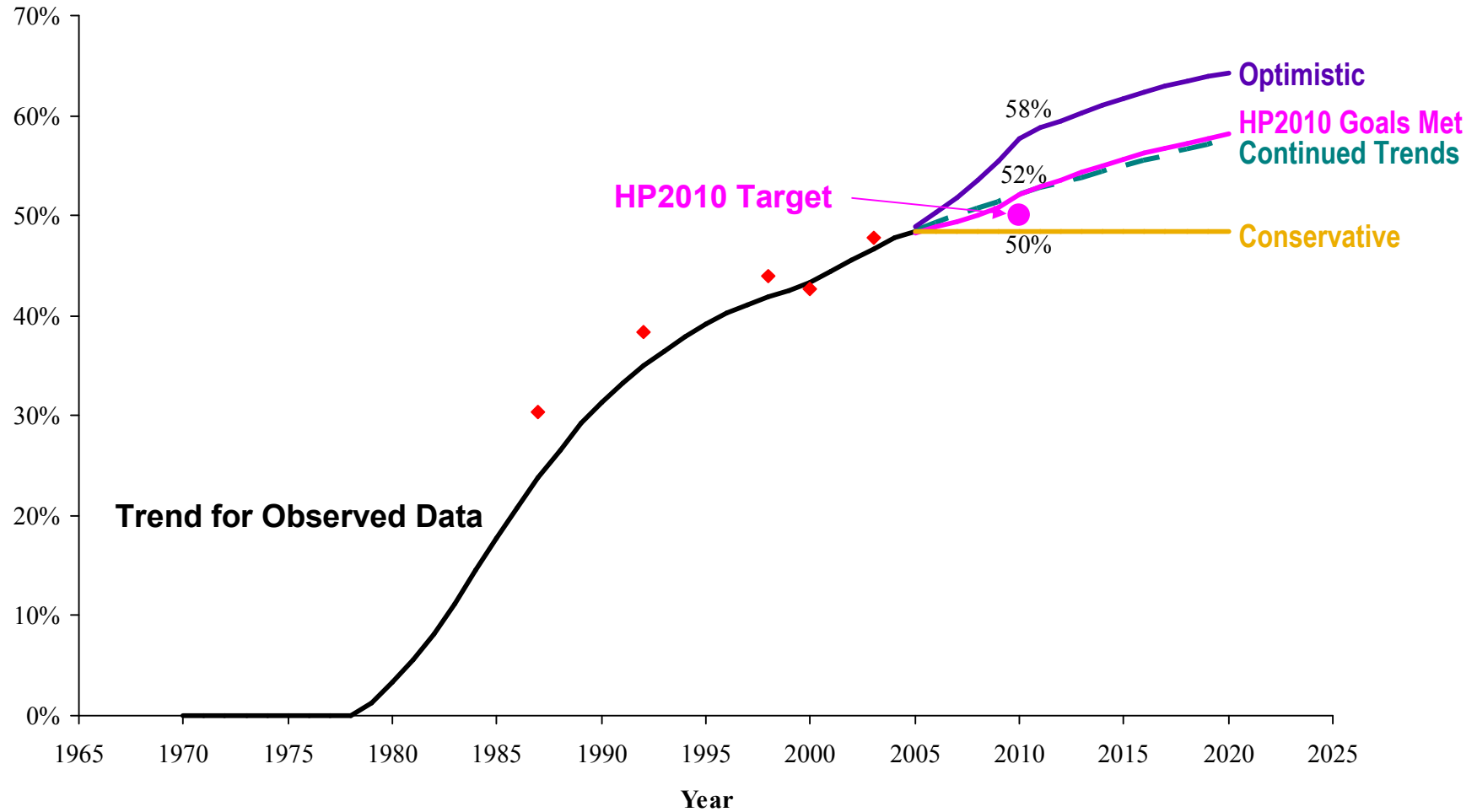
Colorectal Cancer Screening: FOBT, Flexible Sigmoidoscopy, Colonoscopy



Fiberoptic sigmoidoscope

Screening Example: Endoscopy

Percent of Adults (Age 50+) Who Ever Had a Colorectal Endoscopy (sigmoidoscopy or colonoscopy)

