Colon cancer prevention in Italy: cost-effectiveness analysis with CT colonography and endoscopy


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 examined three screening strategies for colorectal cancer (CRC). The strategies were computerised tomographic colonography (CTC), colonoscopy (COL) and flexible sigmoidoscopy (FS). The strategy of no screening was also considered as the main comparator. Each screening test was assumed to be performed once every 10 years.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical cohort of 50-year-olds at average risk of CRC.

Setting
The setting was a hospital. The economic study was carried out in Italy.

Dates to which data relate
The clinical data were derived from studies published between 1963 and 2005. No dates for the resource use data were given. The price year was not reported.

Source of effectiveness data
The clinical and epidemiological data used in the analysis were:

- disease prevalence (CRC and polyps),
- transition probabilities (from small polyps to medium or large polyps, from polyps to early CRC, from early to advanced CRC, etc.),
- the mortality rates,
- the accuracy (sensitivity and specificity) of screening tests for polyps of different size and for CRC,
- compliance and adherence with screening, and
- the complication rates associated with COL and FS.
Modelling
A Markov model was developed to simulate the natural history of the disease and the impact of the three screening strategies. The time horizon of the model was 30 years. Health states and transition data were reported in detail in an appendix. A deterministic analysis was carried out. The structure of the model was depicted.

Sources searched to identify primary studies
Most of the clinical data were derived from published studies. However, details of the sources of the data were limited: the Italian census and Italian National Center for Statistics. The accuracy of CTC appears to have been derived from a meta-analysis. Compliance was based on authors’ assumptions.

Methods used to judge relevance and validity, and for extracting data
It was not stated whether a systematic review of the literature was undertaken to identify the primary studies. Epidemiological data were taken from Italian sources, while accuracy data appear to have been taken from several sources.

Measure of benefits used in the economic analysis
The summary benefit measure used was the expected number of life-years (LYs) gained with each screening strategy. The LYs were estimated using a modelling approach and were discounted at an annual rate of 3%. Other model outputs, such as cases of CRC diagnosed, reduction in mortality, and reduction in the number of procedures and related complications, were also reported.

Direct costs
The perspective of the Italian NHS appears to have been adopted in the analysis of the costs. The cost categories included were CTC, COL (with or without polypectomy), FS, bleeding, perforation, and late and early CRC treatment. The unit costs were not presented separately from the resource quantities, except for CTC. A detailed breakdown of the cost items was reported for the three screening tests. No information on the sources of the resource use data was provided. The cost of each screening procedure was derived from the nominal fees paid by the regional health office to the public hospitals. The costs of the endoscopic procedures came from an analysis by the Italian Society of Digestive Endoscopy. Other costs were derived from published studies (details not given). Discounting was relevant, given the long-term horizon of the study, and an annual rate of 3% was applied. The price year was not explicitly reported.

Statistical analysis of costs
The costs and quantities were treated deterministically.

Indirect Costs
The productivity costs were not considered.

Currency
Euros (EUR).

Sensitivity analysis
All model inputs were varied in a univariate sensitivity analysis to assess the robustness of the cost-effectiveness ratios. Published ranges of values obtained from the literature or authors’ assumptions were used.

Estimated benefits used in the economic analysis
In a hypothetical cohort of 100,000 individuals, the expected LYs saved in comparison with no screening were 2,945
with FS, 3,589 with CTC and 3,821 with COL.

The number of cases of CRC in a hypothetical cohort of 100,000 individuals was 15,385 with no screening, 10,556 with FS, 9,551 with CTC and 9,142 with COL. Thus, the CRC incidence reduction with respect to no screening was 40.9% with COL, 38.2% with CTC and 31.8% with FS.

The reduction in mortality with respect to no screening was 43% with COL, 40.5% with CTC and 33.5% with FS.

Cost results
In a hypothetical cohort of 100,000 individuals, the total costs were EUR 51,434,543 with no screening, EUR 49,728,410 with FS, EUR 46,862,560 with CTC and EUR 50,360,402 with COL. Thus, the extra-cost of screening tests (about EUR 16 million for CTC and FS, and about EUR 21 million for COL) was more than offset by a reduction in the cost of CRC treatment.

Synthesis of costs and benefits
Incremental cost-effectiveness ratios were calculated in order to combine the costs and benefits of the alternative strategies. All three screening options dominated the no screening strategy, which was both less effective and more expensive. When the three strategies were compared with each other, FS was dominated by CTC, while COL was only slightly more expensive than FS (incremental cost of EUR 721 per LY gained). The incremental cost per LY gained with COL over CTC was EUR 15,091.

The sensitivity analysis showed that accuracy for polyps of 6 mm or larger, initial adherence, screening costs, and time interval for screening tests were the main drivers of the decision model. A drop of 39% in baseline CTC sensitivity for polyps 6 mm or larger raised the cost-effectiveness ratio of CTC over no screening to that of COL (about EUR 15,000 per LY gained). Changes in adherence rates affected all screening strategies similarly. An increase in CTC cost to EUR 148 (+47%) worsened the cost-effectiveness ratio of CTC in comparison with no screening to that of COL, with COL dominating CTC. If each test were performed every 5 years, examination-related costs increased. This worsened the cost-effectiveness ratios of all strategies as accuracy rates improved only slightly. FS every 5 years would be dominated by COL every 10 years, while the increased cost-effectiveness of CTC every 5 years compared with COL every 10 years would be EUR 76,453.

Authors’ conclusions
Colorectal cancer (CRC) screening was cost-effective in comparison with no screening in Italy. Computerised tomographic colonography (CTC) should be preferred to flexible sigmoidoscopy (FS) and represents a valid alternative to colonoscopy (COL).

CRD COMMENTARY - Selection of comparators
The selection of the comparators was appropriate. The use of less accurate screening strategies, such as the faecal occult blood test, was not considered. You should decide whether they are valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness data were derived from published studies, but it was not stated whether a systematic review of the literature had been undertaken. Inclusion criteria and search methods were not reported. There was also no information on the primary studies. It was not possible to judge the validity of the data given the information reported in the paper. However, accuracy data for CTC were probably taken from a meta-analysis, which should ensure high internal validity. The epidemiological data would appear to reflect the Italian setting.

Validity of estimate of measure of benefit
Benefits (LYs) were estimated using a Markov model, which was appropriate given the nature of disease. The benefits were discounted according to international guidelines. An assessment of the impact of the interventions on quality of
life would have been interesting.

Validity of estimate of costs
Although not explicitly stated, the perspective of the Italian NHS appears to have been adopted. All the relevant categories of costs were included, but a breakdown of the cost items was presented only for some categories. The sources of the resource use and unit cost data were not extensively reported for all items. The costs were discounted at an annual rate of 3%, which appears to have been appropriate in this instance. This may have implications for the generalisability of the study beyond the study setting. The authors stated that the inclusion of costs associated with a national campaign of CRC screening might increase the total costs of each strategy.

Other issues
The authors compared the hypothetical implementation of CRC screening in Italy and in the USA. The observed differences were mainly due to the lower costs of screening tests in Italy. The issue of the generalisability of the study results to other settings was not directly addressed but several sensitivity analyses were carried out, thus improving the external validity of the study. As the authors acknowledged, the baseline compliance rate of 65% might have been too optimistic. At lower uptake rates, the benefits of the screening programme are likely to be outweighed by the costs of implementation. The results of the analysis were reported extensively.

Implications of the study
The study results strongly support the implementation of a national programme of CRC screening in Italy. CTC emerged as a good competitor to COL in CRC prevention. However, these results should be treated with some caution given the high compliance rate assumed.

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Other publications of related interest
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