Gender and race/ethnicity affect the cost-effectiveness of colorectal cancer screening

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The study compared two screening strategies for the detection of colorectal cancer (CRC). One strategy was faecal occult blood testing (FOBT) annually combined with flexible sigmoidoscopy every 5 years, while the other was colonoscopy every 10 years. Both strategies were initiated at the age of 50 years and were considered to be applied until the age of 85.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The target population comprised a cohort of 100,000 persons aged 50 years and above who participated in CRC screening between 1988 and 1995.

Setting
As this was a modelling study the setting was not explicitly stated at the outset. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness data were derived from medical records from 1988 to 1998. The cost data were taken from sources published in 2000 and were reported for the price year 2000.

Source of effectiveness data
The effectiveness data were derived from medical records, national sources and assumptions based on published literature.

Modelling
A model was constructed to estimate the cost-effectiveness of the screening strategies. Details of the model were published elsewhere (United States Office of Technology Assessment 1995; Wagner et al. 1991 and 1996; Glick S et al. 1998; see ,Other Publications of Related Interest(-below for bibliographic details). The time horizon was 35 years. No further details on the modelling approach used were reported in the present paper.

Outcomes assessed in the review
The parameters included in the model for the natural history of the disease were:
the prevalence of adenomas at age 50;  
the proportion of all clinically detected cancers that begin as polyps;  
years required for a 5-mm adenoma to progress to CRC and for a new invasive cancer to progress to late-stage cancer;  
years before late-stage CRC is detected;  
the prevalence of lifetime-latent cancers at age 50; and  
the annual incidence of life time-latent cancer.  
The parameters included in the model for the accuracy of screening tests were:  
sensitivity for polyps, sensitivity for CRC, and specificity with FOBT; and  
sensitivity for polyps (within reach of the scope), and specificity of polyps with sigmoidoscopy and colonoscopy.  
The parameters included in the model for the medical risks were the rate of colonoscopy-induced perforation of the large bowel, colonoscopy-induced mortality, and surgery-related mortality in patients with CRC.

**Study designs and other criteria for inclusion in the review**  
Data on cancer cases were derived from medical records from the California Cancer Registry from 1988 - 1995. Such data included demographic data such as age, gender, race or ethnicity (white, black, Latino or Asian), pathology of the disease, site and stage of disease, treatment during the first 4 months and survival status. In addition, CRC survival data were derived from the SEER Cancer Incidence Public-Use Database from 1992 - 1998, while life expectancy tables for Californians from 1989 - 1991 were derived from the National Centre for Health Statistics at the Centre for Disease Control and Prevention.

**Sources searched to identify primary studies**  
No sources were reported.

**Criteria used to ensure the validity of primary studies**  
No criteria were reported.

**Methods used to judge relevance and validity, and for extracting data**  
The authors only commented on the method of abstracting medical records. This was carried out according to Cancer Reporting in California using the C/NET software package. It ensured high quality and completeness higher than 99% annually from 1988 to 1998.

**Number of primary studies included**  
It seems that no primary studies were used as sources of effectiveness evidence.

**Methods of combining primary studies**  
The authors combined data through the use of 95% confidence intervals using the exact Poisson method.

**Investigation of differences between primary studies**  
Not applicable as no primary studies were used to derive effectiveness estimates.
Results of the review
The prevalence of adenomas at age 50 years was 30%.

The proportion of all clinically detected cancers that begin as polyps was 70%.

Five or 10 years were required for a 5-mm adenoma to progress to CRC.

Two years were required for a new invasive cancer to progress to late-stage cancer, as well as to detect a late-stage CRC.

The prevalence of lifetime-latent cancers at age 50 years was 2/1,000.

The annual incidence of lifetime-latent cancer was 2/10,000.

Using FOBT, the sensitivity for polyps was 10%, the sensitivity for CRC was 60%, and the specificity was 90%.

The sensitivity of sigmoidoscopy and colonoscopy for polyps was 90%, while the specificity was 95%.

The rate of colonoscopy-induced perforation of the large bowel was 7/10,000.

Colonoscopy-induced mortality was 5 in 100,000.

Surgery-related mortality in patients with CRC was 1/50.

Measure of benefits used in the economic analysis
The authors used life-years saved as the measure of benefit in the economic analysis. These were derived directly from the model. The benefits do not appear to have been discounted.

