Conclusions

Laparoscopic surgery is associated with similar long-term outcomes, at a slight additional cost. Laparoscopic surgery is also associated with short-term quality of life benefits, though it has not been possible to quantify the magnitude of these benefits. A judgement must be made as to whether the gain in quality of life in the short-term is worth the extra cost. Based on this and other evidence i.e. patient preference, expert opinion, the National Institute for Health and Clinical Excellence recommended that laparoscopic surgery is an acceptable method of surgery for colorectal cancer.

For further details about this study see:

de Verteuil R, Hernández R, Vale L "Economic evaluation of laparoscopic surgery for colorectal cancer" Int J Techn Ass Health Care Volume 23:4 (forthcoming) and (2) above.

This briefing paper describes work conducted by members of the Health Economics Research Unit (HERU) and Health Services Research Unit (HSRU) at the University of Aberdeen. Further information about this topic may be obtained by contacting Robyn de Verteuil at HERU, Polwarth Building, University of Aberdeen, Foresterhill, Aberdeen AB25 2ZD (email: r.deverteuil@abdn.ac.uk).

For further information about HERU please contact Anne Bews at the above address or visit our website at **http://www.abdn.ac.uk/heru**

HERU and HSRU are supported by the Chief Scientist Office of the Scottish Executive Health Directorate. This report was based on a study funded by the Health Technology Assessment Programme (project 04/44/01 and commissioned on behalf of the National Institute for Health and Clinical Excellence). The views expressed here are those of the authors.

References

1. Cancer Research UK. UK Bowel Cancer Statistics. 2006; Available at: http://info.cancerresearchuk.org/cancerstats/types/bowel/?a=5441. Accessed February, 2006.
2. Murray A, Lourenco T, de Verteuil R, Hernández R, Fraser C, McKinley Aea. Clinical effectiveness and cost-effectiveness of laparoscopic surgery for colorectal cancer: systematic reviews and economic evaluation. Health Technol Assess 2006;10(45).
3. Fenwick E, Claxton K, Sculpher M, Briggs AH. Improving the efficiency and relevance of health technology assessment: The role of iterative decision analytic modelling. DP CHE May 2002;179.
4. Briggs AH. Handling uncertainty in economic evaluation and presenting the results. In: Drummond M, McGuire A, editors. Economic evaluation in health care: merging theory with practice. 1st ed. Oxford, UK: Oxford University Press; 2001. p. 172-214.

CONTACT US . . .
HEALTH ECONOMICS RESEARCH UNIT
Institute of Applied Health Sciences
Polwarth Building
Foresterhill
Aberdeen AB25 2ZD
Tel: +44 (0) 1224-553480/553733
Fax: +44 (0) 1224-550926
Email: heru@abdn.ac.uk
www.abdn.ac.uk/heru

CHIEF SCIENTIST OFFICE

HERU is supported by the Chief Scientist Office (CSO) of the Scottish Government Health Directorates (SGHD) and the University of Aberdeen. The views expressed here are those of the authors and not necessarily those of the CSO.

HERU Briefing Paper

HEALTH ECONOMICS RESEARCH UNIT

Briefing paper for the NHS October 07

THE COST-EFFECTIVENESS OF LAPAROSCOPIC SURGERY FOR COLORECTAL CANCER

Key Messages

1. **Colorectal cancer is one of the most common cancers in the UK.**
2. **The use of laparoscopic surgery for colorectal cancer appears to be an acceptable method of surgery.**
3. **For many patients, open surgery still remains the standard surgical method for colorectal cancer.**
4. **Further research is needed to better determine longer-term outcomes after laparoscopic surgery, especially in terms of survival and disease-free survival.**

Background

Colorectal cancer, also known as bowel cancer, is one of the most common cancers in the Western world. In the United Kingdom (UK), it is the second most common cancer in women and the third most common cancer in men.[1] In the year 2005, there were over 16,000 deaths attributable to colorectal cancer in the UK with 1,575 of these deaths occurring in Scotland. [1] In terms of new cases detected, for the year 2004, 3,554 new cases of bowel cancer were detected in Scotland.[1] As such, colorectal cancer constitutes a major public health problem and an important issue for policymakers.

