Cancer-attributable costs of diagnosis and care for persons with screen-detected versus symptom-detected colorectal cancer

Ramsey S D, Mandelson M T, Berry K, Etzioni R, Harrison R

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 screen-detected colorectal cancer using faecal occult blood testing (FOBT) with symptom-detected colorectal cancer (CRC).

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients who were within the recommended age for screening (aged 50 years or older) and had been diagnosed with colon or rectal cancer.

Setting
The setting was primary care. The economic study was carried out in Seattle (WA), USA.

Dates to which data relate
The effectiveness evidence and resource use data were collected from 1993 to 1999. The price year was 2002.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
This was a retrospective cohort study in which the costing was carried out on the same sample of patients as that used in the effectiveness analysis.

Study sample
Individuals with CRC were identified by routine linkage between the enrolment database and a public cancer registry database. A review of medical records was also performed to complete the patients' data. Patients were classified as screen-detected if their CRC was diagnosed within 12 months following a positive FOBT screening FOBT. They were considered unscreened if there was no evidence of screening by any modality in the 12 months preceding diagnosis.

A total of 1,470 persons were diagnosed with CRC during the study period. From the 923 (62.8%) eligible patients, 206 (22.3%) were from the screen-detected group and 717 (77.7%) from the symptom-detected group. The use of power
calculations was not reported. From the 923 eligible patients, 551 (59.7%) of them were aged 70 years or older, 462 (50.1%) were male and 846 were white (92.8%).

A total of 480 (32.6%) patients did not meet study eligibility criteria or were unavailable for analysis. Patients excluded were those enrolled in the HMO for less than a year before diagnosis, and those with a known history of colon polyps, ulcerative colitis, Crohn's disease or familial polyposis syndrome. Also excluded were those patients whose cancer was detected following screening endoscopy or an FOBT performed in their physician's office.

**Study design**
This was a retrospective cohort study performed in an HMO setting, serving a population of 450,000, with a 7-year follow-up period.

**Analysis of effectiveness**
The primary health outcomes used in the analysis were cancer stage at diagnosis, incidence, survival and mortality rates. In addition, a chronic disease score (CDS) was used for all patients and in both groups to compare non-cancer co-morbidity at the time of diagnosis. The CDS is associated with physician-rated disease severity and patient-rated health status. It predicts subsequent mortality and hospitalisation rates.

**Effectiveness results**
The distribution of screen- versus symptom-detected cases among all persons with newly diagnosed CRC was equivalent over the years of observation (chi-squared p=0.32). For screen-detected cases, there was a mean of 2.06 months between the index FOBT test and the diagnosis of cancer. In relation to the stage at diagnosis, 51 (5.7%) were in situ, 257 (29.0%) were at Dukes A, 271 (30.6%) were at Dukes B, 181 (20.4%) were at Dukes C, and 127 (14.3%) were at Dukes D. Screen-detected cancers had significantly earlier stages.

Thirteen patients in the screen-detected group and 133 patients in the symptom-detected group died during the 12-month follow-up period (chi-squared p<0.001). Non-cancer co-morbidity, as measured by the CDS, was not significantly different between the screen- and symptom-detected groups, (p=0.12).

**Clinical conclusions**
Screen-detected cases were more likely to be diagnosed with early-stage cancer.

**Measure of benefits used in the economic analysis**
No summary measure of benefit was used and the costs and effects were left disaggregated. The study was, therefore, classified as a cost-consequences analysis.

**Direct costs**
Discounting was not carried out because the costs were incurred during less than 2 years. The quantities and the costs were analysed separately and measured, but not reported. The data were obtained from a database consolidating resource use and costs. The database included the full cost of patient care services at the unit-of-service level. The cost per unit, (resulting from a step-down cost accounting system), reflected the actual costs of medical personnel and supplies to provide the service, as well as overhead costs such as administration, charting and automated information systems. Departments captured in the database included medical staff, nursing, pharmacy, laboratory, radiology, hospital inpatient and community health services. Data on the costs and quantities of resources used were collected from 1993 to 1999. All the costs were adjusted to 2002 dollars using the Consumer Price Index values for medical care/ser

**Statistical analysis of costs**
The costs were treated stochastically and a Kaplan Meier non-parametric test was used. The formulation accounted for censoring and months with zero costs. Confidence intervals (CIs) were derived to evaluate the statistical significance of differences between the groups. The costs for screen- and symptom-detected individuals were also stratified by age group and gender.

**Indirect Costs**
The indirect costs were not included.

**Currency**
US dollars ($).

**Sensitivity analysis**
Conservative (no stage shift with screening) and less conservative (stage shift occurring) scenarios were evaluated to predict the cost-savings over time with screening.

**Estimated benefits used in the economic analysis**
See the 'Effectiveness Results' section.

**Cost results**
For all patients, at all stages, the diagnosis costs (i.e. the costs for the 3 months before diagnosis) were $2,959 lower for the screen-detected group than for the symptom-detected group, (p<0.005). The diagnosis costs were $7,302 (95% CI: 6,267 - 8,338) and $10,261 (95% CI: 9,243 - 11,279) for the screen- and symptom-detected groups, respectively.

Screen-detected cancers were significantly less expensive for both sexes, but the absolute difference was much greater for women ($3,657; p=0.005) than for men ($2,188; p=0.005). For women, the diagnosis costs were $7,486 (95% CI: 5,784 - 9,187) for the screen-detected group compared with the $11,143 (95% CI: 9,395 - 12,891) for the symptom-detected group. For men, the diagnosis costs were $7,149 (95% CI: 5,889 - 8,408) for the screen-detected group compared with $9,337 (95% CI: 8,350 - 10,324) for the symptom-detected group.