Direct costs
The health care costs included in the analysis were for FOBT, screening sigmoidoscopy, screening colonoscopy, therapeutic colonoscopy, the treatment of patients with cancer, the treatment of patients with colonoscopy-induced perforations, and the treatment of patients who died as a result of colonoscopy. The unit costs were reported only for screening tests and therapeutic colonoscopy, while summary costs were reported for treatment costs. As the time horizon of the model was 35 years, the costs were appropriately discounted. The costs were derived from Medicare reimbursement rates and were reported for the price year 2000.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not included in the economic analysis.

Currency
US dollars ($).

Sensitivity analysis
Although it was reported that a sensitivity analysis was performed, the authors did not give relevant details.

Estimated benefits used in the economic analysis
The estimated benefits used in the economic analysis were not reported separately.

Cost results
The total cost results were not reported separately.

Synthesis of costs and benefits
When using FOBT plus sigmoidoscopy every 5 years, a 35-year screening programme in black men cost $39,776 per life-year saved when assuming a 5-year polyp dwell time and $36,578 per life-year saved when assuming a 10-year polyp dwell time.

When using colonoscopy every 10 years, a 35-year screening programme in black men beginning at the age of 40 years cost $114,961 per life-year saved when assuming a 5-year polyp dwell time and $63,736 per life-year saved when assuming a 10-year polyp dwell time.

When the same screening programme was initiated at the age of 45 years, it resulted in a cost of $79,008 per life-year saved when assuming a 5-year polyp dwell time and $42,383 per life-year saved when assuming a 10-year polyp dwell time.

Regardless of the screening strategies (i.e. annual FOBT plus sigmoidoscopy every 5 years or colonoscopy every 10 years) and of whether a 5- or 10-year polyp dwell time was considered, screening was most cost-effective in black men and least cost-effective in Latino women.

The cost-effectiveness of screening in black men beginning at age 45 was similar to that of screening white men and black women beginning at age 50, and more cost-effective than screening nonblack women as well as Asian and Latino men beginning at age 50.

The sensitivity analysis demonstrated that the results were inversely proportional to age-specific CRC incidence rates and were insensitive to variations in polyp incidence rate in black men.

Authors' conclusions
"Screening is most cost-effective in black men because of high age-specific colorectal cancer (CRC) incidence rates. Initiation of CRC screening in this high-risk group prior to age 50 should be strongly considered."

CRD COMMENTARY - Selection of comparators
The selection of the comparators was clear as the screening strategies compared have been recommended by the American Cancer Society since 1997. You should decide if they represent widely used technologies in your own setting.

Validity of estimate of measure of effectiveness
The authors did not state explicitly whether a systematic review of the literature had been undertaken. The data were collected from medical records and the SEER database. The authors reported that the data used were of a high quality. Only age-specific CRC incidence and polyp incidence rates were examined in the sensitivity analysis. The authors also reported that the modelling approach and justifications of the data used in the model were based on reviews of published literature using the same model. However, no details of these published studies were provided. Therefore, the validity of the present study was based on the validity of the published studies.

Validity of estimate of measure of benefit
The authors used life-years saved as the measure of benefit in the economic analysis. These were derived directly from the model. The estimated benefits used in the economic analysis were not reported separately for each race/ethnic group and for each screening method, thus the analysis could not be easily reworked for other settings.
Validity of estimate of costs
The perspective adopted was not reported, but it could not be societal since the indirect costs were not included in the analysis. The unit costs were reported for the screening tests only, while summary costs were reported for all other treatment costs. It was therefore not possible to know which categories of costs were included (e.g. overhead costs). In addition, the quantities of resources used were not reported. The reproducibility of the results to other settings is therefore difficult. The costs were derived from official published sources and were appropriately discounted, and the price year was reported, which enhances any future reflation exercises. The costs were treated deterministically, but no sensitivity analysis was conducted to assess the robustness of the estimates used.

Other issues
The authors did not compare their findings with those from other studies. However, this might have been due to a lack of published literature in the same area. The issue of generalisability of the results was not addressed. The authors do not appear to have presented their results selectively, although numerical results from the sensitivity analysis were not reported. The authors reported a number of limitations to their study. For example, the patients included in the model were assumed to be of average risk for CRC, and it was assumed that there was no distinction between patients of high, moderate or average risk for CRC. In addition, the proportions of high- or moderate-risk patients within different ethnic groups were not taken into consideration.

Implications of the study
The authors did not make explicit recommendations for changes in policy or practice. They suggested that comprehensive population-based studies are required to facilitate categorisation of racial and ethnic groups into specific risk categories of CRC.

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Bibliographic details

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Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
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