Cancer Intervention and Surveillance Modeling Network: Scientific Update

Colorectal Cancer Initiative

National Cancer Advisory Board
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Outline

- Colorectal Cancer CISNET program
- Micro-simulation modeling for colorectal cancer
- Example: How much can current interventions reduce colorectal cancer in the United States?
  - What are best short term and long term choices for cancer control interventions?

How I became involved in modeling

- I am the biostatistician for National Polyp Study
  - National Polyp Study (NPS) was RCT for colonoscopic surveillance intervals for adenoma patients
  - Provided study data from NPS to assess a policy model for natural history predicting adenoma and colorectal cancer outcomes
- Microsimulation model (MISCAN)
  - Preliminary fit to observed data was not good
  - When changed model to assume some adenomas regress, then good fit of model
    - Adenoma regression was novel at the time
    - Regression is now more accepted

CISNET Modeling to Inform Health Policy

What CMS reimbursement for a new FOBT test?

$4.50

Guaiac FOBT

$ to be determined

Immunochemical FOBT

Cost Effectiveness of Immunochemical FOBT of CMS

- What CMS reimbursement relative to increase in effectiveness?
- CRC CISNET modeling for AHRQ and CMS
  - Immunochemical FOBT approved for reimbursement
  - Cost effectiveness estimate used in setting reimbursement fee

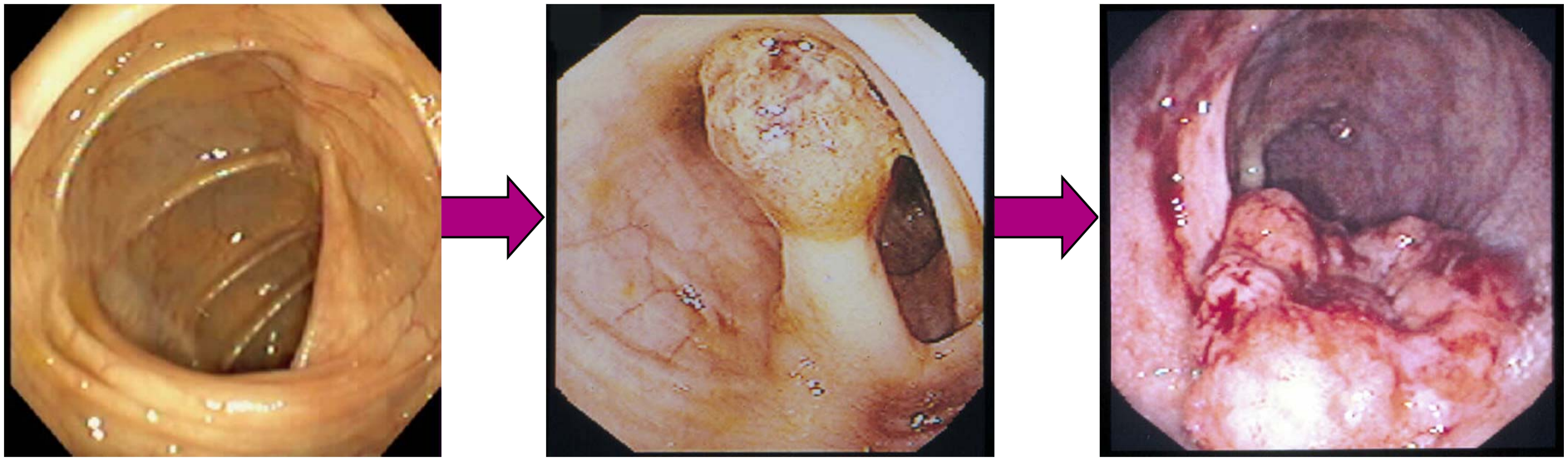
$22

Other Examples of CISNET Modeling to Inform Health Policy Decisions

- Impact of screening, treatment, and risk factor effects on CRC incidence and mortality 1975-2000
- Clinical processes that affect survival and quality of care for CRC for Cancer Care Quality Measurement Project (Canqual)
- Customizing colonoscopy screening by race and age to begin screening
- Impact of missing diminutive adenomas with virtual colonoscopy

Microsimulation Modeling of Colorectal Cancer

Adenoma to Carcinoma Pathway



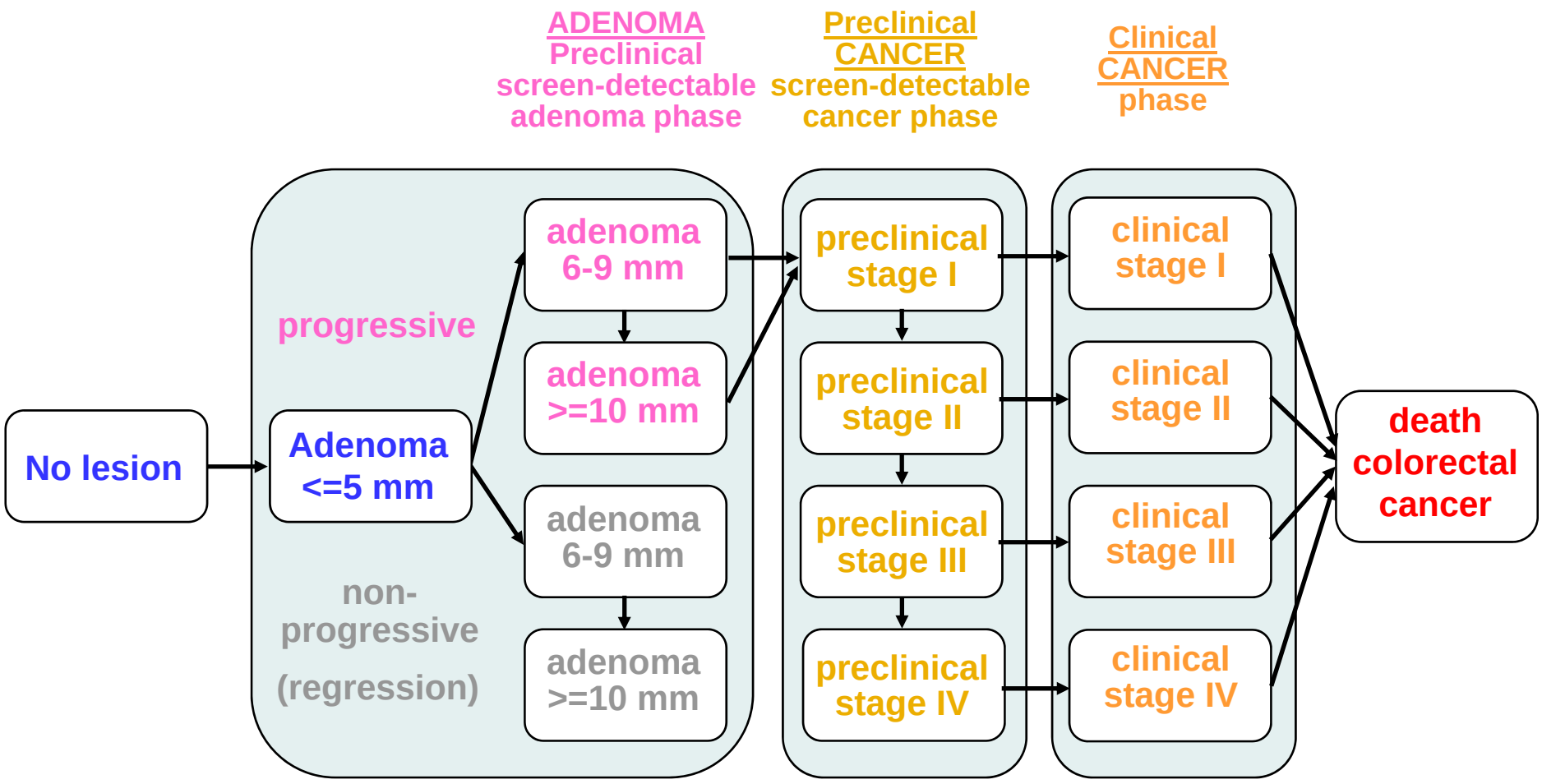
Normal Epithelium

Small Adenoma

Advanced Adenoma

Colorectal Cancer

Natural History of Colorectal Cancer



Datasources:

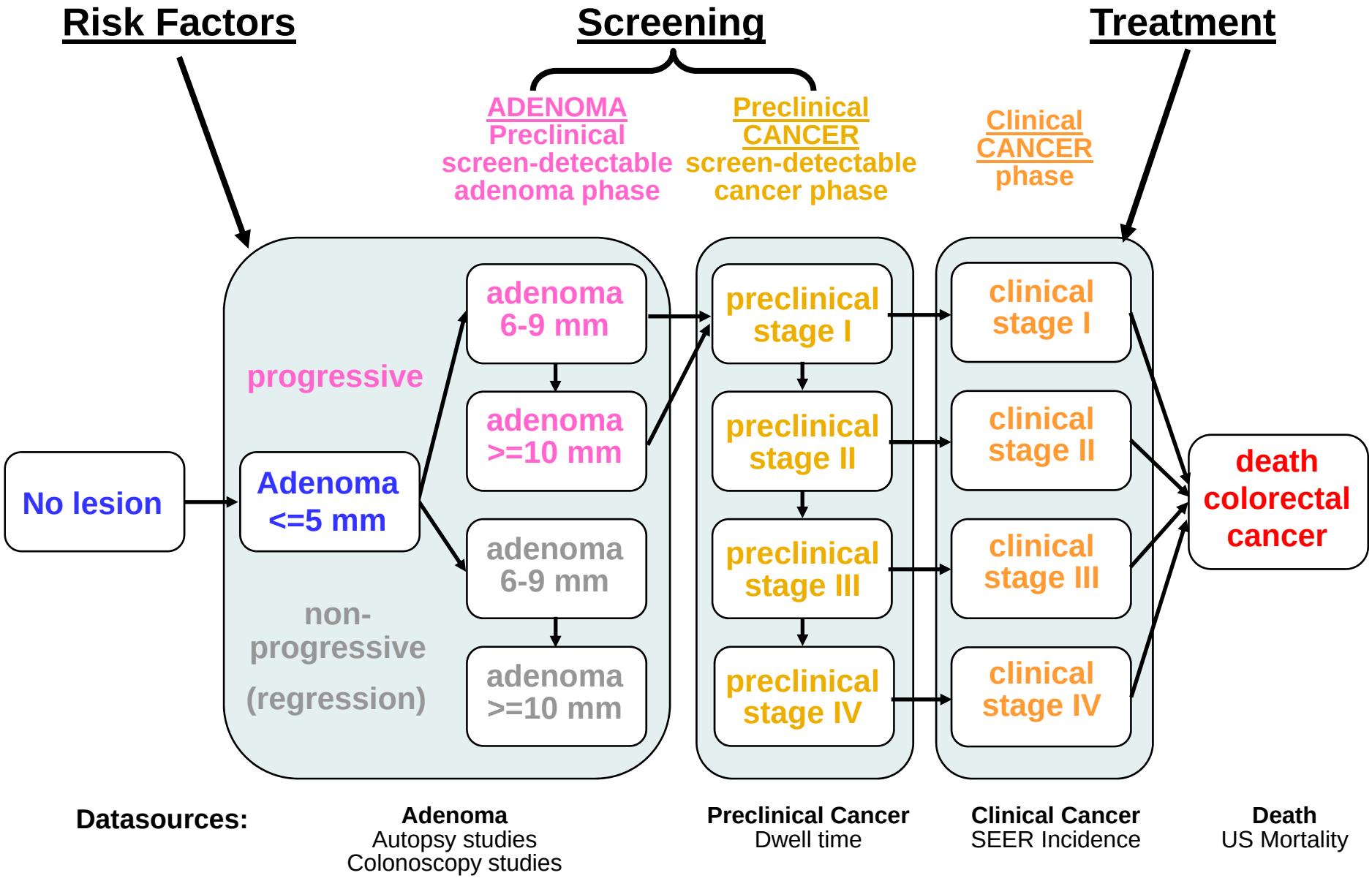
Adenoma
Autopsy studies
Colonoscopy studies

Preclinical Cancer
Dwell time

Clinical Cancer
SEER Incidence

Death
US Mortality

Interventions on Colorectal Cancer



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Projecting Colorectal Cancer Mortality to 2020

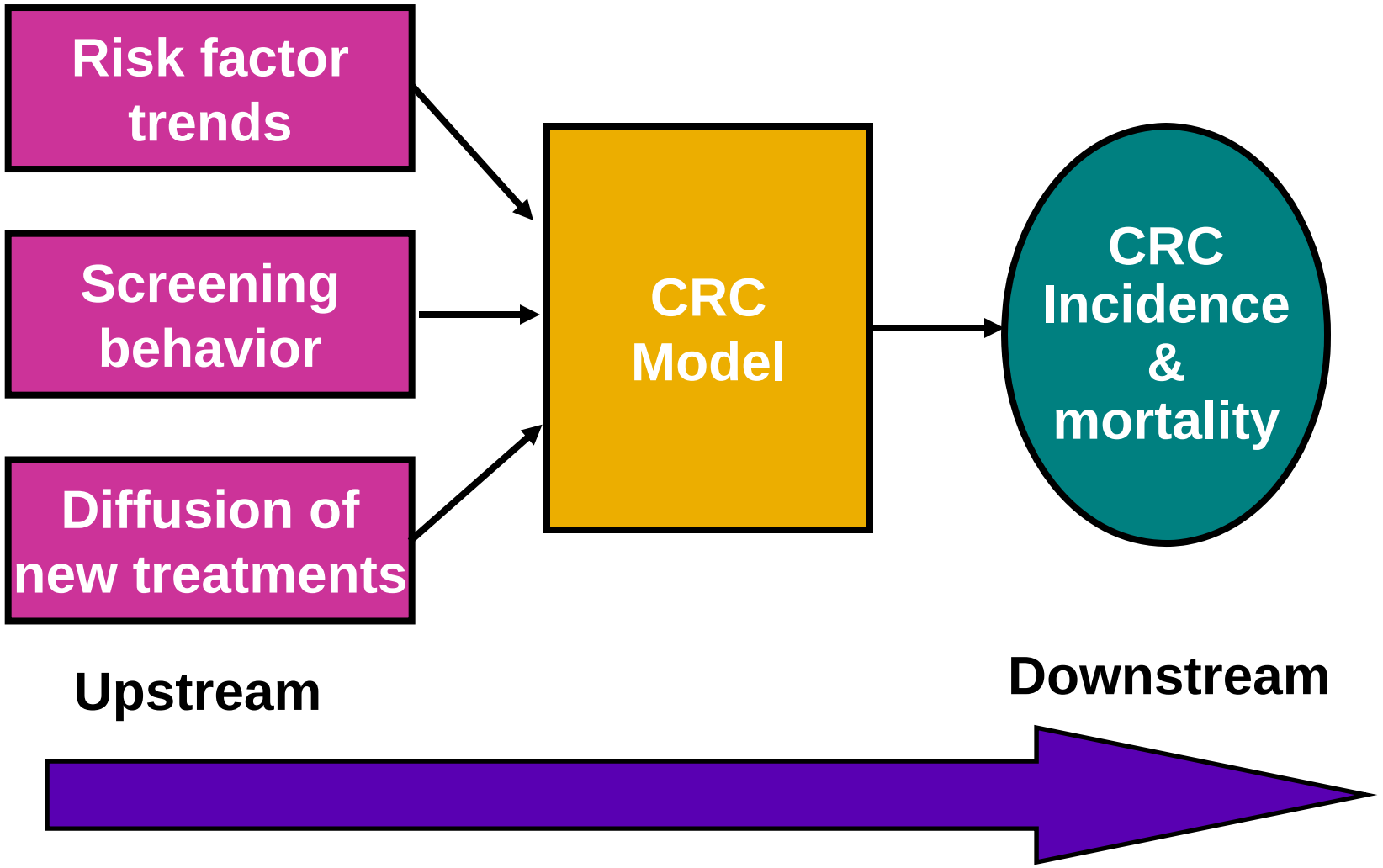
How much can current interventions reduce colorectal cancer mortality in the United States?