Surgical resection of the cancer is the only curative treatment and is almost always performed as an open surgical procedure; a major abdominal surgery. Laparoscopic surgery, a minimally invasive surgical technique, might be an alternative and may offer a quicker recovery. Laparoscopic surgery is a technically more difficult surgery to perform, however, and it's uptake has been relative slow with only 0.1% of all colorectal cancer procedures in Scotland being conducted laparoscopically. There have also been concerns as to the longer term effects on costs and benefits which are uncertain.

The aim of this study was to investigate the cost-effectiveness of laparoscopic compared to open surgery in the treatment of colorectal cancer.

UNIVERSITY OF ABERDEEN

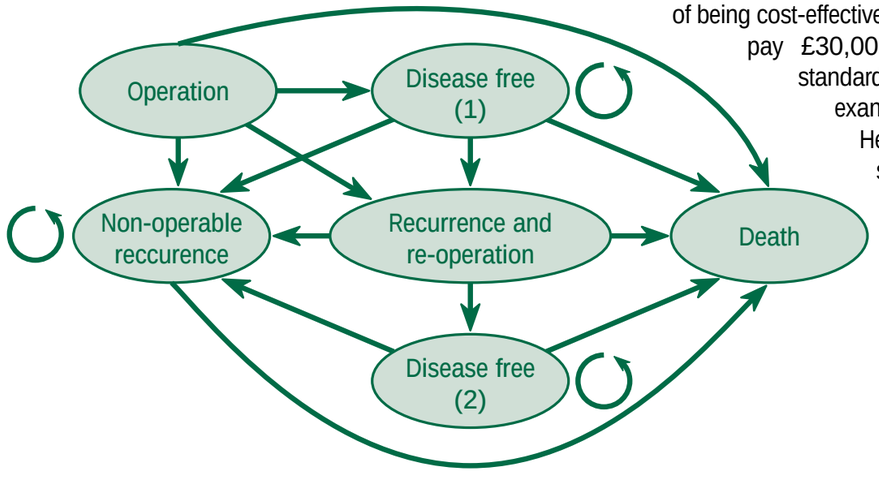
Methods

A Markov model was constructed to estimate the long-term costs and benefits, over a 25 year time period, of a group of typical patients (starting age of 65) for both open and laparoscopic surgery for colorectal cancer. A Markov model describes the pathways of care that a patient might follow over time. Figure 1 shows the structure of the model used in this study. In Figure 1, the circles represent distinct health states that a patient can be in at any one time. Each state has an associated cost and quality of life estimate attached to it and the chance of moving (making the transition) between alternative states is given by transition probabilities, represented by the arrows. Within the model it is assumed that a patient can only move between health states once per cycle. The cycle length is a relevant time period meaningful to the management of colorectal cancer, which in this case, was taken to be six months. The states with arrows going back on themselves are states where a person can remain for more than one cycle. All Markov models have an absorbing state where, once entered, a patient cannot leave and in this case, the absorbing state is death.

Following their initial surgery, patients could move into one of the following states:

- Disease-free (1);
- Recurrence of the disease; receiving either a second operation or non-operative management;
- Disease-free (after a recurrence) (2); where a patient, following a successful second operation, remains until they have a second recurrence or die;
- Non-operable recurrence resulting in non-curative management of the disease; and
- Death.

Figure 1 Model structure



Data on the cost-effectiveness of laparoscopic and open surgery in the treatment of colorectal cancer were derived from a systematic review of randomised controlled trials (RCTs).[2] Data on mortality, recurrence rates, re-operation rates, emergency operations and the long-term risk of hernia were all taken from this review. A systematic review of economic evaluations and UK sources provided cost data. Quality Adjusted Life Years (QALYs) were only calculated in a sensitivity analysis as data on utilities were poor. Deterministic and probabilistic analyses were performed and outcomes were presented as incremental cost per life year gained and incremental cost per QALY. The price year for the analysis was 2004 and costs and benefits were discounted at annual rates of 6% and 1.5% respectively.

