Cost-effectiveness of double-contrast barium enema in screening for colorectal cancer

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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
Double contrast barium enema for screening for colorectal cancer within a middle age population.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population was a hypothetical population of asymptomatic males and females aged 50 entering a programme of colorectal cancer screening, who were assumed to have a 30% prevalence of detectable polyps. A cohort of 100,000 was used for the analysis.

Setting
Community. The economic study was carried out in Philadelphia, USA.

Dates to which data relate
The effectiveness data were taken from studies published between 1974 - 1997. Resource and cost data were derived from models previously published in 1990 and 1995. The price year was not stated.

Source of effectiveness data
The effectiveness data were derived from a review of previously published sources.

Modelling
The costs and consequences of the screening strategies employing double contrast barium enema were derived from a model adapted from one previously constructed by the US Congress Office of Technology Assessment to investigate other colorectal cancer screening strategies.

Outcomes assessed in the review
The sensitivity and specificity of double contrast barium enema, which was used within the model, were assessed from the literature. The remaining model parameters were taken from the original model.

Study designs and other criteria for inclusion in the review
The authors included all identified studies within the review regardless of study design. When selecting values for the
model from the review the authors used those that most closely reflected a screening population.

**Sources searched to identify primary studies**
The authors undertook a search of MEDLINE and a review of the citations in the identified papers.

**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**
Approximately 28 studies were used. Five studies were deemed appropriate for measuring sensitivity within a screening population and two studies were deemed appropriate for measuring specificity within a screening population.

**Methods of combining primary studies**
Not undertaken.

**Investigation of differences between primary studies**
The authors identified the population and environment in which each study was conducted.

**Results of the review**
The sensitivity of the double contrast barium enema for polyps or cancer was reported as 70% and the specificity of the double contrast barium enema was reported as 90%. These data were used to enhance the original model to include screening with double contrast barium enema, the other parameters within the model were unchanged from the original.

**Measure of benefits used in the economic analysis**
The measure of benefits used within the analysis was life years gained.

**Direct costs**
Unit costs associated with the double contrast barium enema, the other screening tests, the diagnostic procedures and tissue pathology were included, as were the lifetime costs of treating both early and late identified colorectal cancer and the costs of treating a perforated colon, a possible complication associated with colorectal cancer screening. The resource quantities were derived from the model although they were not detailed separately. Costs were discounted at an annual rate of 5%. The cost/quantity boundary adopted was that of the third party provider. The price year was not specified.

**Statistical analysis of costs**
Not stated.

**Indirect Costs**
Not assessed.
Currency
US dollars ($).

**Sensitivity analysis**
In order to test the robustness of the results to variability in the data one-way sensitivity analysis was undertaken for the sensitivity of the double contrast barium enema. In addition, the analysis was undertaken for two scenarios of polyp dwelling time: 5 and 10 years. Sensitivity analyses involving other parameters used within the model were undertaken and are reported elsewhere.

**Estimated benefits used in the economic analysis**
A screening strategy involving double contrast barium enema every 5 years for a population of 100,000 was credited with a gain of 5,050 life years compared with no screening. Incorporating annual faecal occult blood tests within this strategy led to gains of 6,870 life years compared with no screening. Annual faecal occult blood tests in isolation led to a gain of 5,150 life years compared with no screening. The use of colonoscopy or flexible sigmoidoscopy every 5 years led to gains of 8,100 and 3,370 respectively, whilst adding an annual faecal occult blood test to the flexible sigmoidoscopy strategy led to a gain of 6,280 life years (All compared with a position of no screening, for a screened population of 100,000 and assuming a polyp dwelling time of 5 years). Assuming a 10 year polyp dwelling time led to gains of 6,020 and 7,330 life years for double contrast barium enema every five years in isolation and with annual faecal occult blood tests; gains of 5,880 life years for annual faecal occult blood tests and gains of 6,500, 3,580 and 6,720 life years for colonoscopy every five years, flexible sigmoidoscopy every five years in isolation and with annual faecal occult blood tests, respectively. (All compared with a position of no screening). All health benefits were discounted at an annual rate of 5%.

**Cost results**
The additional costs of screening a population of 100,000 with double contrast barium enema every five years was $68.2 million ($58.8 million) when polyp dwell time was assumed to be 5 (10) years compared with no screening. Incorporating annual faecal occult blood tests within this strategy led to a cost of $101.4 million ($93.9 million), whilst annual faecal occult blood tests in isolation led to costs of $70 million ($58.2 million). Colonoscopy every 5 years cost $87.7 million ($82.9 million), flexible sigmoidoscopy every 5 years cost $40.2 million ($37.8 million) and enhancing this policy with annual faecal occult blood tests cost $85.7 million ($78.3 million). All costs were discounted at an annual rate of 5%.

**Synthesis of costs and benefits**
The base case results for population screening through double contrast barium enema every 5 years were $13,495 ($9,435) per life year gained compared with no screening when the polyp dwell time was assumed to be 5 (10) years. When the policy was enhanced by annual faecal occult blood tests the cost-effectiveness fell to $14,750 ($12,815) per life year gained, compared with no screening. Annual faecal occult blood tests in isolation had a reported cost-effectiveness of $13,581 ($9,906) per life year gained compared with no screening. Five yearly screening via colonoscopy, flexible sigmoidoscopy in isolation or with annual faecal occult blood tests were reported to have cost-effectiveness ratios of $14,383 ($12,750), $11,947 ($10,541) and $13,639 ($11,652) respectively per life year gained compared with no screening.

The sensitivity analysis revealed that the cost-effectiveness of screening with double contrast barium enema every five years was sensitive to changes in the sensitivity and specificity of the test. When the sensitivity was reduced to 50% the cost-effectiveness was reduced to $19,800 per life year gained compared with no screening for an assumed polyp dwell time of 5 years. By simultaneously improving the specificity to 93% the cost-effectiveness ratio was improved to $19,200 per life year gained. By employing a regimen where polyps were only treated if they measured at least 10-mm, the cost-effectiveness of the policy of double contrast barium enema every 5 years was improved to $4,283 per life year gained, assuming a 5 year polyp dwelling time.
Authors' conclusions
The use of double contrast barium enema can be a cost-effective method for screening for colorectal cancer within a middle aged population, especially if the test is focused upon identifying large polyps and performed at a regular interval, to allow detection of previously overlooked or irrelevant polyps.

CRD COMMENTARY - Selection of comparators
The reason for the choice of comparison strategies is clear. You, as a user of this database, should consider whether these health technologies apply to your setting.

Validity of estimate of measure of effectiveness
There is evidence of an extensive search of the literature to determine the sensitivity and specificity of the double contrast barium enema. However, the sensitivity and specificity parameters may be biased as a result of a lack of evidence from a screening population. The lack of information concerning other parameters within the model makes it difficult to assess the internal and external validity of the results and, whilst the validity was tested through sensitivity analysis, the results are not reported comprehensively.

Validity of estimate of costs
The costs used originate from the USA, and therefore may be inappropriate for use within the NHS. Important cost items do not appear to have been omitted.

Other issues
The structure of the original model from which the results are generated is not discussed within the paper. The issue of generalisability to other settings is not specifically addressed by the authors, and there is no comparison with other studies. The results, however, do not appear to be presented selectively.

Source of funding
None stated

Bibliographic details

PubMedID
9490943

DOI
10.2214/ajr.170.3.9490943

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Barium Sulfate /administration & dosage /economics; Colorectal Neoplasms /economics /mortality /radiography; Contrast Media /economics; Cost-Benefit Analysis; Enema; Humans; Middle Aged; Models, Statistical; Quality-