What are best short term and best long term choices of cancer control interventions?

Healthy People 2010 Mortality Goals for Cancer

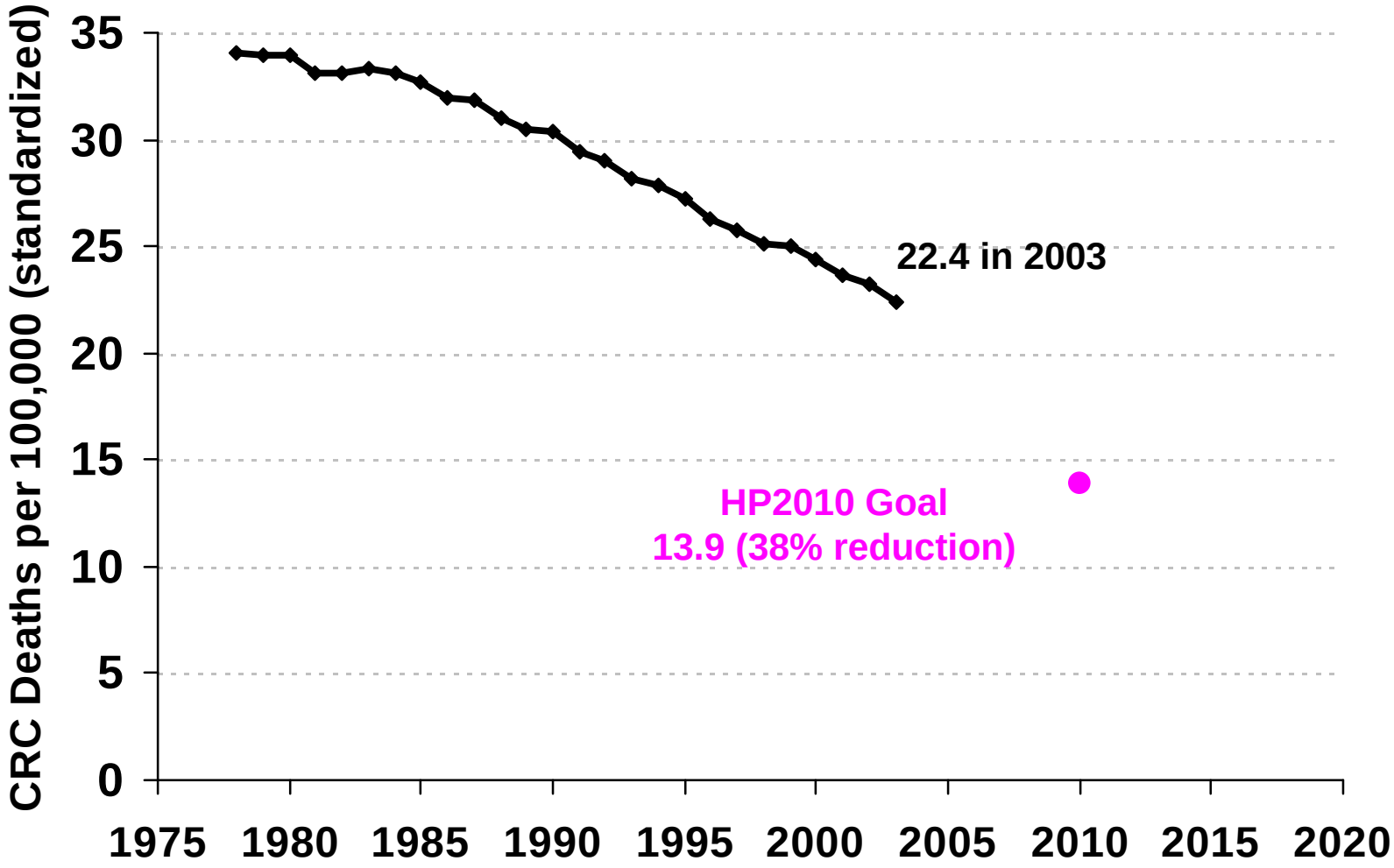
- Between 2003 and 2010, to reach the HP2010 mortality goals, mortality would have to drop by:
  - 12% for female breast cancer
  - 17% for lung cancer
  - 27% for colorectal cancer
- Goals are the same for all race/sex groups
  - Drop in CRC mortality needed to achieve goal
    - WM (38%), WF (10%), BM (57%), BF (39%)

Population Simulation Model



Downstream Goal for Colorectal Cancer Mortality – White Men

Developing scenarios for WM, WF, BM, BF



Upstream Factors Modeled: Colorectal Cancer

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

- Screening: FOBT, Endoscopy (Sigmoidoscopy / Colonoscopy)

- Treatment: Stage III Adjuvant Chemo, Stage IV Chemo

Scenarios Modeled for Upstream Factors – Colorectal Cancer

SCENARIO	*DESCRIPTION*
CONSERVATIVE	Upstream factors remain frozen at levels achieved in 2005
CONTINUED 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

Projection Questions

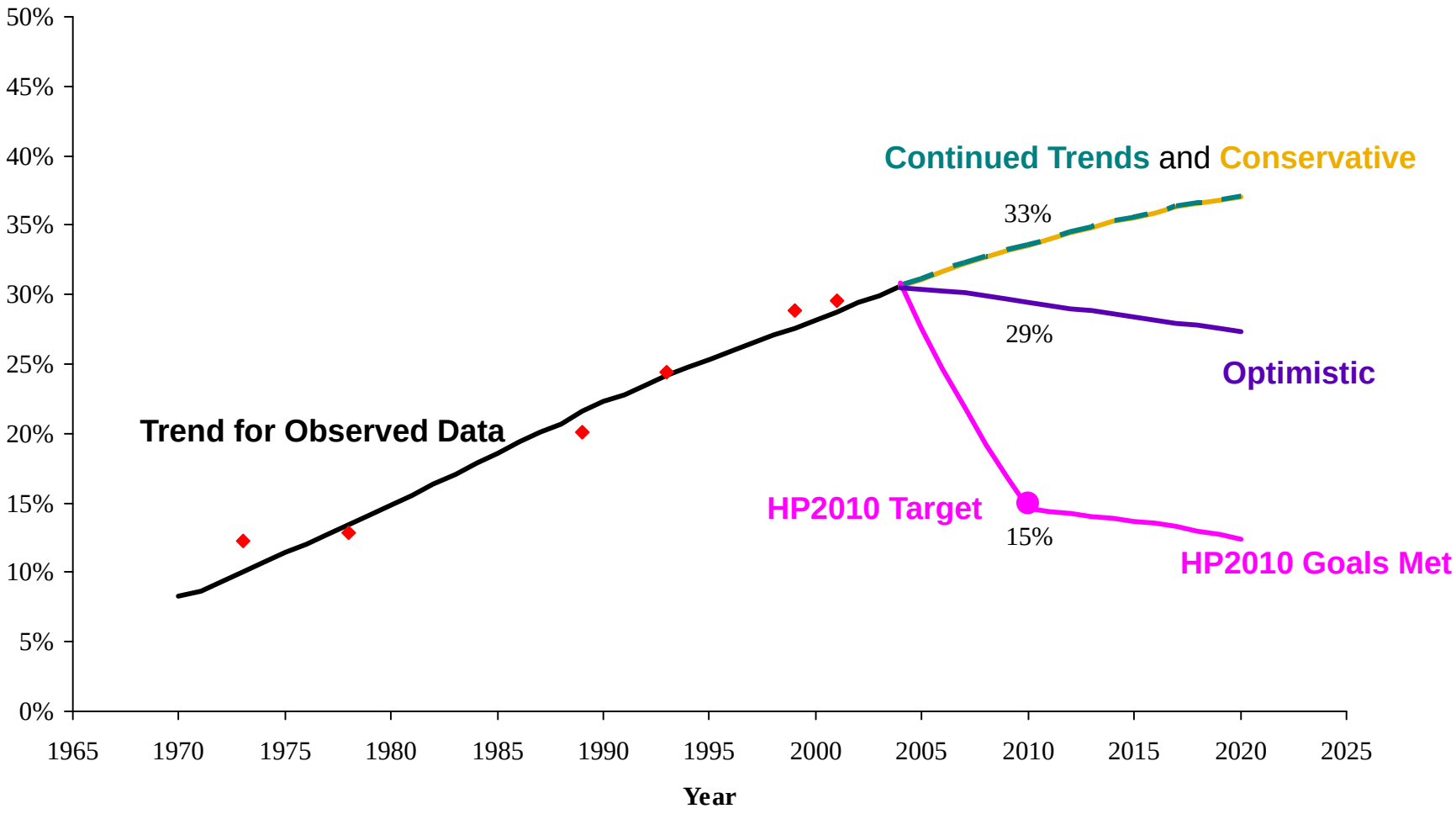
- Given reasonable projections of screening, treatment and risk factor levels, what level will CRC mortality reach in 2010 and beyond?

