Colorectal cancer screening for average-risk North Americans: an economic evaluation

Heitman SJ, Hilsden RJ, Au F, Dowden S, Manns BJ

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.

CRD summary
This study examined the cost-effectiveness of mass screening strategies for colorectal cancer in average-risk individuals aged 50 to 75 years. The authors concluded that annual screening using the faecal immunochemical test was more effective and cheaper than the other strategies, making it the best strategy. The cost-effectiveness framework was valid and considered alternative scenarios. These features support the reliability of the authors’ conclusions.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of various mass screening strategies for colorectal cancer in average-risk individuals aged 50 to 75 years.

Interventions
The screening strategies were a guaiac-based faecal occult blood test (FOBT) or faecal immunochemical test (FIT) annually, faecal deoxyribonucleic acid (DNA) every three years, flexible sigmoidoscopy or computed tomography (CT) colonography every five years, and colonoscopy every 10 years. No screening was the background comparator. Low, middle, and high performance in detecting adenomas and colorectal cancer were considered for the FIT, while low and high performance were considered for the FOBT. First and second generation assays were considered for faecal DNA testing.

Location/setting
Canada/primary care.

Methods
Analytical approach:
The analysis was based on a Markov cohort simulation with a lifetime horizon. The authors stated that it was carried out from the perspective of a publicly funded health care system.

Effectiveness data:
The clinical data were from selected studies, with the test performance data identified by a search of the literature. The natural history of colorectal cancer and the risks of polyps and cancer were from a published systematic review and published economic models. Screening adherence was from clinical trials and was assumed to be equal for all the strategies. In general, landmark studies and pivotal clinical trials were used for the accuracies of the screening strategies, which were the key inputs for the model.

Monetary benefit and utility valuations:
The utility values were from a study that used the standard gamble technique in patients with a previous history of colorectal cancer or polyps, who were asked to value stage-dependent outcome states for colorectal cancer.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and they were discounted at an annual rate of 5%.

Cost data:
The economic analysis included two main cost categories: the costs of screening and those of managing colorectal cancer. Screening included physician fees, non-physician costs (capital, nursing, drugs, cleaning, screening kit, and laboratory or processing costs), and patient and caregiver time and travel costs. Management included the costs of surgery and chemotherapy. Screening costs were local estimates from the Calgary Health Region, supplemented with conservative assumptions and available survey data. Colorectal cancer costs were from Canadian sources and depended on the stage of the disease. All costs were in Canadian dollars (CAD), discounted at an annual rate of 5%. The price year was 2008.

Analysis of uncertainty:
The uncertainty was investigated in deterministic and probabilistic analyses, using first- and second-order Monte Carlo simulations. A number of alternative scenarios were analysed, including various assumptions for screening adherence, the inclusion of administrative costs for each screening strategy, and a two-year screening interval for FIT. Confidence intervals for the model outcomes were calculated.

Results
Mean costs were CAD 1,833 with FIT middle performance, CAD 1,901 with no screening, CAD 2,004 with FIT high, CAD 2,005 with FIT low, CAD 2.084 with FOBT high, CAD 2,100 with colonoscopy, CAD 2,195 with FOBT low, CAD 2,263 with flexible sigmoidoscopy, CAD 2,409 with CT colonography, CAD 2,491 with faecal DNA assay one, and CAD 2,720 with faecal DNA assay two. The QALYs were 11.300 with FIT middle, 11.255 with no screening, 11.302 with FIT high, 11.282 with FIT low, 11.267 with FOBT high, 11.296 with colonoscopy, 11.271 with FOBT low, 11.291 with flexible sigmoidoscopy, 11.296 with CT colonography, 11.278 with faecal DNA assay one, and 11.265 with faecal DNA assay two.

The incremental analysis showed that FIT middle performance was more effective and less expensive than all the other strategies, including no screening, except FIT high performance, which was more effective, but more expensive, with an incremental cost per QALY gained of CAD 85,150.

Flexible sigmoidoscopy, FOBT, CT colonography, and faecal DNA were not cost-effective under any circumstances. Increasing the cost of FIT resulted in an incremental cost of CAD 2,375 for FIT middle over no screening, while lowering the cost of colorectal cancer treatment resulted in CAD 3,691 per QALY. Colonoscopy had an incremental cost per QALY gained of CAD 32,912 over FIT high when the adherence rate to FIT was decreased to only 20%. If the administrative costs were CAD 50 per test, colonoscopy was preferred over FIT, with a cost per QALY gained of CAD 5,903 compared with no screening. Otherwise, FIT middle was the preferred strategy, as also demonstrated in the probabilistic analysis.

Authors’ conclusions
The authors concluded that annual colorectal cancer screening with FIT was more effective and cheaper than the other strategies and was the best strategy for these patients.

CRD commentary
Interventions:
The selection of the comparators was appropriate as all the available screening options were considered. The authors highlighted the key advantages and disadvantages of each strategy. Colonoscopy was considered to be the gold standard, but was not infallible.

Effectiveness/benefits:
The relevant sources of data seem to have been selected without a literature review, except that a search was conducted for the test performance data. Few details of the methods of the published sources were reported, but the clinical data were reported to be mainly from well-known landmark studies or clinical trials and the design of these should have ensured the validity of the clinical inputs. Some assumptions were needed, but the authors explored their impact in extensive sensitivity analyses, using published ranges of values. QALYs were appropriate as the disease has a big impact on survival and quality of life and a valid instrument was used to elicit the patients’ preferences.

Costs:
The cost categories appear to have been consistent with the perspective stated. The costs were from local sources and reflected the Canadian accounting system. The unit costs of the screening tests were reported, while the disease management costs were presented as category totals, as is often the case for cancer-related costs. Limited information on the patterns of resource consumption was given, but the treatment regimens for colorectal cancer were reported. The price year and discounting were clearly stated and the cost estimates were extensively analysed for uncertainty.

Analysis and results:
The projected costs and benefits of the screening strategies were appropriately synthesised, using an incremental approach, and the results were clearly reported. The authors provided a clear description of the approaches used to validate the structure and the findings of the decision model. The uncertainty was satisfactorily investigated, using various approaches, and the key findings were presented and discussed. The study findings might be transferable to other setting with similar costs and resource use. Future studies should assess the adherence of patients to the screening strategies.

Concluding remarks:
The study had a valid cost-effectiveness framework and considered alternative scenarios. These features support the reliability of the authors' conclusions.

Funding
Supported by the Canadian Agency for Drugs and Technologies in Health, and Alberta Innovates - Health Solutions.

Bibliographic details

PubMedID
21124887

DOI
10.1371/journal.pmed.1000370

Original Paper URL
http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000370

Indexing Status
Subject indexing assigned by NLM

MeSH
Aged; Colorectal Neoplasms /diagnosis /economics; Early Detection of Cancer /economics /methods; Female; Humans; Male; Middle Aged; North America

AccessionNumber
22011000048

Date bibliographic record published
16/03/2011

Date abstract record published
06/04/2011