Screening for colorectal cancer: the cost to find an advanced adenoma

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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
Four screening strategies for the detection of advanced adenoma in patients referred for a positive faecal occult blood test (FOBT), were examined. Advanced adenoma was defined as a villous adenoma, tubular adenoma of at least 10 mm, high-grade dysplasia or cancer. The strategies were:

- flexible sigmoidoscopy (FS) to the splenic flexure (FS-SF);
- FS with air contrast barium enema (FS-ACBE);
- virtual colonoscopy (VCOL); and
- colonoscopy (COL).

In the FS branch the authors considered a further option, intubation to the sigmoid colon.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population consisted of hypothetical patients referred for a positive FOBT.

Setting
The setting of the study was not stated. The economic study was carried out in Ontario, Canada.

Dates to which data relate
The effectiveness data were derived from studies published in 1999 and 2000. No dates for the resource use data were reported. The price year was 2000.

Source of effectiveness data
The effectiveness evidence came from a review of published studies. The authors also made one assumption.

Modelling
A decision tree model was constructed to evaluate the costs and clinical outcomes of four screening strategies (FS-SF, FS-ACBE, VCOL and COL) for the detection of colon cancer after a positive FOBT in a hypothetical population of 1,000 patients. There were two possible outcomes, the presence or absence of adenoma. In all patients who tested
positive in the first three strategies, COL was required and all patients found with adenoma underwent polypectomy. The model was populated with data derived from the literature and local costs.

Outcomes assessed in the review
The outcomes used as model inputs were the probabilities of left-sided lesion, right-sided lesion, and lesion on right and left. Also, the sensitivity and specificity of VCOL and ACBE.

Study designs and other criteria for inclusion in the review
Not stated.

Sources searched to identify primary studies
MEDLINE was searched.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Not stated.

Number of primary studies included
Three primary studies were included in the review.

Methods of combining primary studies
Not stated.

Investigation of differences between primary studies
Not stated.

Results of the review
The probability value was 61.6% for left-sided lesion, 30.7% for right-sided lesion, and 8.2% for lesion on right and left.

The sensitivity and specificity of VCOL were both 96%. The sensitivity of ACBE was 51.7% and the specificity was 82.3%.

Methods used to derive estimates of effectiveness
The authors assumed the prevalence rate of advanced adenoma based on findings from a published study.

Estimates of effectiveness and key assumptions
The prevalence rate of advanced adenoma was assumed to be 16.9%.

Measure of benefits used in the economic analysis
The benefit measure used in the economic analysis was the number of advanced adenomas detected with each screening
approach. This was derived using modelling. No discounting was applied due to the short time horizon of the study.

Direct costs
No discounting was performed since the costs were incurred over a short time period. Only the unit costs of the screening procedures were reported separately from the quantities of resources used. The health services included in the economic evaluation were treatment costs. These were calculated by summing the inpatient and outpatient hospital costs, supplies, medications, nursing costs, equipment (capital cost and maintenance), cost of perforation and physician fees. The cost/resource boundary adopted in the study was that of the Canadian third-party payer. The costs were estimated using a combination of the Ontario Health Insurance Plan (OHIP) fee schedule, Ontario Nurse's Association collective agreement, and hospital administration. The source of the resource use data was unclear. The price year was 2000.

Statistical analysis of costs
The costs were treated deterministically.

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

Currency
Canadian dollars (Can$).

Sensitivity analysis
One-way and two-way sensitivity analyses were conducted to evaluate the robustness of the estimated cost-effectiveness ratios to variations in all the cost and probability values used in the decision model. The authors stated that plausible ranges were used. In particular, the prevalence rate of disease was varied between 10.5 and 50% to take into account high-risk patients.

Estimated benefits used in the economic analysis
In a hypothetical population of 1,000 patients, and assuming a prevalence of 16.9%, the number of advanced adenomas detected was 96 with FS, 117 with FS-SF, 137 with FS-ACBE, 162 with VCOL, and 169 with COL.