- What are the best cancer control opportunities?
  - Best *short term* opportunities
  - Best *long term* opportunities

Obesity
RR=1.5 for BMI ≥ 27 vs <21

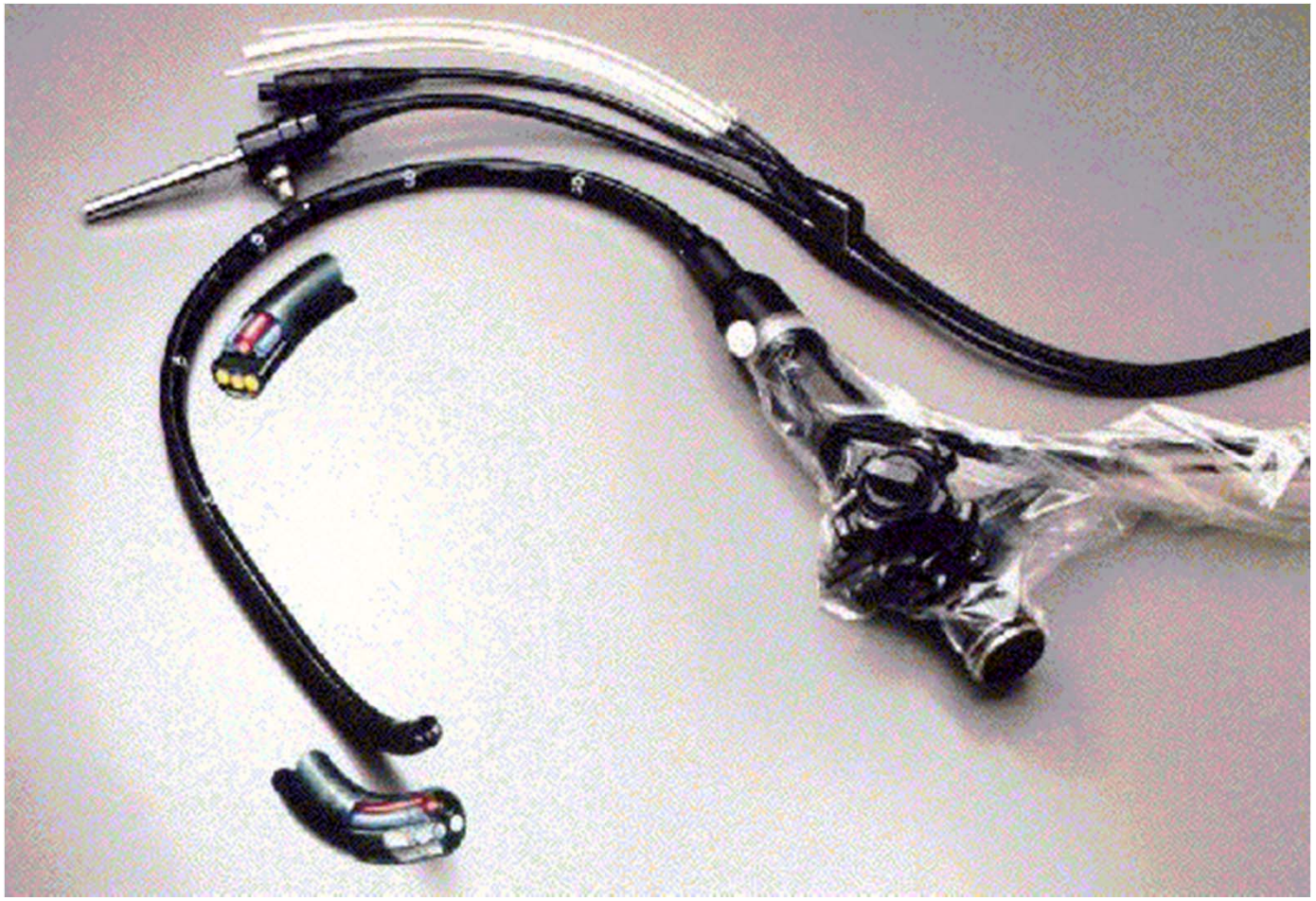
Risk Factor Example: Obesity

Percent of White Men (Age 25-84) who are Obese (BMI ≥30 kg/m²) (RR=1.5)



Data Source: NHANES Surveys

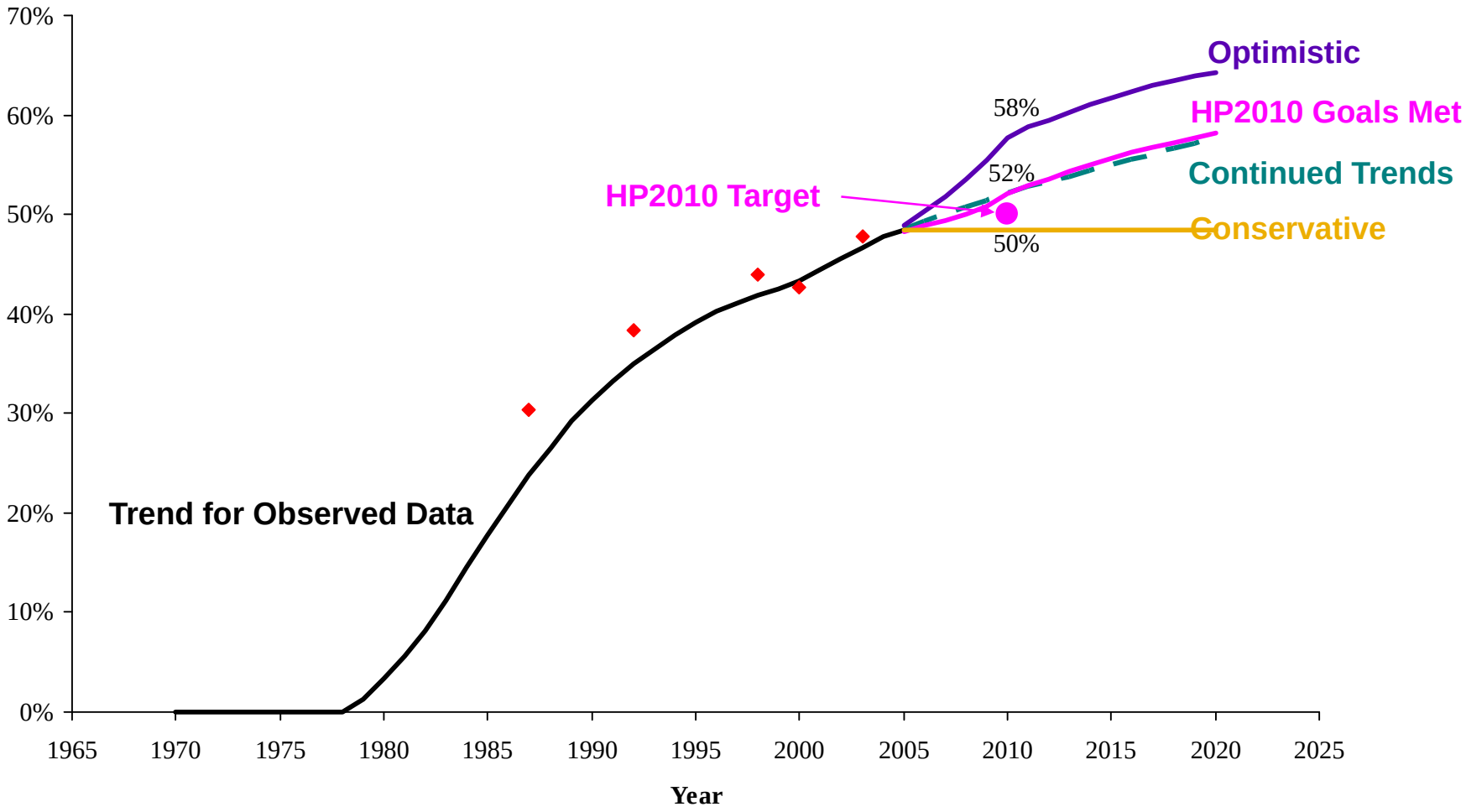
Colorectal Cancer Screening:
FOBT, Flexible Sigmoidoscopy, Colonoscopy