Many of the estimates required for the economic model were not known precisely and, in order to reflect this uncertainty, prior probability distributions were specified following usual practice,[3,4] and probabilistic sensitivity analysis was performed.

Results

Data on the longer term survival and disease-free survival following laparoscopic surgery provided no evidence of a statistically significant difference, though confidence intervals were wide enough for clinically and economically important differences to exist. Using these data showed that laparoscopic surgery was approximately £300 more costly and slightly less effective than open surgery (Table 1). When probabilistic sensitivity analysis was performed, laparoscopic surgery had approximately a 30% chance of being cost-effective if society would be willing to pay £30,000 for a unit of effect (a standard threshold adopted by, for example, the National Institute for Health and Clinical Excellence), see Figure 2.

Sensitivity Analysis

Further extensive sensitivity analyses were also conducted (reported in detail in the HTA monograph).[2] One interpretation of the available data was equal survival and disease-free survival after both forms of resection. Making this assumption gave laparoscopic surgery a 45% chance of being considered cost-effective at the £30,000 threshold (Table 1 and Figure 3). In this analysis, it is purely costs driving results as long-term effects are the same. Presenting outcomes as incremental cost per QALY made no difference to results as little data on quality of life was available.

Evidence suggests short-term benefits following laparoscopic surgery, though it was not possible to incorporate this element into the analysis. If the potential QALY gain from earlier recovery were in the order of 0.01 of a QALY (which is equivalent to an extra three to four days in full health) then laparoscopic surgery might be considered cost-effective.

Table 1 Base-case and sensitivity analysis results (deterministic and probabilistic)

Base-case and sensitivity analysis	Procedure	Cost (£) 2004	Eff.	ICER (£)	Probability of cost-effectiveness for different threshold values for society's willingness to pay for a unit of effect (%)			
					£10,000	£20,000	£30,000	£50,000
Base-case	Open	10,174	15.351*		61.6%	66.4%	67.6%	67.7%
	Laparoscopic	10,463	15.298*	Dominated	38.4%	33.6%	32.4%	32.3%
Equal Survival	Open	10,174	15.351*		54.7%	54.8%	54.9%	54.2%
	Laparoscopic	10,490	15.351*	Dominated	45.3%	45.2%	45.1%	45.8%
Use of utility values to estimate QALYs	Open	10,174	14.679**		57.0%	62.7%	64%	65%
	Laparoscopic	10,463	14.630**	Dominated	43.0%	37.3%	36%	35%

ICER = Incremental cost effectiveness ratio; QALYs = Quality adjusted life years; Eff = Effectiveness measure; * Effectiveness measure in life years; ** Effectiveness measure in quality adjusted life years

Figure 2 Cost-effectiveness acceptability curves (base-case analysis)

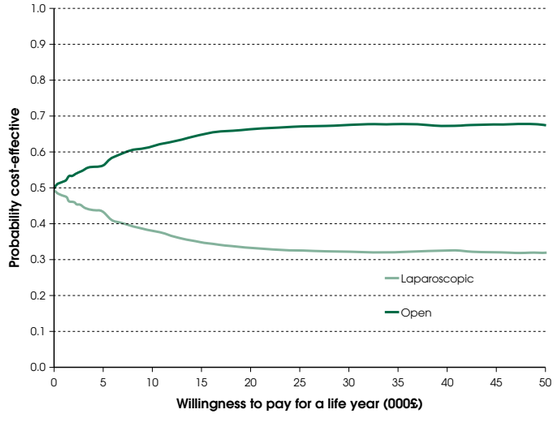


Figure 3 Cost effectiveness acceptability curves (equal survival analysis)