Performing a cost-effectiveness analysis: surveillance of patients with ulcerative colitis

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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 use of surveillance strategies for patients with ulcerative colitis.

Type of intervention
Secondary prevention.

Economic study type
Cost-utility analysis.

Study population
The study population was a hypothetical population of 10,000 patients with long-standing ulcerative colitis involving the entire colon (pancolitis).

Setting
Hospital. This study was carried out in Durham, North Carolina, USA.

Dates to which data relate
The effectiveness data were collected from studies published between 1982-1992. The date of the cost data and the price year were not stated.

Source of effectiveness data
Effectiveness data were derived from a synthesis of previously completed studies and expert opinion.

Modelling
A Markov model was constructed to model the natural history of ulcerative colitis and consequent health states.

Outcomes assessed in the review
The outcomes included the probabilities of moving from one health state to another, death rates from other causes, the incidence of dysplasia and cancer, quality of life after colectomy, loss to follow-up or non-compliance with surveillance.

Study designs and other criteria for inclusion in the review
Not stated.
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
Approximately 12 primary studies were included in the review.

Methods of combining primary studies
Not stated.

Investigation of differences between primary studies
Not stated.

Results of the review
The principal data used as input variables for the Markov model were as follows. The incidence of cancer is 0.5% per person per year from 10-20 years after the diagnosis of pancolitis, 0.9% per person per year from 20-30 years after diagnosis, and 1.5% per person per year from 30-40 years after diagnosis. Approximately 0.1% of patients are lost to follow-up each year under a surveillance strategy. Approximately 0.6% of patients with ulcerative colitis will require colectomy each year for refractory or severe colitis. Life expectancy for patients with ulcerative colitis is similar to that of the general population. These data were used as inputs to the Markov model.

Methods used to derive estimates of effectiveness
Expert opinion was also used to supply estimates of effectiveness.

Estimates of effectiveness and key assumptions
Approximately 29% of patients with concomitant ulcerative colitis and colon cancer will have symptoms indicative of cancer each year. Approximately 10% of patients with ulcerative colitis develop symptoms or a flare-up of colitis. These data were also used as inputs to the Markov model.

Measure of benefits used in the economic analysis
Quality-adjusted life years (QALYs) were the measure of benefits in the economic analysis. Estimates of quality of life after colectomy and estimates for the short-term disabilities associated with surveillance and its potential complications were derived from a previously published study.

Direct costs
Direct costs included costs for endoscopic procedures and subsequent complications, surgical procedures, inpatient and outpatient post-operative care, and the costs for the care of terminally ill patients with colon cancer. Actual variable costs for endoscopic and surgical procedures and costs for inpatient post-operative care were obtained from the Transition System I: Clinical Cost Manager (Transition System Inc., Boston, MA) at Duke University. As a proxy for costs, outpatient visit charges and physician fees were adjusted to reflect actual reimbursement at Duke University.
Costs for terminal cancer care were obtained from hospice fees in North Carolina. Costs were discounted at a 5% rate. The quantities and costs were not reported separately. The quantity/cost boundary adopted was that of the hospital. The estimation of quantities and costs was based on actual data.

**Statistical analysis of costs**
Not stated.

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

**Currency**
US dollars ($).

**Sensitivity analysis**
A one-way sensitivity analysis was performed on the following parameters: incidence of cancer, willingness to pay for surveillance, quality of life after colectomy, loss to follow-up or non-compliance and age.

**Estimated benefits used in the economic analysis**
These benefits were derived from a graph produced by the authors and are therefore approximations:

- 'no surveillance' strategy, 17.41 QALYs;
- 1 year surveillance, 17.59 QALYs;
- 2 yearly surveillance, 17.58 QALYs;
- 3 yearly surveillance, 17.56 QALYs;
- 4 yearly surveillance, 17.55 QALYs;
- 5 yearly surveillance, 17.54 QALYs;
- variable interval surveillance strategy, 17.57 QALYs.

**Cost results**
The lifetime discounted costs estimates are approximations, derived from a graph:

- 'no surveillance' strategy, $8,934;
- yearly surveillance, $16,000;
- 2 yearly surveillance, $13,500;
- 3 yearly surveillance, $11,500;
- 4 yearly surveillance, $10,400;
- 5 yearly surveillance, $9,539.
Synthesis of costs and benefits
Incremental cost-effectiveness ratios were calculated:

- 5 years surveillance strategy, $4,700/QALY;
- 4 years surveillance strategy, $83,700/QALY;
- 3 years surveillance strategy, $111,600/QALY;
- Variable interval surveillance strategy, $155,400/QALY;
- 2 years surveillance strategy, $159,500/QALY;
- 1 year surveillance strategy, $247,200/QALY, respectively.

If the policy maker is willing to spend $300,000 to increase life expectancy by 1 year, surveillance every 4 years and every year provide the greatest gain in life expectancy for a cancer incidence of less than half and 0.8 of the baseline values, respectively. If the policy maker is willing to spend $100,000, surveillance every 5 years and every year is optimal when the cancer risk is less than 0.9 and 1.7 times the baseline values, respectively. For the policy maker willing to pay $50,000, surveillance should be performed every 5 years unless the cancer incidence is at least 1.3 times the baseline value and every year if the cancer incidence approaches 2.5 times the baseline values. If the policy maker is willing to spend $25,000, surveillance should be performed every 5 years unless cancer incidence is at least 1.9 times the baseline values and each year for a cancer incidence of 3.5 times the baseline. Surveillance should not be performed unless the quality of life is greater than 0.99. Using a measure of 1.0 for the quality of life after colectomy, surveillance every 5 years has an incremental ratio of $23,900/QALY. If 0.1% of patients are lost to follow-up each year, no surveillance is dominated by the surveillance strategies and surveillance each year provides an incremental ratio of $240,240/QALY. For patients aged 30-75 years, incremental ratios range from $9,300/QALY for surveillance every 5 years to $289,900/QALY for yearly surveillance.

Authors’ conclusions
Surveillance with colectomy for low-grade dysplasia is effective, with incremental cost-effectiveness ratios ranging from $4,700 to nearly $250,000. Surveillance every year is the most effective strategy, but its incremental cost-effectiveness ratio of nearly $250,000 may be expensive compared to common practices such as breast cancer screening.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparator is clear.

Validity of estimate of measure of benefit
The measure of benefit seems to be valid. More detail could have been provided about how quality of life adjustments were conducted and whose values were elicited.

Validity of estimate of costs
Only direct costs falling to the hospital were measured. Although an extensive sensitivity analysis was performed on other measures, cost figures were not varied. It is therefore difficult to assess the generalisability of the cost figures and therefore cost-utility ratios to other settings or countries. The price year was not reported.

Other issues
It should be noted that the paper also has as its aim an illustration of methodological issues around the performing of a cost-effectiveness analysis and uses ulcerative colitis as an example study. It therefore brings to the reader’s attention the steps required and the issues that need to be addressed in designing a modelled solution of this nature and therefore
would be of interest to anyone conducting a similar study.

**Implications of the study**
These results should be empirically validated by a prospective, randomised controlled trial, although the large sample size required and the long follow-up period will make such a trial extremely expensive.

**Source of funding**
None stated.

**Bibliographic details**

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**Other publications of related interest**


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