Fiberoptic sigmoidoscope

Screening Example: Endoscopy

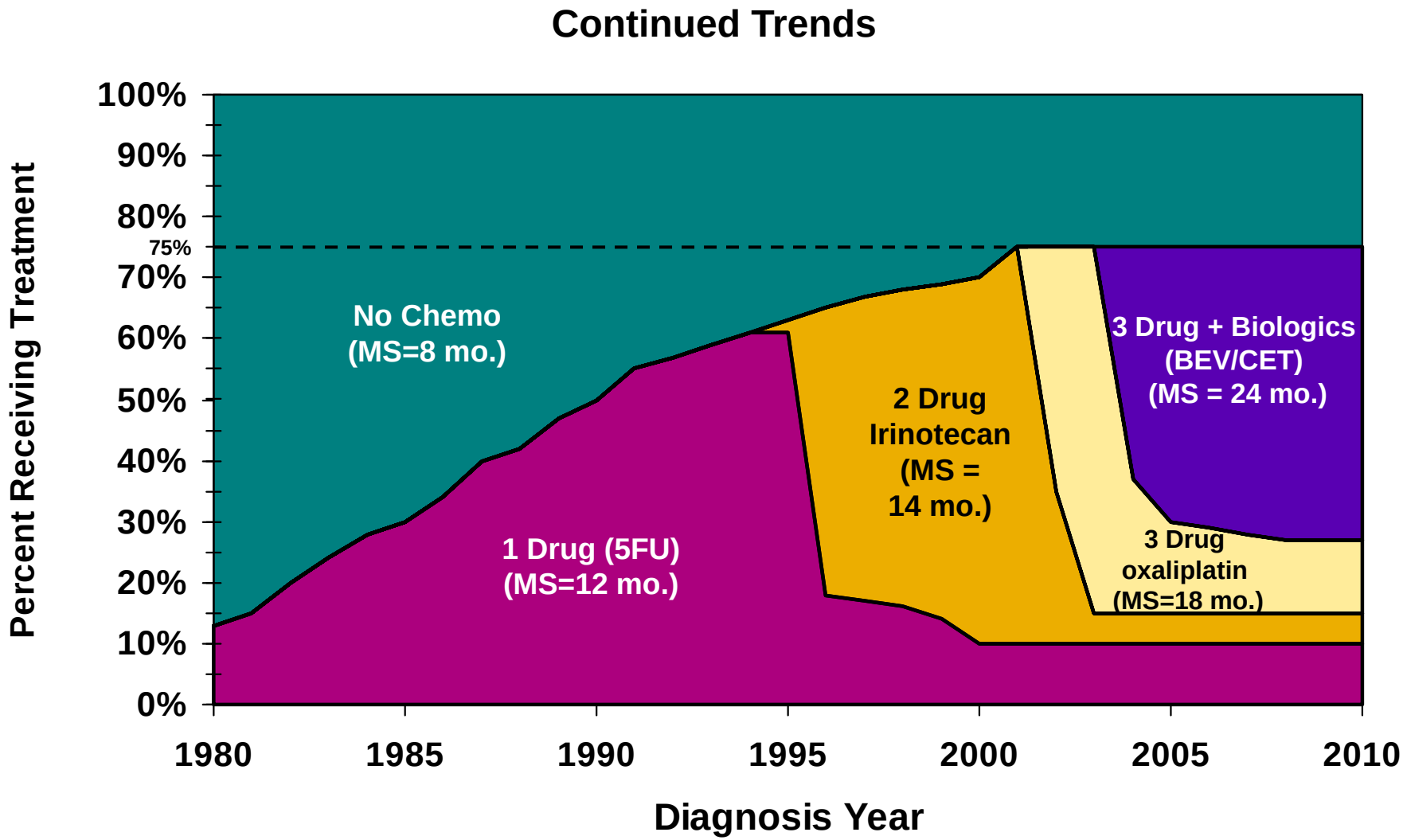
Percent of Adults (Age 50+) Who Ever Had a Colorectal Endoscopy (sigmiodoscopy or colonoscopy)