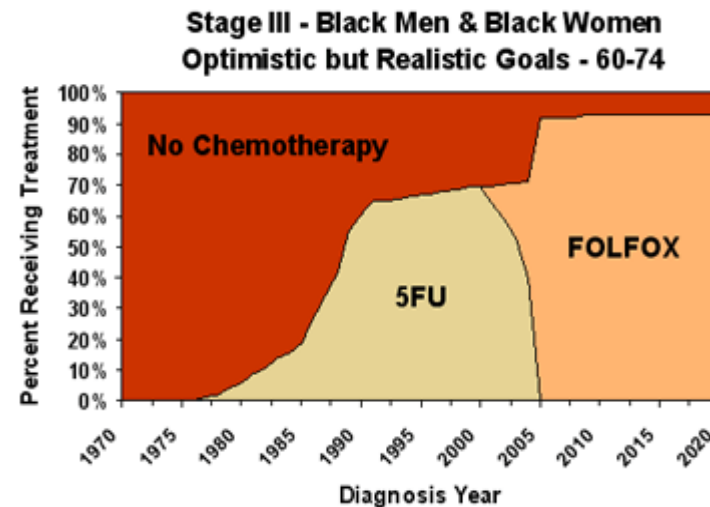
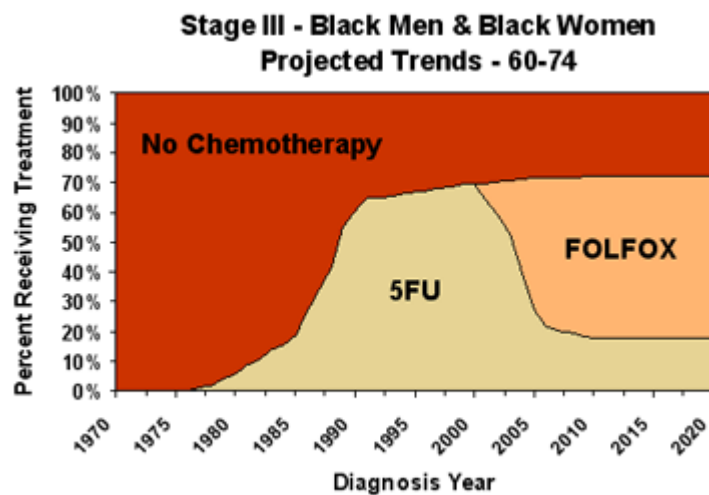
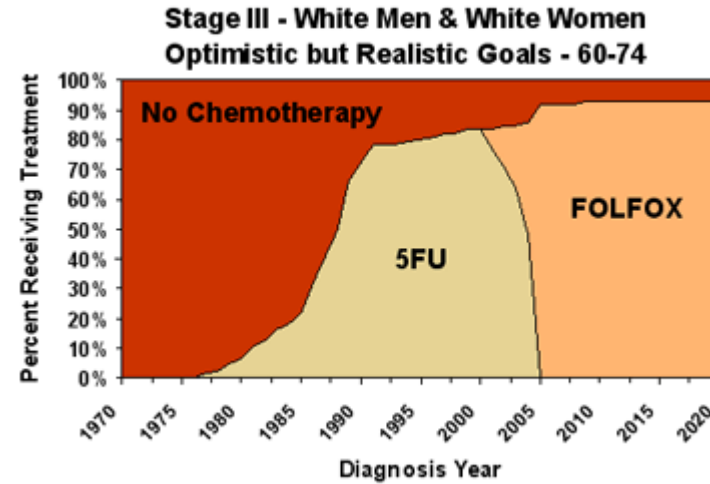
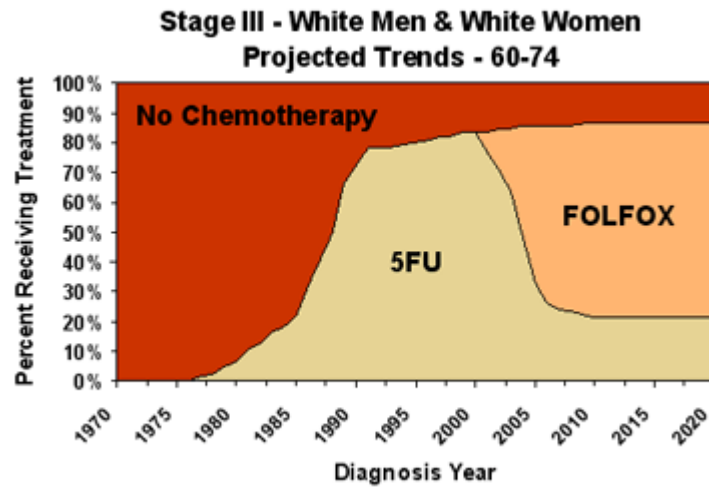


