Filtering strategies in mass population screening for colorectal cancer: an economic evaluation

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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 use of mass population filtering strategies for the selection of individuals requiring further screening (colonoscopic investigation) for the detection of colorectal cancer (CRC). The strategies examined were as follows.

Strategy 1: the Hemoccult faecal occult blood (FOB) test. A 3-day test, with no subsequent retesting of positives or negatives.

Strategy 2: the Hemoccult FOB test. All first-round positive results are subjected to a retest and confirmed positives proceed to investigation.

Strategy 3: the Hemoccult FOB test. All first-round positive results are subjected to a retest and confirmed positives proceed to investigation. Negative retests take a third test and those confirmed positive proceed to investigation.

Strategy 4: the Hemoccult FOB test as in strategy 1, but all test samples are rehydrated prior to development. All positives proceed to investigation.

Strategy 5: the Hemoccult FOB test as in strategy 1, but administered over 6 days and no retesting.


Strategies 7, 8 and 9 used Hemoquant FOB tests with different sensitivities. Strategy 7 was sensitive at 1.5 mg haemoglobin-g stool, strategy 8 was sensitive at 2.0 mg/g, and strategy 9 was sensitive at 3.0 mg/g.

Strategy 10: the Fecatwin/Feca EIA FOB test.

Strategy 11: the Coloscreen FOB test.


Strategy 13: a risk questionnaire in which positives are identified on the basis of the presence of one or more risk factors, such as symptoms, personal risk, or familial risk.

Strategy 14: no screening.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical cohort of 100,000 asymptomatic individuals. In general, persons over 50 years of age were included in the target population.

Setting
Although not explicitly stated, the setting might have been primary care. The economic study was carried out in the UK.

Dates to which data relate
The effectiveness evidence came from studies published from 1987 to 1991. The cost data were estimated from an article published in 1989. The price year was 1989.

Source of effectiveness data
The effectiveness evidence was derived from a synthesis of completed studies, supplemented by authors' assumptions.

Modelling
A traditional economic modelling approach appears to have been used to assess the costs and benefits of the filtering strategies. Decision trees were not used.

Outcomes assessed in the review
The outcomes assessed from the literature were the compliance rates and sensitivity and specificity values.

Study designs and other criteria for inclusion in the review
It was unclear whether a formal review of the literature was undertaken, but most of the evidence came from randomised clinical trials.

Sources searched to identify primary studies
Not stated.

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
Ten primary studies provided the evidence.

Methods of combining primary studies
The authors did not report the method used to combine the results of the individual studies, although a narrative method appears to have been used.

Investigation of differences between primary studies
Not stated.
Results of the review
The compliance rate was 57.8% for strategies 1 to 4 and 6 to 10, 53.4% for strategy 5, 86% for strategy 11, 88% for strategy 12, and 69% for strategy 13.

The sensitivities and specificities of the strategies were as follows:

- strategy 1, sensitivity 0.67 and specificity 0.97;
- strategy 2, sensitivity 0.58 and specificity 0.99;
- strategy 3, sensitivity 0.65 and specificity 0.99;
- strategy 4, sensitivity 0.72 and specificity 0.95;
- strategy 5, sensitivity 0.74 and specificity 0.99;
- strategy 6, sensitivity 0.95 and specificity 0.93;
- strategy 7, sensitivity 0.90 and specificity 0.94;
- strategy 8, sensitivity 0.85 and specificity 0.95;
- strategy 9, sensitivity 0.70 and specificity 0.98;
- strategy 10, sensitivity 0.67 and specificity 0.91;
- strategy 11, sensitivity 0.33 and specificity 0.94;
- strategy 12, sensitivity 0.36 and specificity 0.89; and
- strategy 13, sensitivity 0.70 and specificity 0.81.

Methods used to derive estimates of effectiveness
The authors formulated several assumptions to derive some estimates of effectiveness.

Estimates of effectiveness and key assumptions
It was estimated that the prevalence of CRC was 3.5 per thousand. The compliance rates of some filtering procedures were not available from the literature and were assumed to have been comparable with the rates of other similar procedures (reported above).

Measure of benefits used in the economic analysis
The summary benefit measure used was the number of cancers detected with each filtering strategy in a target population of 100,000. The number of positives was also reported.

Direct costs
The cost analysis was based on the results of a published clinical trial, which was partly used as source of evidence (Hardcastle et al., see Other Publications of Related Interest). Limited information on the economic analysis was provided. The unit costs and the quantities of resources used were not analysed separately. The health services included in the economic evaluation were filtering tests and colonoscopic investigation. The cost/resource boundary of the study was unclear. The only unit cost reported was that of colonoscopy. Discounting does not appear to have been relevant as the costs were incurred during a short timeframe. The resource use data were mainly derived from authors’ assumptions. It was also assumed that the relevant filter was distributed to all members of the target population, and that
all unused material was discarded. The price year was 1989.

**Statistical analysis of costs**
The costs were treated deterministically.

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

**Currency**
UK pounds sterling (£). The authors stated that when the article was written, the pound was equivalent to approximately 2 US dollars.