Data Source: NHIS

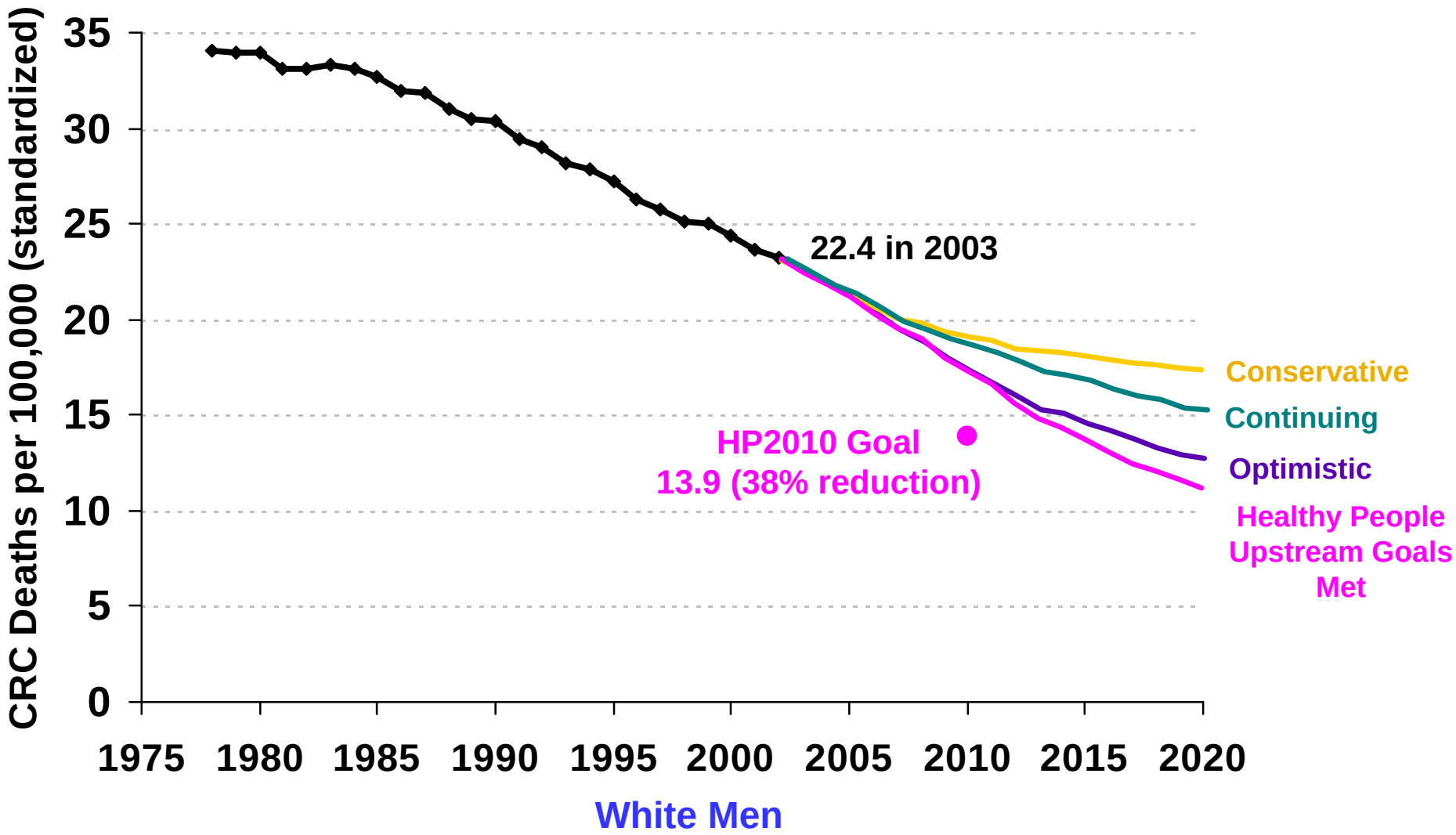
Chemotherapy for Colorectal Cancer

Treatment Example: Stage IV Treatment in White Men 70-74

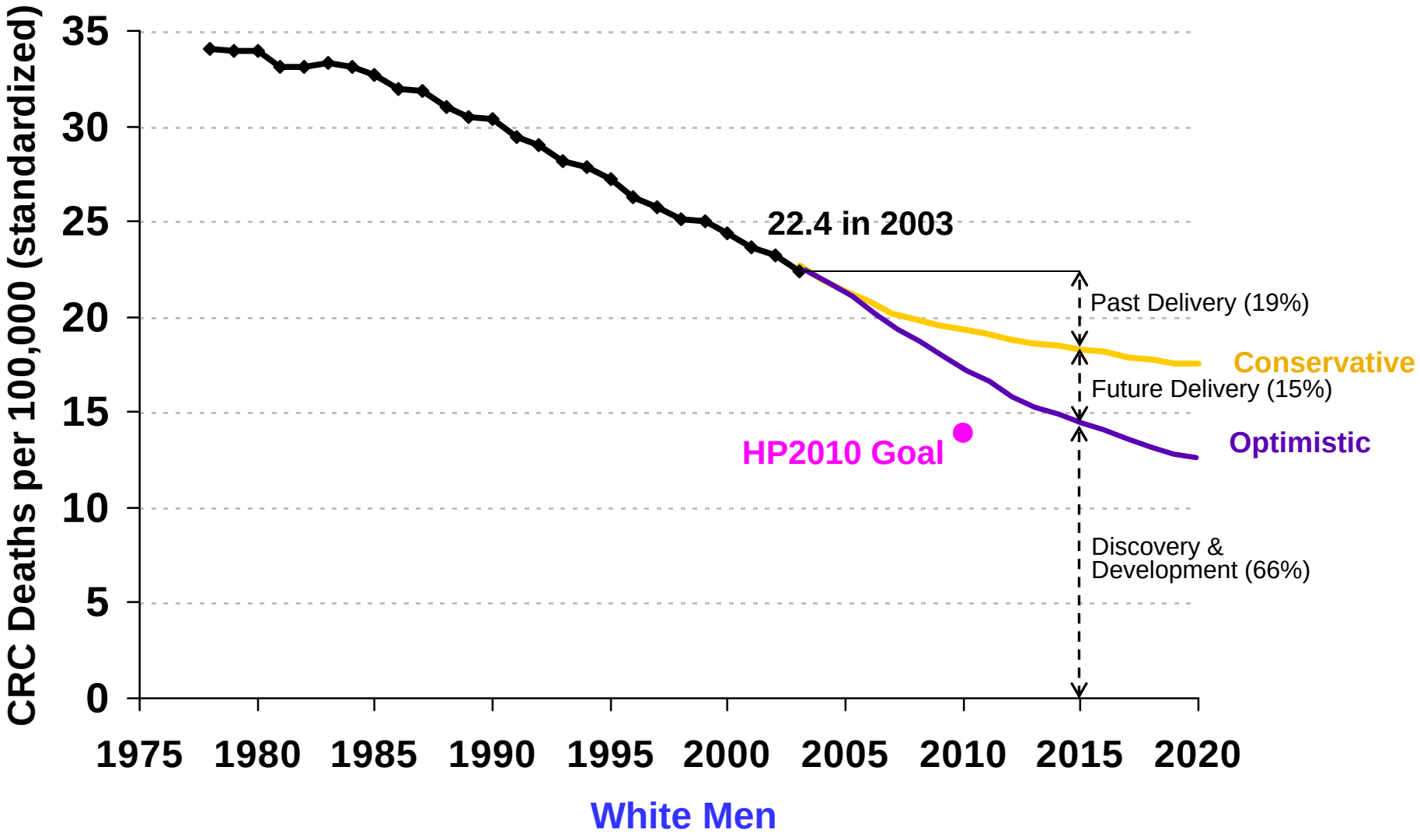


Data Sources: SEER Based Patterns of Care Studies, SEER-Medicare (older patients), NICCQ survey (5 metro areas)

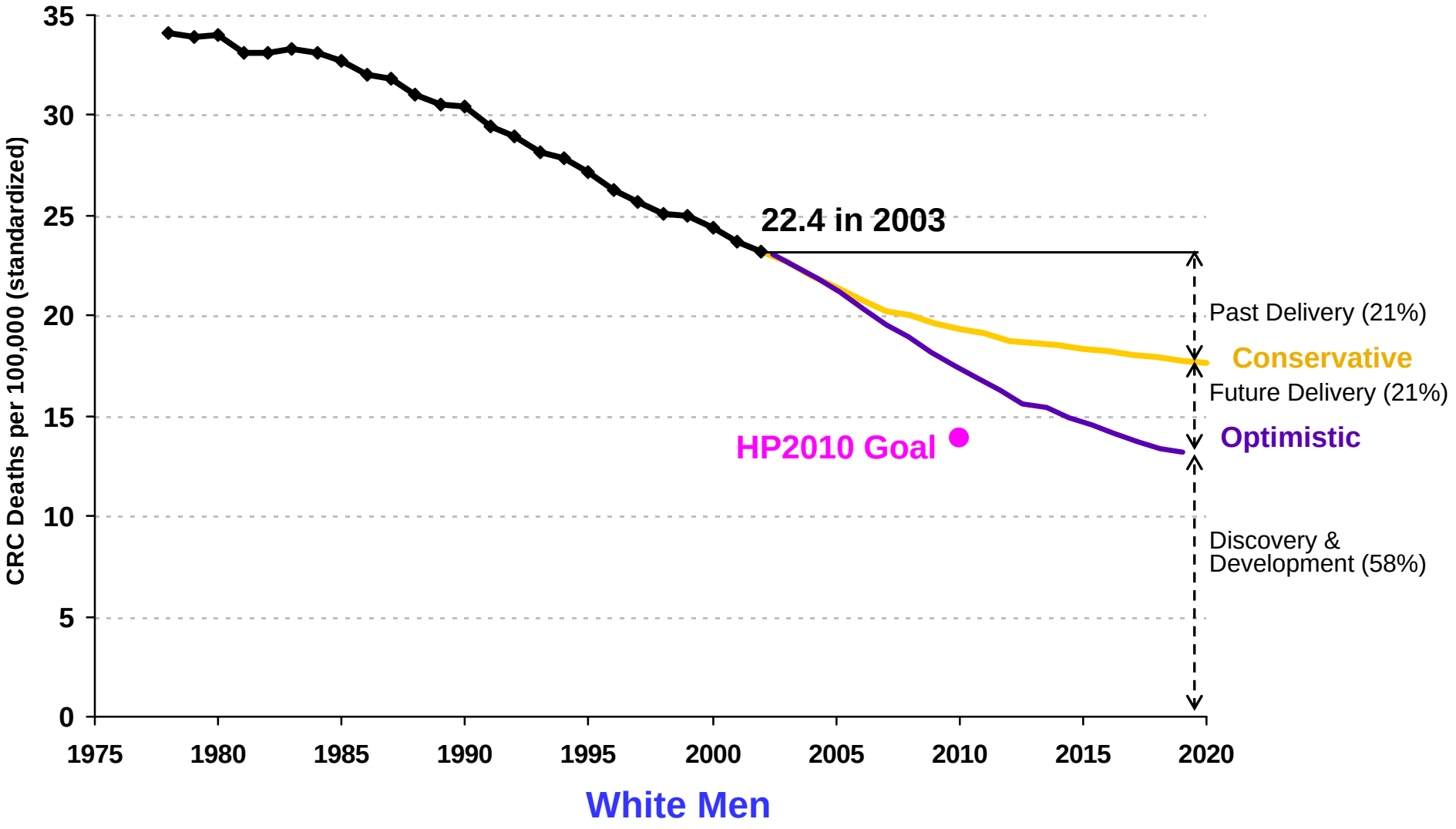
If we meet all the upstream goals, how close can we come to meeting the mortality goal?



