Cost-effectiveness of colorectal cancer screening with computed tomography colonography: the impact of not reporting diminutive lesions

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 several screening strategies for colorectal cancer (CRC):
computed tomography colonography (CTC), with and without a 6-mm reporting threshold;
optical colonoscopy (OC); and flexible sigmoidoscopy (FS).
A strategy of no screening was also considered.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical cohort of individuals aged 50 years or older at average risk for CRC.

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

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

Source of effectiveness data
The clinical and epidemiological model inputs were:
adenoama prevalence and incidence rates,
annual transition rates from different health states reflecting disease progression (no polyp, small, medium and large polyp, early cancer, late cancer),
mortality rates from cancer,
test accuracy (sensitivity and specificity) for all screening strategies,
adherence to initial screening and compliance with follow-up testing, and
the screening-related complication rates.

**Modelling**
A Markov model with a lifetime horizon and annual cycles was constructed to simulate the natural history of disease and the impact of the different screening strategies. The health states were depicted graphically and represented standard progression from no lesion to different stages of CRC. The model was applied to a hypothetical cohort of 100,000 persons aged 50 years. Individuals were referred for standard testing every 10 years, beginning at age 50 years and covering three decades to 80 years of age.

**Sources searched to identify primary studies**
The was limited information about the primary sources of the data. Population size and age distribution reflected that of the US population using 2004 Census data. CTC and OC performance data (sensitivity and specificity) for polyp detection came from recent head-to-head comparison trials or from meta-analyses of trials. No other details were given.

**Methods used to judge relevance and validity, and for extracting data**
The approach used to derive the clinical data was not described. No systematic search for primary studies was reported. The most recent trials were used to obtain data on screening accuracy.

**Measure of benefits used in the economic analysis**
The summary benefit measure used was the expected number of life-years (LYs). These were estimated using the decision model. The LYs were discounted at an annual rate of 3%. Cases of CRC prevented and other model outputs (e.g. OC-related complications, number of invasive procedures) were also reported.

**Direct costs**
The authors did not state the perspective adopted in the study. The health services included in the analysis were OC (with and without polypectomy), FS, CTC, bleeding, perforation and CRC treatment. A detailed breakdown of the cost items was not provided. The unit costs and the quantities of resources used were not presented separately. The sources used to derive the resource use data were not given. The costs (and presumably some data on resource consumption) were obtained from published studies. Future costs were included in the analysis, thus discounting was relevant and an annual rate of 3% was applied. The price year was not reported.

**Statistical analysis of costs**
The costs and quantities appear to have been treated deterministically.

**Indirect Costs**
Productivity costs were not considered.

**Currency**
US dollars ($).

**Sensitivity analysis**
A univariate sensitivity analysis was carried out in order to assess the robustness of the base-case results to variations in all model inputs. Model inputs were varied according to published ranges of values.

**Estimated benefits used in the economic analysis**
In the cohort of 100,000 individuals, the LYs gained in comparison with no screening were:

4,266 with CTC and a 6-mm reporting threshold,
4,372 with CTC without a reporting threshold,
3,609 with FS, and
4,641 with OC.

The percentage of CRC cases prevented relative to no screening were:

36.5% with CTC and a 6-mm reporting threshold,
37.8% with CTC without a reporting threshold,
31.4% with FS, and
40.4% with OC.

The identification of diminutive lesions therefore resulted in the detection of only 1.3% of CRC cases (and 106 LYs gained in a cohort of 100,000 individuals) with respect to the use of a 6-mm reporting threshold.

Cost results
The expected total costs in the whole cohort were:

$97,976,886 with no screening,
$116,581,633 with CTC and a 6-mm reporting threshold,
$129,183,146 with CTC without a reporting threshold,
$124,705,103 with FS, and
$140,582,839 with OC.

Synthesis of costs and benefits
Incremental cost-effectiveness ratios (ICERs; i.e. the incremental cost per LY gained) were calculated to combine the costs and benefits of the alternative strategies.

In comparison with no screening, the ICER was:

$4,361 with CTC and a 6-mm reporting threshold,
$7,138 with CTC without a reporting threshold,
$7,407 with FS, and
$9,180 with OC.

Thus, all screening strategies were cost-effective in comparison with no screening.

In comparison with CTC and a 6-mm reporting threshold, the ICER was $63,900 with OC and $118,440 with CTC with no size threshold. FS was dominated since it was both more expensive and less effective than CTC with a 6-mm reporting threshold.
The results of the sensitivity analysis showed that the ICERs were sensitive to the sensitivity of CTC in detecting polyps. For example, assuming a CTC sensitivity for large polyps of 55% (it was 85% in the base-case), the ICER of OC compared with CTC using a 6-mm reporting threshold improved from $63,900 to $16,450. Adherence with initial screening and the cost of CTC also had a significant impact on the base-case ICERs.

Authors’ conclusions
Computed tomography colonography (CTC) with non-reporting of diminutive lesions was the most cost-effective and safe screening option evaluated. A key result of the analysis was that polypectomy of diminutive lesions was not an appealing strategy as it led to unjustified costs and complications, despite a minimal gain in clinical efficacy.

CRD COMMENTARY - Selection of comparators
The choice of the comparators under examination was appropriate in that existing screening strategies were compared with the proposed approach. The strategy of no screening was also considered for comparative purposes. The authors noted that a strategy of CTC screening for patients with polyps measuring 6 to 9 mm was not incorporated into the model, thus its cost-effectiveness has yet to be evaluated. Also, the faecal occult blood test was not considered as an alternative strategy. You should decide whether they are valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The approach used to derive the clinical data was not described. The authors did not state whether a review of the literature was undertaken to identify the primary studies, the design of which was generally not described. The methods used to combine the primary studies and to select the point estimates used in the model were not described. This limits the possibility of judging the validity of the clinical data, although all model inputs were varied extensively in the sensitivity analysis. Test accuracy was appropriately taken from recent head-to-head trials or meta-analyses.

Validity of estimate of measure of benefit
The summary benefit measure was modelled. LYs represent a commonly used outcome of cancer screening programmes and have the advantage of being comparable with the benefits of other health care interventions. The impact on patient quality of life was not investigated.

Validity of estimate of costs
Very limited information on the cost analysis was provided. A breakdown of the cost items was not presented and some costs were reported as macro-categories, which limits the possibility of replicating the analysis in other settings. The perspective of the study was unclear since the sources of the data were not described. The price year was not reported, thus hindering reflation exercises in other time periods. No statistical analyses of the costs were performed, although some sensitivity analyses were carried out.

Other issues
The authors did not compare their findings with those from other studies. They also did not explicitly address the issue of the generalisability of the study results to other settings, although sensitivity analyses were carried out. However, the results of the analysis were presented selectively. For example, the results of the sensitivity analysis were not extensively described. In general, the analysis seems mainly focused on the US population and may not be easily transferable to other settings.

Implications of the study
The results of the study support the use of CTC with non-reporting of diminutive lesions for CRC screening.

Source of funding
None stated.

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Other publications of related interest
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