Data Source: NHIS

Chemotherapy for Colorectal Cancer

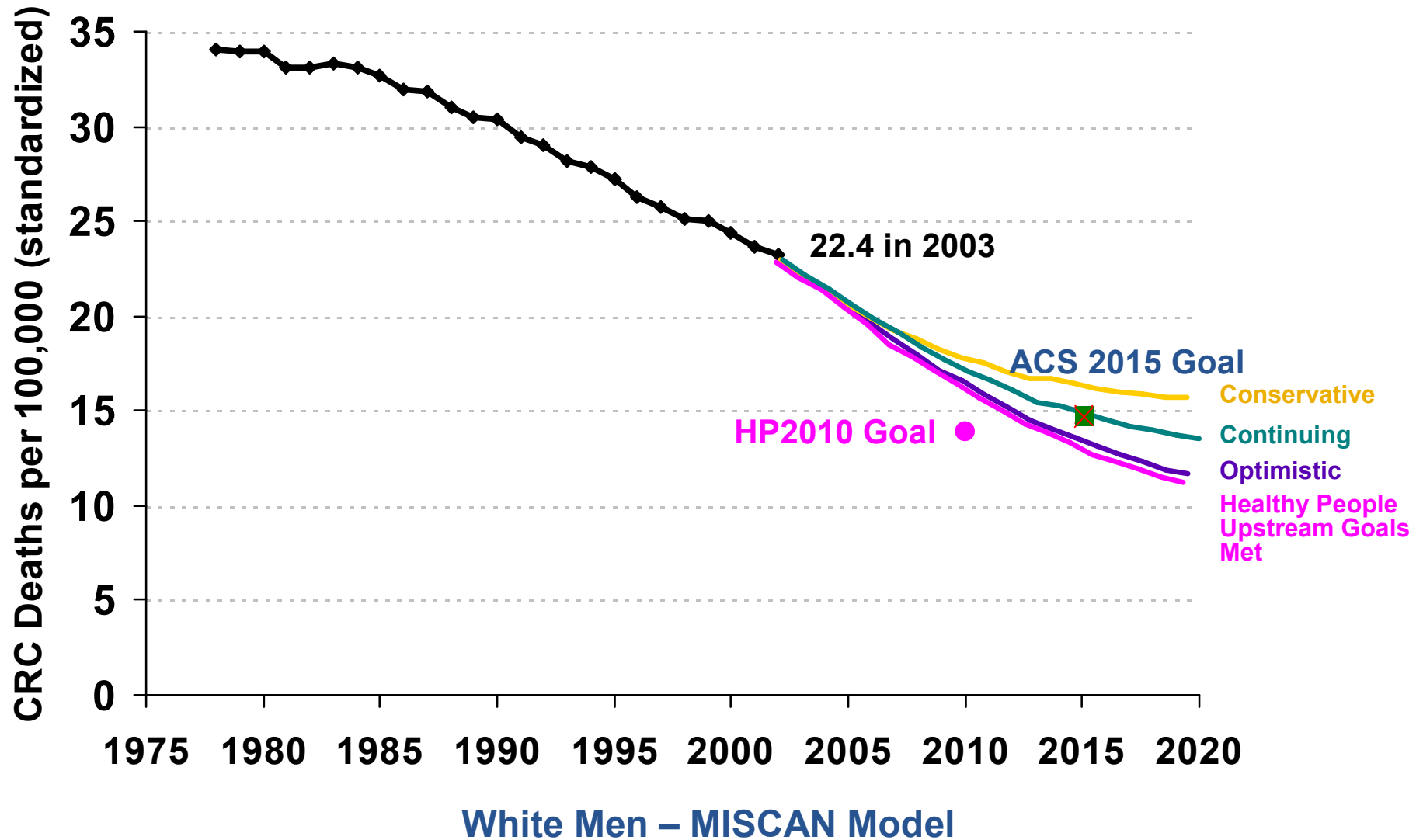


Dissemination of Chemotherapy Stage III

