Long-term Evaluation of the Benefits of Colorectal Cancer Screening through Epidemiology and Microsimulation Modeling

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• **Meeting Theme:** “Accelerating the Use of Epidemiologic Findings for Population Benefits”

• What are population based benefits of colorectal cancer screening?

• Microsimulation modeling of colorectal cancer to inform health policy (CISNET)

• Two examples
  - Lansdorp-Vogelaar: Racial disparities in CRC
  - Goede: Cost savings to Medicare with CRC screening in pre-Medicare population
Adenoma to Carcinoma Pathway

- Normal Epithelium
- Small Adenoma
- Advanced Adenoma
- Colorectal Cancer
Microsimulation Modeling of Adenoma Carcinoma Sequence with Potential Screening Interventions
Contribution of Screening and Survival Differences to Racial Disparities in Colorectal Cancer Rates

Iris Lansdorp-Vogelaar and colleagues

*Cancer Epidemiology Biomarkers Prevention*

*May, 2012*
Background:

Considerable disparities in CRC incidence and mortality in blacks and whites in the United States

Research question:

How much of the disparities explained by differences in CRC screening rates and stage-specific relative CRC survival?
1. Blacks same screening trends as observed for whites (incidence and mortality)

2. Blacks same trends in stage specific relative CRC survival as whites (mortality)

3. Blacks same trends in screening and stage specific relative CRC survival as whites

• Racial disparities derived for hypothetical expected relative to the black observed rates.
**Methods:**

- MISCAN model for CRC incidence and mortality rates
- Blacks and whites, age 50 years and older
- 1975-2007
- Ever had CRC screening test (FOBT or endoscopy)?

  *National Health Interview Survey from 1987 to 2008*

  - Black men 18% to 56%  
  - Black women 20% to 57%
  - White men 36% to 64%  
  - White women 36% to 64%

- SEER for race and sex-specific relative survival rates by stage 1975 to 2003

Lansdorp-Vogelaar et al, CEBP May 2012
RESULTS

Example 1, Lansdorp-Vogelaar

Lansdorp-Vogelaar et al, CEBP May 2012
Colorectal Cancer Incidence
Observed and Hypothetical by Race

42% Reduction
Colorectal Cancer Mortality Observed and Hypothetical by Race

Age-adjusted CRC mortality per 100,000 50+ year-old population

- Blacks, observed
- Whites, observed
- Blacks, if screening of whites
- Blacks, if survival of whites
- Blacks, if screening and survival of whites

54% Reduction
Sensitivity Analysis

- Lower quality endoscopy in blacks
  - Higher percent (68%) disparity explained

- 25% remaining survival difference even with equal access
  - Lower percent (28%) disparity explained

- Same stage distribution as whites
  - Higher percent (60%) disparity explained

Lansdorp-Vogelaar et al, CEBP May 2012
Conclusion for Racial Disparities in CRC Incidence and Mortality

- Together differences in screening and stage specific relative survival explain slightly more than 50% disparity in CRC mortality between blacks and whites.

- Enabling equal access to care for screening and treatment would be expected to decrease the racial disparities.

- Differences in lifestyle factors could account for the remaining racial disparity
Cost savings to Medicare from Increased Colorectal Cancer Screening in the Pre-Medicare Population

Luuk Goede and colleagues
Erasmus MC, the Netherlands
Cost savings to Medicare from Increased CRC Screening in the Pre-Medicare population

- **Background:** Aging of the US population and rising treatment costs may increase CRC related expenditures in the Medicare population.

- **Research Question:** What would be the impact of enhancing CRC screening participation in the pre-Medicare population on CRC related expenditures in the Medicare population?
METHODS: Cost savings to Medicare from Increased CRC Screening in the Pre-Medicare Population

- MISCAN and SimCRC microsimulation modeling of US population
- Age groups: 50-64 and 65+
- Dynamic population including new 50-year older participants each year.
- 2010 to 2060 for 50 year period
Screening Scenarios

- Current trends

- Enhanced screening participation for ages 50 to 64
  - Increases 2010 to 2015 where reaches 70% up to date
    - 90% at least once screened
  - Screening is 87% colonoscopy and 17% FOBT (H SENS A)
  - Screening patterns of age group 50-64 continue into 65+ ages
RESULTS

Example 2, Goede

(Using MISCAN model)
Annual Screening Costs by Age Group: Current and Enhanced Trends

- Current trends 50-64
- Enhanced participation 50-64
- Current trends 65+
- Enhanced participation 65+

MISCAN model
Annual Treatment Costs by Age Group: Current and Enhanced Trends

MISCAN model
Annual Total (Screening and Treatment) Costs by Age Group: Current and Enhanced Trends

MISCAN model
Conclusions for Increased CRC screening ages 50-64 on impact for Medicare costs

- An investment in screening pre-Medicare eligible individuals results in substantial CRC cancer treatment savings to the Medicare program (Cumulative over 50 years of $24 billion)

- Initiatives in the pre-Medicare eligible population will decrease CRC incidence and mortality

- Overall cost savings for all ages 50 and over will be obtained by 2050.
Microsimulation modeling provides a powerful tool for health policy researchers and epidemiologists to evaluate the potential impact of proposed interventions on a population basis.

Michael Pignone for Editorial on Lansdorp-Vogelaar

“The debate over HOW to achieve universal access to health care, including cancer control services, is not resolved.

Questions as to whether differences in health care access explain a significant proportion of the inequities in health outcomes are empirical, not ideological questions. This study [Lansdorp-Vogelaar] adds still more convincing data supporting this relationship.”
Thank You

Cancer Intervention and Surveillance Modeling Network (CISNET)
U01 CA152959
Results of United States Preventive Task Force (USPSTF) Decision Analysis

- USPSTF recommendations were informed by decision analysis using microsimulation modeling by MISCAN
- Age to begin screening – 40, 50, or 60
- Age to end screening – 75 or 85
- Intervals of screening – 5, 10, 20 for colonoscopy*

*Note those with adenomas or CRC have surveillance colonoscopies

Balance Benefit to Risk

Benefits
- Life years gained (LYG)

Risk
- Colonoscopies
- Complications*

Risk ratio = Risk to Benefit
- Colonoscopies per LYG
- Complications per LYG