Cost results
In a hypothetical population of 1,000 patients, and assuming a prevalence of 16.9%, the total costs were Can$213,696 with FS, Can$225,810 with FS-SF, Can$389,080 with FS-ACBE, Can$596,322 with VCOL, and Can$387,010 with COL.

Synthesis of costs and benefits
The average and incremental cost-effectiveness ratios were calculated to combine the costs and benefits of the screening strategies, assuming a prevalence of 16.9%.

The average cost per advanced adenoma detected was Can$2,226 with FS, Can$1,930 with FS-SF, Can$2,840 with FS-ACBE, Can$3,681 with VCOL, and Can$2,290 with COL.

The incremental cost per advanced adenoma detected was Can$2,226 with FS over no screening, Can$577 with FS-SF over FS, Can$8,164 with FS-ACBE over FS-SF, Can$8,280 with VCOL over COL, and a negative value with COL over VCOL (the former being less costly and more effective than the latter).
The sensitivity analyses produced interesting results. First, $115 was the threshold value at which ACBE became less expensive than COL. Second, $291 was the threshold value at which VCOL was cheaper than COL. Third, for a high-risk population (disease prevalence rate $\geq 33.5\%$), COL was the most cost-effective screening option.

Variations in the remaining model inputs did not produce substantial changes in the estimated results.

**Authors' conclusions**
Flexible sigmoidoscopy (FS) and flexible sigmoidoscopy to the splenic flexure (FS-SF) were the cheapest approaches, but were associated with low and ethically unacceptable detection rates of advanced adenomas. Among the remaining options, colonoscopy (COL) was the dominant strategy because it detected all advanced adenomas at a cost lower than virtual colonoscopy (VCOL) and flexible sigmoidoscopy with air contrast barium enema (FS-ACBE), especially at a high prevalence rate.

**CRD COMMENTARY - Selection of comparators**
The rationale for the choice of the comparators was clear. The four strategies were selected because they represented actual screening options for colon cancer. The authors took into account two different forms of FS. The no screening option appears to have been considered only for computational purposes, not as an actual strategy. You should decide whether they represent widely used screening approaches in your own setting.

**Validity of estimate of measure of effectiveness**
The effectiveness data were derived from a review of published studies. However, the methods and conduct of the review were not reported. MEDLINE was searched, but the search details were not provided. Information on the primary studies was not given. In addition, it was unclear whether the primary studies were comparable in terms of patient population and screening options used. The authors made a crucial assumption on disease prevalence on the basis of a published study, but the uncertainty around this value was investigated in sensitivity analyses whose results were appropriately reported.

**Validity of estimate of measure of benefit**
The number of advanced adenomas detected with each screening approach represented the benefit measure used in the economic analysis. It was calculated through modelling. The use of survival would have helped in comparing the benefits of the present interventions with those from other screening programmes implemented in the health care system.

**Validity of estimate of costs**
The perspective adopted in the study was explicitly reported and it appears that all the relevant categories of costs have been included. Local cost data were used. However, details on resource consumption were not reported. The price year was given, thus simplifying relflation exercises in other settings. The unit costs and the quantities of resources used were reported separately only for the four screening procedures. The costs were treated deterministically, but several sensitivity analyses were conducted.

**Other issues**
The authors did not compare their findings with those from other studies. They also did not address the issue of the generalisability of the study results to other settings. However, sensitivity analyses were conducted and some results were reported. Overall, the external validity of the analysis was low. The study referred to hypothetical patients who resulted positive after a FOBT and this was reflected in the conclusions of the analysis.

**Implications of the study**
The study suggests that COL is the screening approach that offers the best cost-effectiveness ratio in comparison with
the other options. The authors recommend extending access to COL to all patients with a positive FOBT. The limitations highlighted should be taken into consideration when referring to the results obtained by this study.

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