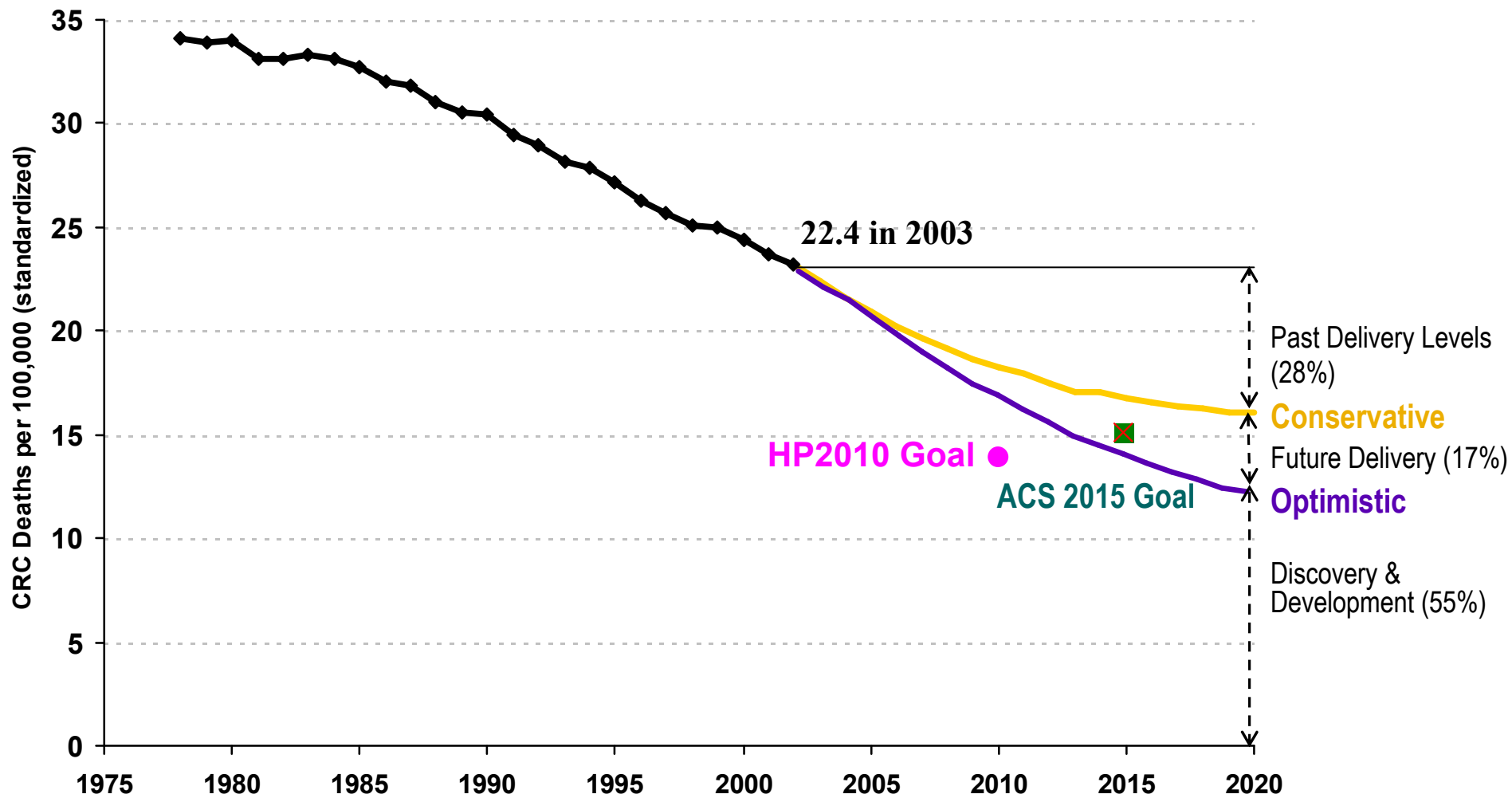


Data Sources: SEER Based Patterns of Care Studies, SEER-Medicare (older patients), NCCQ survey (5 metro areas)

