Cost-effectiveness of population-based screening for colorectal cancer: a comparison of guaiac-based faecal occult blood testing, faecal immunochemical testing and flexible sigmoidoscopy


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
The study examined the cost-effectiveness of screening strategies for colorectal cancer, including guaiac-based faecal occult blood testing (gFOBT), reflex faecal immunochemical testing and flexible sigmoidoscopy. All strategies were highly cost-effective. Faecal immunochemical testing resulted in the greatest health gains but required more colonoscopy and had more adverse events. The analysis used valid and transparent methodology that used valid sources of data. The authors’ conclusions are robust but there is a great uncertainty about the optimal screening strategy.

Type of economic evaluation
Cost-utility analysis

Study objective
The study examined the cost-effectiveness of various population-based screening strategies for colorectal cancer including guaiac-based faecal occult blood testing (gFOBT), reflex faecal immunochemical testing and flexible sigmoidoscopy.

Interventions
The screening strategies under examination in the base case were: biennial gFOBT at ages 55 to 74 years with reflex faecal immunochemical testing; biennial faecal immunochemical testing at ages 55 to 74 years; and once-only flexible sigmoidoscopy at age 60 years.

Investigation of positive tests was by colonoscopy.

The background comparator was no screening.

Location/setting
Ireland. Primary care.

Methods
Analytical approach:
The analysis was based on a Markov process with three main interlinked components (natural history of colorectal neoplasia, impact of screening and subsequent adenoma surveillance, and impact of mortality). A lifetime horizon was considered. The authors stated that the perspective of the third-party payer was adopted.

Effectiveness data:
Comprehensive literature reviews were carried out to identify relevant sources of clinical inputs. Screening uptake was based on UK pilot programmes and a flexible sigmoidoscopy trial. Sensitivity and specificity of screening tests were the key inputs of the model and were taken from pooled analysis of cohort studies supplemented with expert opinions. Irish life tables and UK studies were used for mortality data.

Monetary benefit and utility valuations:
Utility valuations for cancer-free individuals and colorectal cancer stage-specific conditions were taken from two published studies.
Measure of benefit:
Quality-adjusted life-years (QALYs) were used as the summary benefit measure and were discounted at an annual rate of 4%.

Cost data:
The economic analysis included costs of screening procedures (materials and personnel), further diagnostic tests, treatment of complications (bowel perforation and bleeding) and management of adenoma and various stages of colorectal cancer. These costs were taken from various sources that included expert opinion (based on discussion with the National Cancer Screening Service, test suppliers and laboratory staff), Department of Health and Children salary scales, UK sources, Irish private health insurer fee schedules, diagnostic-related group costs and a published study. Costs were in Euros (€). The price year was 2008. A 4% annual discount rate was applied.

Analysis of uncertainty:
The most uncertain and debated inputs were varied in one-way sensitivity analyses. Age-variant scenarios for screening tests were considered in the sensitivity analyses. Probabilistic sensitivity analysis was carried out using Monte Carlo simulation to sample simultaneously from all uncertain model parameters.

Results
Expected costs and QALYs for age-variant screening scenarios were €1,074 and 10.961 with no screening, €1,107 and 10.968 with gFOBT at 55 to 74 years, €1,092 and 10.966 with gFOBT at 55 to 64 years, €1,089 and 10.963 with gFOBT at 65 to 74 years, €1,114 and 10.984 with faecal immunochemical testing at 55 to 74 years, €1,094 and 10.978 with faecal immunochemical testing at 55 to 64 years, €1,088 and 10.969 with faecal immunochemical testing at 65 to 74 years, €1,077 and 10.966 with flexible sigmoidoscopy once at 60 years and €1,092 and 10.968 with flexible sigmoidoscopy once at 55 years.

For base case strategies compared with no screening, the lowest incremental cost per QALY gained was €589 with flexible sigmoidoscopy followed by faecal immunochemical testing at €4,428; gFOBT was eliminated by extended dominance. The incremental cost per QALY with faecal immunochemical testing over flexible sigmoidoscopy was €2,058. All these ratios appeared well below the notional cost-effectiveness threshold of €45,000 per QALY.

The most influential inputs were discount rate, cost of screening tests and costs of managing colorectal cancer. The results of the probabilistic sensitivity analysis showed that there was a great uncertainty on the most cost-effective approach.

Authors’ conclusions
The authors concluded that all three screening strategies were highly cost-effective compared to no screening. In particular, faecal immunochemical testing was likely to result in the greatest health gains but required more colonoscopy and more individuals suffered adverse events.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear as the possible colorectal cancer screening strategies were considered. Appropriate age-variant scenarios were considered.

Effectiveness/benefits:
Clinical data were obtained by means of a review of the literature that should have ensured the identification of relevant studies. Test accuracy was taken from a pooled analysis of diagnostic study that was supplemented by local experts given the high uncertainty around some of these values. Epidemiological and behavioural estimates were appropriately taken from Irish or UK sources. Other data came from clinical trials and large cohort studies. Extensive sensitivity analysis was conducted on all clinical parameters. QALYs were a relevant measure of benefit for the patient population analysed and enabled comparisons with other disease areas. The was little information on sources of utility weights.

Costs:
The economic analysis was consistent with the viewpoint of the analysis in terms of cost categories included and
sources selected. Unit costs were reported for some screening tests but most costs were presented as macro-categories. Data sources were reported and most of referred to the Irish setting or the UK setting. The impact of variations in economic inputs was tested in the sensitivity analyses. It appeared that appropriate distributions were assigned to cost parameters. Reflation exercises in other time periods were possible as the price year was stated explicitly.

Analysis and results:
The study results were presented extensively for both the base case analysis and the alternative scenarios. An incremental approach was appropriately used to synthesise costs and benefits of the alternative strategies. Valid approaches were used to deal with the issue of uncertainty. The methods and results of the sensitivity analyses were described clearly. Study results appeared specific to the Irish setting and might be difficult to transfer to other jurisdictions.

Concluding remarks:
The analysis used a valid and transparent methodology that used valid sources of data. The authors' conclusions are robust but there is a great uncertainty about the optimal screening strategy.

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