**Sensitivity analysis**
One- and two-way sensitivity analyses were carried out to assess the impact on the estimated cost-effectiveness ratios of varying the compliance rate and the prevalence rate. The ranges used were derived from authors' opinions.

**Estimated benefits used in the economic analysis**
The number of cancers detected in a target population of 100,000 was:

- 135 with strategy 1;
- 118 with strategy 2;
- 131 with strategy 3;
- 145 with strategy 4;
- 137 with strategy 5;
- 192 with strategy 6;
- 182 with strategy 7;
- 172 with strategy 8;
- 142 with strategy 9;
- 136 with strategy 10;
- 99 with strategy 11;
- 112 with strategy 12;
- 169 with strategy 13; and
- 0 with strategy 14.

**Cost results**
The estimated total costs (in million) in a target population of 100,000 with each strategy were:
strategy 1, 0.38;
strategy 2, 0.26;
strategy 3, 0.28;
strategy 4, 0.50;
strategy 5, 0.43;
strategy 6, 1.03;
strategy 7, 1.88;
strategy 8, 1.82;
strategy 9, 1.64;
strategy 10, 0.86;
strategy 11, 0.66;
strategy 12, 1.11;
strategy 13, 1.45; and
strategy 14, 0.

Synthesis of costs and benefits
An average cost-effectiveness ratio was calculated to combine the costs and benefits of the filtering strategies. After dominated strategies were eliminated, the incremental cost-effectiveness ratios of the remaining strategies were calculated.

The average cost per cancer detected with each strategy was:

strategy 1, 2,814;
strategy 2, 2,202;
strategy 3, 2,116;
strategy 4, 3,456;
strategy 5, 3,156;
strategy 6, 5,356;
strategy 7, 10,323;
strategy 8, 10,569;
strategy 9, 11,561;
strategy 10, 6,373;
strategy 11, 6,691;
strategy 12, 9,869;
strategy 13; and
strategy 14, 8,582.

The incremental cost per cancer saved was 2,116 with strategy 3 over strategy 14, and 12,376 with strategy 6 over strategy 3.

The authors noted that the choice of the preferred approach depended on the financial value the decision-maker put on a case of cancer missed. The sensitivity analysis revealed that variations in the model assumptions did not alter the ranking of the filtering tests, although the cancer-miss valuations increased with higher prevalence and lowered with higher compliance rates (range: 1,900 - 4,800).

Authors' conclusions
The Hemeselect 3-day faecal occult blood (FOB) test and Hemoccult 3-day FOB test with two retests were the most cost-effective strategies of all those investigated. However, the choice of the filtering screening depended on the payer's willingness to pay for a case of missed cancer. Under some scenarios, the no screening option could have been the preferred strategy.

CRD COMMENTARY - Selection of comparators
The choice of the comparators appears to have been appropriate, as it covered all possible filtering strategies used for the detection of CRC in asymptomatic individuals. The authors provided a justification for the selection of the interventions under evaluation. The no screening option was also appropriately considered. You should decide whether these are valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The authors did not state that a systematic review of the literature had been undertaken. The methods used to find and select the primary studies were unclear, therefore some relevant studies could have been excluded. Although most of the effectiveness estimators were derived from clinical trials, the quality and validity of the data collected from these studies was not reported. The primary estimates were combined using narrative methods. The authors made several assumptions to derive some of the effectiveness estimators, which were then varied in the sensitivity analysis. However, the impact of variations in estimates derived from the literature was not investigated. The authors noted that comparing data derived from different sources was a problem, and some data could have been biased. Further, the published evidence pertaining to the risk questionnaire was controversial, which added further uncertainty to the results of the study.

Validity of estimate of measure of benefit
The summary benefit measure was specific to the interventions considered in the study and would be difficult to compare with the benefits of other health care interventions. The use of life-years saved as a result of the filtering strategies would have been helpful, but the authors stated that such an estimate would have needed epidemiological data that they did not possess.

Validity of estimate of costs
The authors did not state explicitly the perspective of the study, although it might have reflected that of the NHS. However, only the costs strictly related to the implementation of the filtering strategies were considered. The authors acknowledged that the inclusion of cancer treatment costs would have been more appropriate. The price year was reported, which will simplify reflation exercises in other settings. However, there was limited information on the whole cost analysis since the data were derived from a published study. The unit costs were not reported separately from the quantities of resources used, and it may therefore be difficult to replicate the study. Most of the resource use data were
derived from authors' assumptions. The costs were treated deterministically, and were specific to the study setting as no sensitivity analyses were carried out.

**Other issues**
The authors did not make extensive comparisons of their findings with those from other studies. They also did not explicitly address the issue of the generalisability of the study results to other settings. However, some sensitivity analyses were carried out on key estimates, and the results would appear to be applicable to settings with difference compliance and cancer prevalence rates. The study referred to the general population of asymptomatic individuals and this was reflected in the conclusions of the analysis. The authors noted some limitations to the validity of their analysis, which mainly related to the source of the clinical data.

**Implications of the study**
The authors stated that their results relied on the current state of clinical research and that they may require revision as this research progresses.

**Source of funding**
None stated.

**Bibliographic details**

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**Other publications of related interest**

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