If we meet all the upstream goals, how close can we come to meeting the mortality goal?

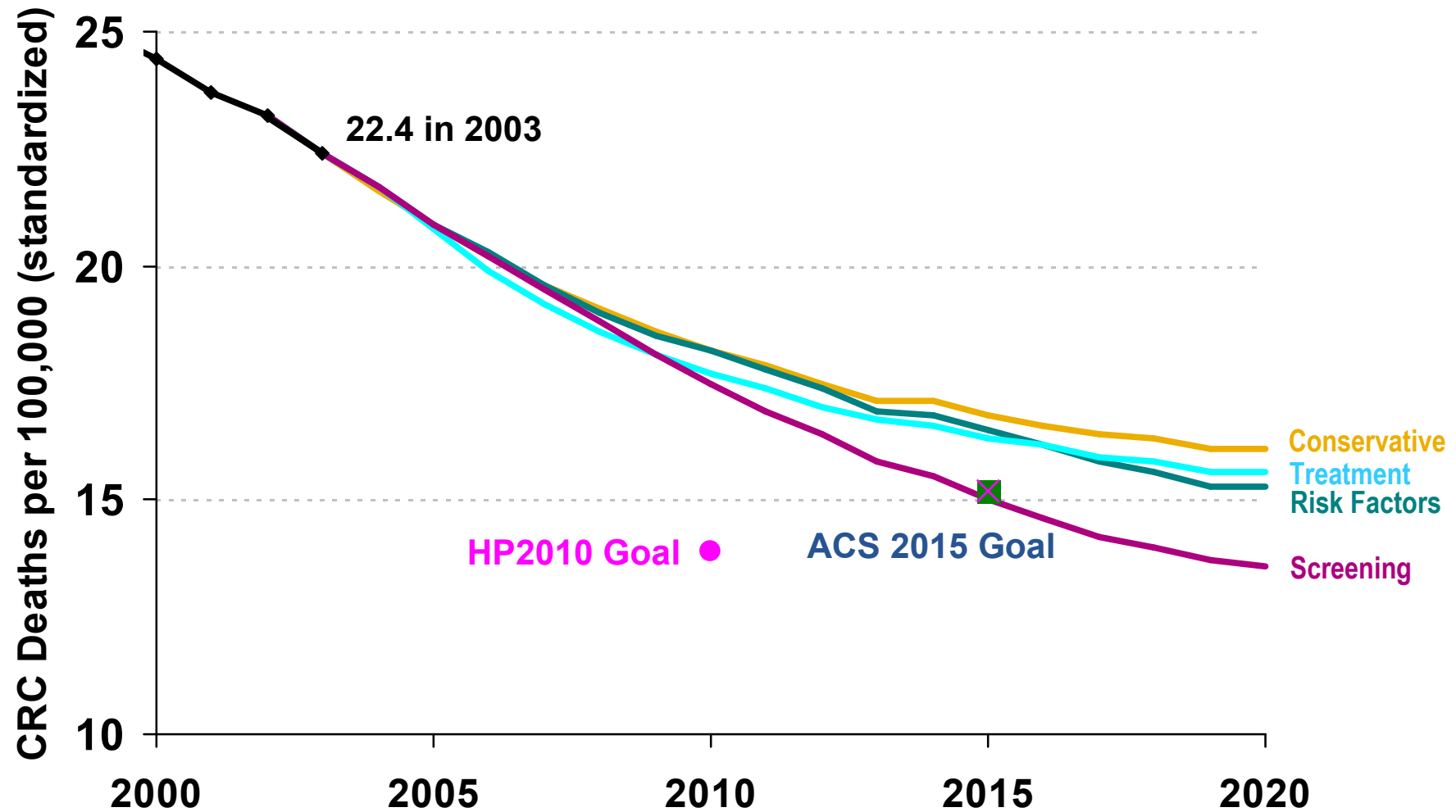


What is the Potential Mortality Impact of Meeting Optimistic Goals for the Delivery of Screening, Treatment, and Prevention by 2020?