Stratifying by age showed that the cost of screen- and symptom-detected cancer were not significantly different for those younger than 65 years, but were approximately $3,000 less per person for those older than 65 years, (p<0.001).

Costs for the 12 months following diagnosis were significantly lower for the screen-detected group as a whole ($23,344 versus $29,384; p=0.001). This was consistent with the stage distribution of persons with symptom-diagnosed cancer being more advanced than for individuals with screen-detected cancers.

For the 12 months following diagnosis, only persons diagnosed with Stage A cancers had significantly less expenses in the screen-detected arm ($17,267 versus $23,310; p=0.0013). When the costs were examined from the period 3 months before diagnosis to 12 months following diagnosis, the diagnosis costs were also significantly lower for persons diagnosed with Stage A cancer, with a consistent trend toward lower costs across all other stages at diagnosis.

The costs of care for patients were significantly and substantially lower in the screen-detected group than in the symptom-detected group over the observed period (3 months before diagnosis to 12 months following diagnosis, $24,636 versus $31,128; p=0.0005).

The authors stated that under a conservative assumption (that the stage distribution for the symptom-detected group would not change under screening), the total savings to the organisation achieved by screening over the 7 years of the study would have been $1,738,075 for the 3-month period immediately before diagnosis, and $2,978,828 for the entire 15-month pre-diagnosis/post-diagnosis period. On the contrary, with a less conservative assumption (that screening would result in a stage shift to the observed stage distribution from screening, as well as savings from eliminating symptom-detected cancers), the savings for the 15-month period would total $4,440,528.
Synthesis of costs and benefits
The cost and benefits were not combined.

Authors' conclusions
Screening using faecal occult blood testing (FOBT) reduced medical care costs in the 3-month period before diagnosis by nearly $3,000 per patient. In addition, the costs for persons with screen-detected cancer were also lower in the year following diagnosis, even adjusting for stage at diagnosis. The analysis suggested that health plans that invest in screening programmes will realise cost-savings from reduced diagnosis costs, from moving persons to earlier stages at diagnosis, and also from reducing costs within stages at diagnosis.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparators. The authors stated that the data were derived from a naturalistic setting; a health plan that recommended CRC screening but did not cover annual FOBT screening for its members older than 50 years. You should judge whether these screening strategies are relevant in your setting, or whether other comparators from other screening modalities could have been relevant as well, including FOBT.

Validity of estimate of measure of effectiveness
The analysis was based on a retrospective cohort study, which was appropriate given the study question. The study sample was representative of the study population. In addition, the patient groups were shown to be comparable at analysis. Appropriate statistical analyses were undertaken to ensure comparability of the patient groups. No power calculations were reported.

Validity of estimate of measure of benefit
The authors did not derive a measure of health benefit. The analysis was therefore categorised as a cost-consequences study.

Validity of estimate of costs
All the categories of costs relevant to the perspective adopted appear to have been included in the analysis. The authors acknowledged that the costs associated with screening a defined population were not considered, and that this could have affected the estimated savings of screening. The costs and the quantities were not reported separately. The results from the study were extrapolated using Kaplan Meier techniques to estimate total medical costs, accounting for survival during the follow-up period. The unit costs were taken from the authors' setting, thus were possibly not representative for other settings. Discounting was unnecessary since all of the costs were incurred during a 15-month period. All the costs were adjusted using an appropriate index and the price year was reported, thus aiding any reflation exercises.

Other issues
The authors acknowledged that they did not make appropriate comparisons of their findings with those from other studies. The issue of generalisability was partially addressed in that the authors stated that guidelines for CRC screening at their setting were somewhat less aggressive than current national guidelines. This could affect the generalisability of their findings, underestimating what might be cost-differences in plans that screen more aggressively, either in frequency or by using other screening modalities. The authors appear to have presented their results selectively, although their conclusions reflected the scope of the analysis.

The authors also acknowledged several limitations of their study. First, the narrow definition of screening FOBT based on the medical record. Second, the fact that cancers identified through screening tend to be more indolent than those diagnosed via symptoms. Third, the timeframe chosen (from 3 months before diagnosis), which might have underestimated the true cost-difference. Fourth, the fact that the costs were obtained from a single local HMO, which might not be representative of the patterns of care and costs of care in other settings. Also, although evidence of cost-savings was
presented, only the costs attributable to diagnosis were examined. The costs associated with screening a defined population were not considered, for example, the costs of administering the tests and the costs associated with diagnostic evaluation of false-positive findings. This might have affected the findings, overestimating the savings achieved through screening.

**Implications of the study**
There is evidence that screening is usually underused. Nevertheless, it is possible that health plans can achieve substantial savings in diagnosis and treatment costs over what would have been spent in the absence of screening. Diagnosis costs have not been considered before in cost-effectiveness studies of CRC screening, and the savings achieved could be weighted against the costs of a screening programme. For this reason, in addition to their potential value for decision-makers in health plans who are considering funding screening programmes, these data may be useful for decision modellers who have to build or refine cost-effectiveness analyses of CRC screening modalities, since they were derived from a naturalistic setting.

**Source of funding**
Supported by the Aetna Research Foundation Quality Care Research Fund and the Applied Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute.

**Bibliographic details**

**PubMedID**
14724816

**Other publications of related interest**


**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Aged; Aged, 80 and over; Colorectal Neoplasms /diagnosis /therapy; Cost-Benefit Analysis; Female; Health Care Costs; Humans; Male; Middle Aged; Occult Blood; Retrospective Studies

**AccessionNumber**
22004000053

**Date bibliographic record published**
31/10/2005

**Date abstract record published**
31/10/2005