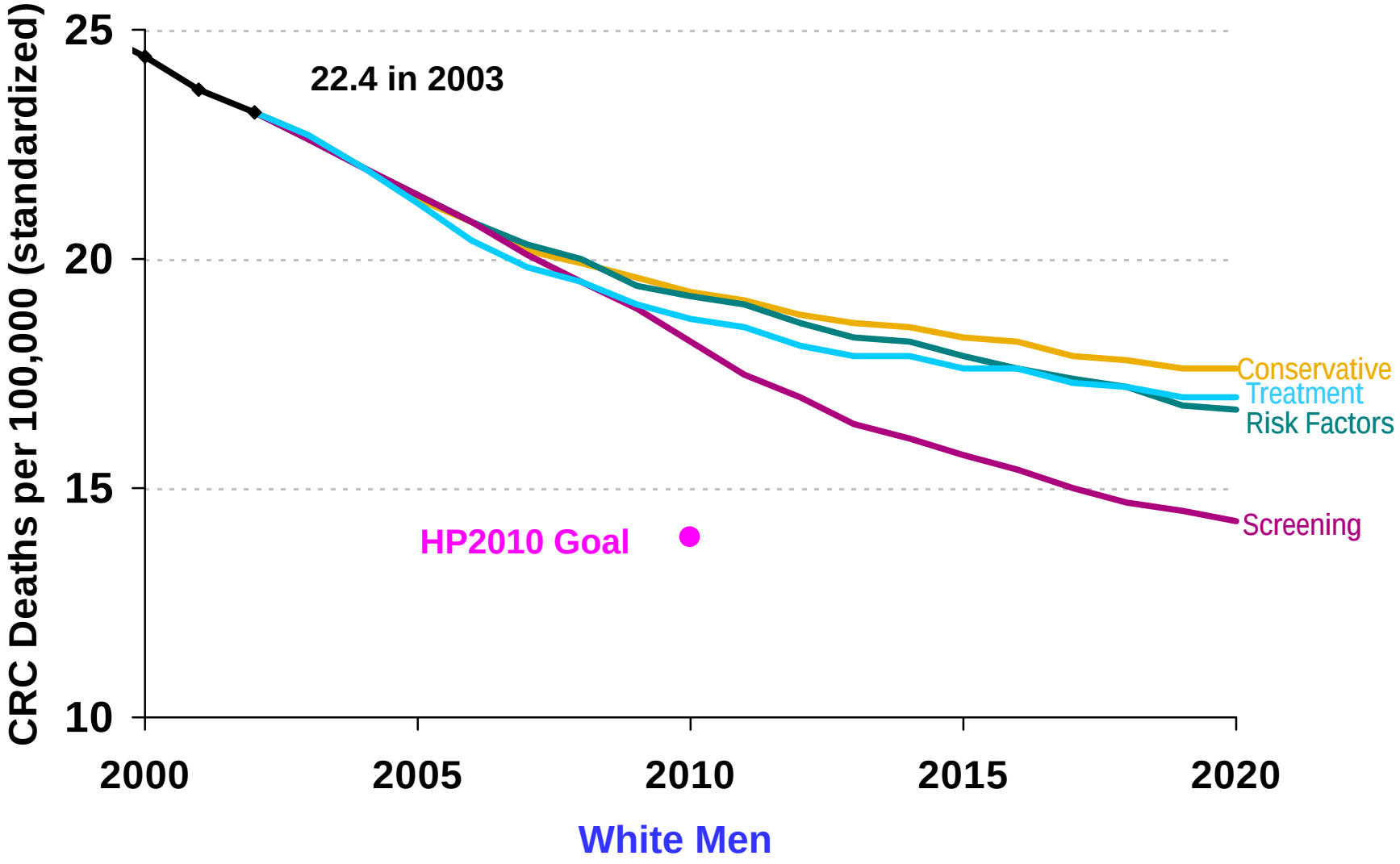
What is the Potential Mortality Impact of Meeting Optimistic Goals for the Delivery of Screening, Treatment, and Prevention by 2015?



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



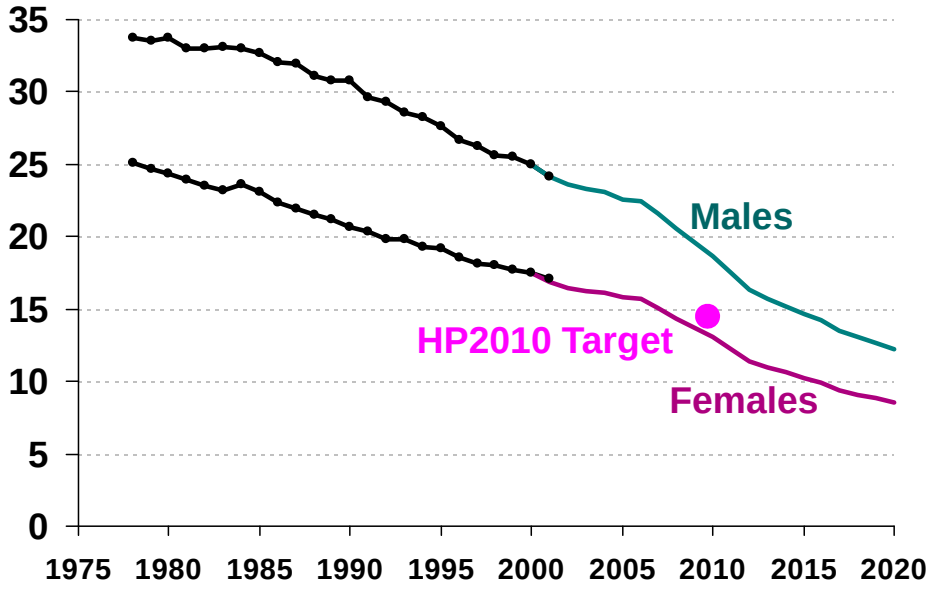
What is the contribution of screening, treatment and risk factors to the mortality decline?