White Men – MISCAN Model

What is the contribution of screening, treatment and risk factors to the mortality decline?



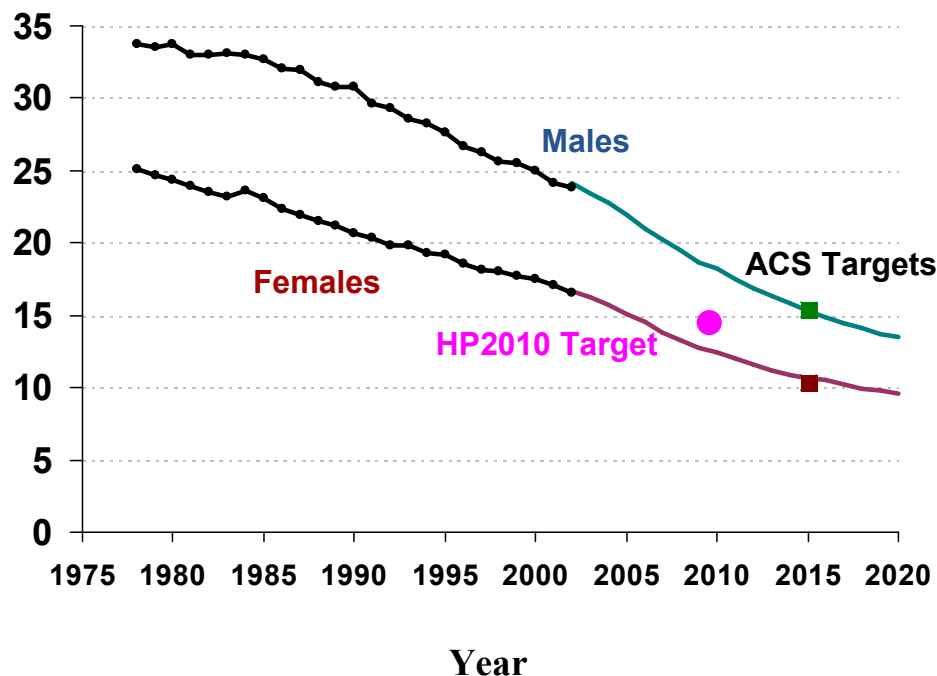
White Men – MISCAN Model

“Optimistic” Results by Sex and Race

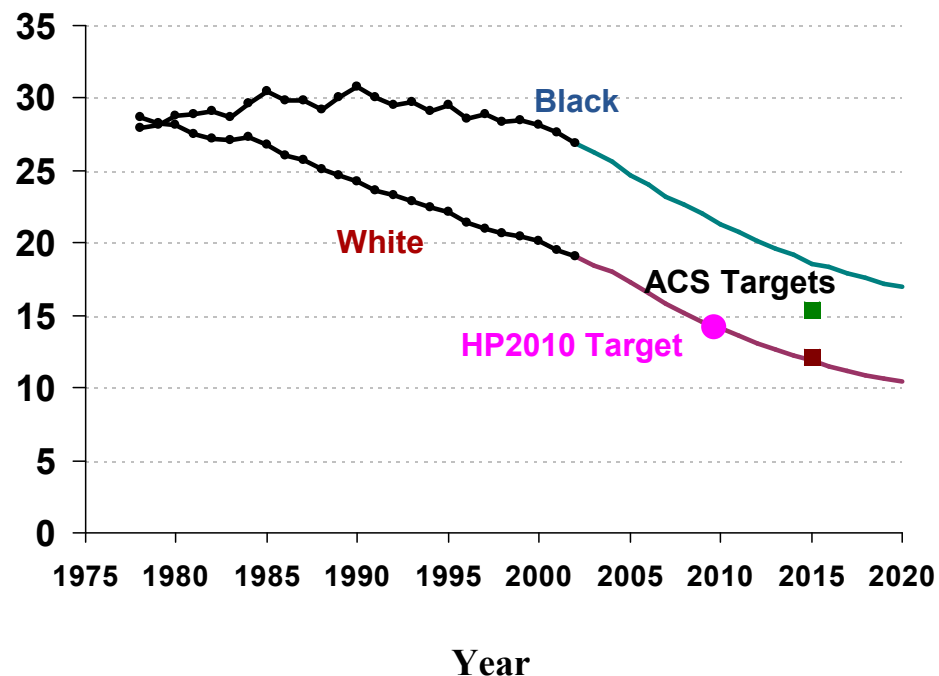


CRC Death Rates per 100,000 (standardized)

By Sex



By Race



MISCAN Model

Some Conclusions



- Fuller utilization of already developed technologies can get us almost half way to eliminating CRC mortality by 2020
- Without an aggressive sustained approach to continuing the increased uptake of current interventions, the reduction could almost half that
- Screening is the best short to medium term cancer control opportunity
 - ◆ Risk factor modification is a long term investment with benefits across a wide range of diseases
 - ◆ Increased treatment utilization has an almost immediate but modest benefit: whites already have high usage levels, more room for improvement in blacks
- Whites will reach or exceed the ACS 2015 goal – it is unlikely for blacks. Some of the best cancer control opportunities are for reducing health disparities.

Colorectal Cancer Mortality Projections Web Site

<http://cisnet.cancer.gov/projections/colorectal/>



National Cancer Institute

U.S. National Institutes of Health | www.cancer.gov

Colorectal Cancer Mortality Projections

SEARCH

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Modeling the impact of cancer control efforts on US colorectal cancer mortality

Our purpose is to inform cancer control planning and public policy discussion.

The NCI's Cancer Intervention and Surveillance Modeling Network ([CISNET](#)) developed this Web site to help cancer control planners, program staff and policy makers consider the impact of risk factor reduction, increased early detection, and increased access to optimal treatment on future colorectal cancer mortality rates.

This site shows the results of simulation modeling—computer simulations of colorectal disease progression in a population with the characteristics of the US population. Use this information to:

