Is virtual colonoscopy a cost-effective option to screen for colorectal cancer?
Sonnenberg A, Delco F, Bauerfeind P

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
Computed tomography (CT) colonography was compared with conventional colonoscopy for screening for colorectal cancer (CRC).

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical population of 100,000 individuals aged 50 years.

Setting
The setting was secondary care. The economic study was carried out in the Veterans Affairs Medical Center, Albuquerque (NM), USA.

Dates to which data relate
The effectiveness estimates were derived from studies published between 1982 and 1997. The price year was 1998.

Source of effectiveness data
The effectiveness data were gathered from a review of completed studies and the authors’ assumptions.

Modelling
A Markov model was used to assess the cost-effectiveness of each screening strategy. Medical events were simulated as transitions of patients among a predefined set of health states. For the colonography path, these health states were CT colonography, status post-CT colonography, colonoscopy, status post-colonoscopy, status post-endoscopic polypectomy, and CRC. The same health states, but without the colonography states, were used for the colonoscopy path. Each cycle covered the events of one year. The individuals were followed until death occurred.

Outcomes assessed in the review
The outcomes assessed in the review and used as model inputs were the sensitivity and specificity of CT colonography, the annual age-specific incidence rate of CRC, the efficacy of colonoscopy, the compliance rates and complication probabilities.
Study designs and other criteria for inclusion in the review
The sensitivity of CT colonography was estimated from published prospective trials. The annual age-specific incidence rate of CRC was taken from published SEER statistics. The efficacy of colonoscopy was estimated from data of the National Polyp Study. The compliance rates were estimated from a compilation of multiple clinical trials of faecal occult blood testing and published studies.

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
Eighteen studies were included in the review.

Methods of combining primary studies
The method used to combine the results of the individual primary studies was not reported.

Investigation of differences between primary studies
Not stated.

Results of the review
The results are presented here as point estimates, along with the ranges used in the sensitivity analysis (in brackets).

The sensitivity of CT colonography was 80% (range: 10 - 100) and the specificity was 95% (range: 50 - 100).

The efficacy of colonoscopy was 75%.

Compliance with the initial screening procedure was 65% (range: 10 - 100).

An 80% (range: 50 - 100) repeat compliance rate was used for both screening procedures.

The follow-up compliance with colonoscopy after CT colonography was 95% (range: 50 - 100).

Methods used to derive estimates of effectiveness
The screening intervals for CT colonography or colonoscopy were assessed from the experts’ recommendations.

Estimates of effectiveness and key assumptions
The screening intervals for each screening procedure were set equally at 10 years. After polypectomy, colonoscopy was repeated every 3 years until no polyps were found.

Measure of benefits used in the economic analysis
The summary measure of benefit used in the economic analysis was the number of life-years saved. The total number of CRCs prevented per strategy was also reported. An annual discount rate of 3% was used.

**Direct costs**
The cost/resource boundary seems to have been that of the third-party payer. The direct costs included were for colonography, colonoscopy, colonoscopy plus polypectomy (including the expected payments for complications such as bleeding or perforation), proctocolectomy and terminal care per patient with CRC. The cost of the screening procedures included facility payments and physician fees. Medical surgical and diagnostic services were assigned code numbers using the Physicians’ Current Procedural Terminology or Diagnosis-Related Group. They were then converted into a cost value using the average payment allowed by the US Health Care Financing Administration during the fiscal year 1998. The costs and the quantities were not reported separately. An annual discount rate of 3% was used.

**Statistical analysis of costs**
No statistical analysis was carried out on the costs.

**Indirect Costs**
No indirect costs were reported.

**Currency**
US dollars ($).

**Sensitivity analysis**
One-way sensitivity analyses were carried out on transition probabilities using ranges derived from the literature (see Results of the Review).

**Estimated benefits used in the economic analysis**
Compared with no screening, screening by colonoscopy prevented 1,030 CRCs (34%) while screening by CT colonography prevented 785 (26%) CRCs.

Compared with no screening, screening by colonoscopy saved 6,823 life-years while screening by CT colonography saved 5,200 life-years.

**Cost results**
The total discounted cost of no screening was $66,193,000 over the life-time duration of the study.

The total discounted cost of screening was $142,798,804 for colonoscopy and $125,906,505 for CT colonography.

**Synthesis of costs and benefits**
The incremental cost-effectiveness ratio of CT colonography was $11,484 per life-year saved in comparison with no screening. The incremental cost of colonoscopy compared with CT colonography screening was $10,408 per additional life-year saved (extended dominance of colonoscopy over CT colonography). CT colonography became less cost-effective than colonoscopy when the costs of CT colonography exceeded $336.

Both screening procedures were sensitive to changes in initial compliance. CT colonography could become a cost-effective option if its initial compliance rate was 15 to 20% better than that of colonoscopy. Both screening procedures were also sensitive to changes in repeat compliance. A reduction in the follow-up compliance to rates of less than 95% shifted the balance greatly in favour of colonoscopy as the primary screening tool. The outcome varied widely in...
response to changes in the sensitivity of CT colonography. However, raising this sensitivity to greater than 80% was hardly sufficient to render the procedure cost-effective in comparison with colonoscopy. Reducing the screening interval from 0 to 5 years led to a 70% increase in the cost per life-year saved on the CT colonography screening programme. The corresponding increase for the colonoscopy screening programme was 76%.

Authors’ conclusions
Computed tomography (CT) colonography does not constitute a cost-effective screening option. To become cost-effective and to be able to compete with colonoscopy in screening for colorectal cancer (CTC), CT (or magnetic resonance) colonography would need to be offered at a very low price or result in compliance rates much better than those associated with colonoscopy.

CRD COMMENTARY - Selection of comparators
The authors justified the health technology comparison on the grounds that they were comparing a new technique with the standard one. You should consider whether this is a widely used technology in your own setting.

Validity of estimate of measure of effectiveness
Several estimates, derived from the literature or from assumptions, were used to assess the effectiveness evidence of the screening alternatives. The authors did not state that a systematic review of the literature had been undertaken. They used data from the available studies selectively and did not consider the impact of differences between the primary studies when estimating the effectiveness. When assumptions were made, the estimates were investigated by sensitivity analyses.

Validity of estimate of measure of benefit
The main benefit measure was the life-years saved.

Validity of estimate of costs
The perspective of the third-party payer was adopted in the analysis. It is likely that all the categories of cost relevant to the perspective adopted were included in the analysis. No sensitivity analyses of the quantities were conducted. However, a sensitivity analysis of CT colonography price was conducted. The costs and the quantities were not reported separately. The price year and discounting were reported.

Other issues
The issue of generalisability to other settings was not addressed and the authors did not compare their findings with those from other studies. The results do not seem to have been presented selectively. The authors did not report further limitations of their study.

Implications of the study
Since the screening programme based on CT colonography is currently less cost-effective than colonoscopy, it does not open up the possibility of more frequent screening.

Source of funding
Supported in part by the Swiss Foundation for Grants in Medicine and Biology.

Bibliographic details
Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; Colonic Polyps /diagnosis /economics; Colonoscopy /economics; Colorectal Neoplasms /diagnosis /economics; Computer Simulation; Cost-Benefit Analysis; Feasibility Studies; Female; Humans; Image Processing, Computer-Assisted /economics; Male; Markov Chains; Mass Screening /economics; Sensitivity and Specificity; Tomography, X-Ray Computed /economics; User-Computer Interface

AccessionNumber
21999001546

Date bibliographic record published
31/01/2004

Date abstract record published
31/01/2004