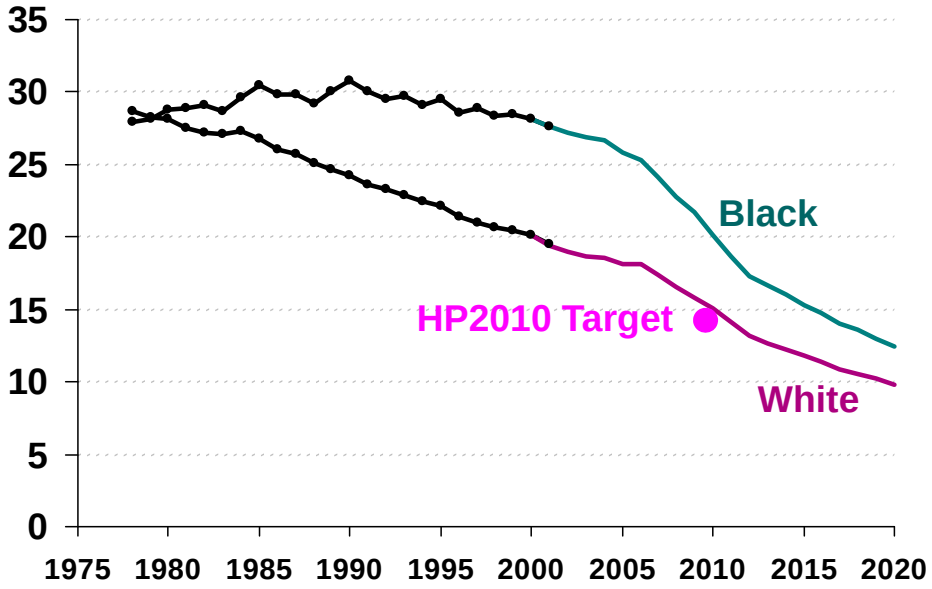
“Optimistic” Results by Sex and Race

CRC Death Rates per 100,000 (standardized)

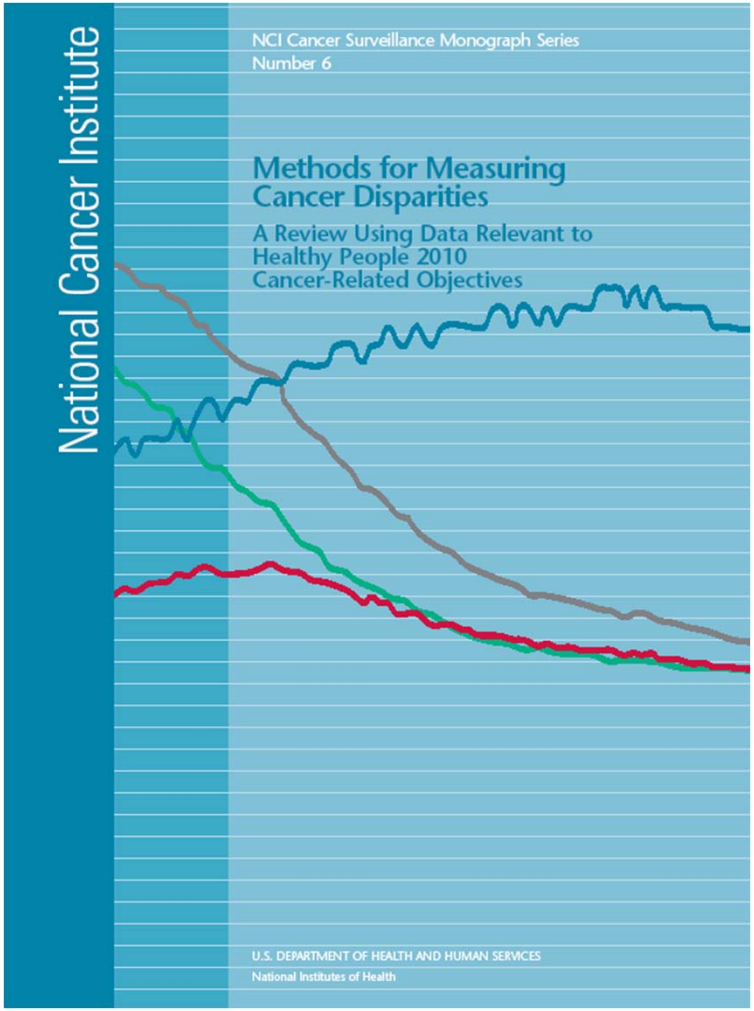
By Sex



By Race



New NCI Monograph: Methods for Measuring Cancer Disparities



Cancer Mortality Projections Web Site Under Development

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

Cancer Mortality Projections

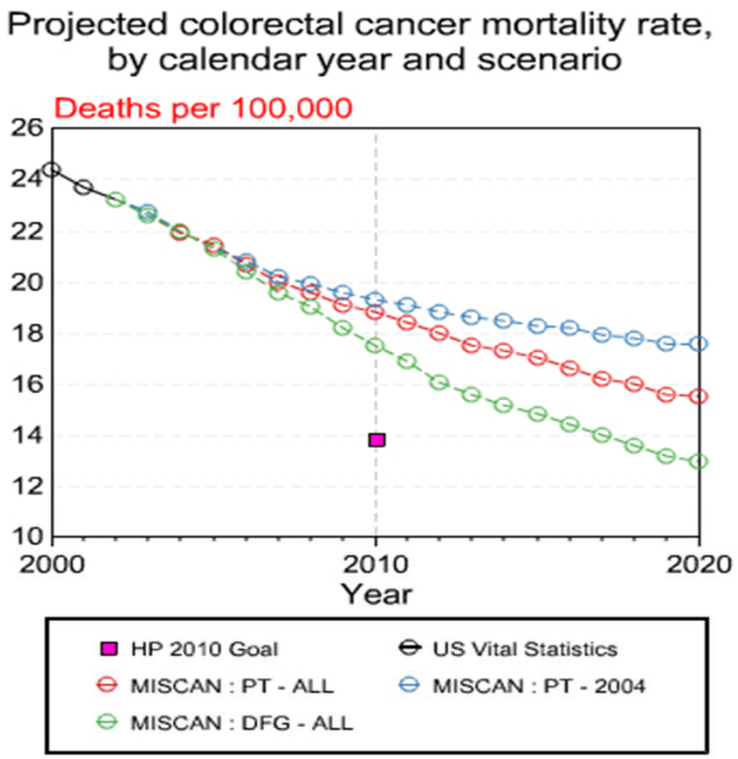
Modeling the impact of cancer control efforts on US cancer mortality

SEARCH GO

Home | About CISNET | Modeling | Colorectal Cancer | Breast Cancer

- Colorectal Home
- Overview
- Results
- Simulation Models
- Risk Factors
- Screening
- Treatment
- Interactive Graphs

Colorectal Interactive Graphs - MISCAN Model



* Age-adjusted to the 2000 standard population using age groups <1y, 1-4y, 5-14y, 15-24y, 25-34y, 35-44y, 45-54y, 55-64y, 65-74y, 75-84y, 85+y

† Treatment-related goals were not included in the Healthy People 2010 goals. We included treatment goals to evaluate the potential impact on colorectal cancer mortality

Sex

○ Both ◉ Men ○ Women

Race

○ All ○ Black ◉ White

Baseline

☑ Continuation of current trends (PT ALL)

☑ Continuation of 2004 levels (PT 2004)

Difficult but Feasible Goals Met

☑ All difficult but feasible goals met (DFG ALL)

☐ All Risk Factors (DFG RF)

☐ Screening (DFG SCR)

☐ Risk Factors and Screening (DFG RF-SCR)

☐ Treatment is best available (DFG TT-TD)

☐ More treated with best available (DFG TT)

☐ More patients are treated (DFG TD)

☐ Body Mass Index (BMI) (DFG ODA)

☐ Multivitamin (DFG MV)

☐ Smoking (DFG SMK)

Healthy People 2010 Goals Met

☐ All HP2010 goals met (HPG ALL)

☐ All Risk Factors (HPG RF)

☐ Screening (HPG SCR)

☐ Risk Factors and Screening (HPG RF-SCR)

☐ Body Mass Index (BMI) (HPG ODA)

☐ Multivitamin (HPG MV)

☐ Smoking (HPG SMK)

Thank you from the Colorectal Cancer CISNET Consortium

- Memorial Sloan-Kettering and Erasmus MC (The Netherlands)
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- NCI
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- Cornerstone Northwest
  - Lauren Clark

* Principal Investigator