- see how **policy** options to increase cancer prevention, screening, and access to state-of-the-science treatment can affect future mortality trends.
- help determine **cancer control program** priority areas for new intervention investments.
- identify **research** questions and opportunities.

To get started:

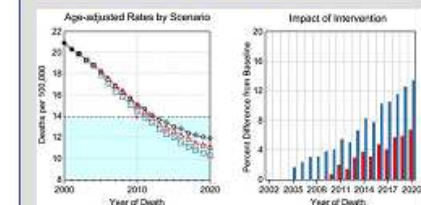
- Watch and listen to our [Introductory Tutorial](#) (Flash - 1:10 min.).
- View [Key Findings](#) to answer important questions about how best to reduce CRC mortality.
- Explore the [Interactive Graphs](#) to view and compare results of the simulation models.

Suggested Citation: Colorectal Cancer Mortality Projections, National Cancer Institute, NIH, DHHS, Bethesda, MD, December 2007, <http://cisnet.cancer.gov/projections/colorectal/>.

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For a printable summary of the Colorectal Cancer Mortality Projections Web Site, download the [Fact Sheet \(PDF\)](#).

Interactive CRC Mortality Graphs



Create charts and graphs projecting future trends in CRC mortality based on results from simulation models. Results are presented as the percent decline in mortality and deaths per 100,000.

Last modified: January 03, 2008

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USA.gov

Working with CISNET Investigators



- CISNET investigators invite collaborations on applying their models
 - ◆ Work together to decide inputs, model runs, interpret results
 - ◆ Past and current collaborations include USPSTF, CMS, CDC

- There is a science of modeling, but also a science of applying modeling, and communicating the results of models to policy makers and cancer control planners

- Several of the program mentors are CISNET investigators
 - ◆ Opportunity to learn the craft of modeling and model application at the members institution and then return to Ireland and apply it to the local situation