Cost-effectiveness of screening for colorectal cancer: evidence from the Nottingham faecal occult blood trial

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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 faecal occult blood (FOB) screening for colorectal cancer was examined.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised asymptomatic individuals who were aged from 45 to 74 years.

Setting
The setting was primary care. The economic analysis was conducted in Nottingham, UK.

Dates to which data relate
The effectiveness data were gathered between 1981 and 2003. The resource data were derived from studies published between 1991 and 1993. The price year was 2002.

Source of effectiveness data
The effectiveness data were derived from a single prospective study.

Link between effectiveness and cost data
The costing was undertaken prospectively on the same group of patients as that used in the effectiveness study.

Study sample
The use of power calculations was not reported. Approximately 153,000 asymptomatic individuals were randomised into equal-sized intervention and control groups. All the patients in the intervention group received a FOB test kit by mail. Most of those patients received either the 3-day or the 6-day haemoccult variant. Small sub-groups received either an alternative test (Fecatwin/Feca enzyme immunoassay; Feca), or both Feca and Haemoccult. Patients recording a positive FOB test were invited for a clinic-based investigation, and any confirmed cancers were removed surgically. Patients for whom no abnormalities had been detected were offered a re-screen after 2 years, with a maximum of five screening rounds in total. The author then compared the participant and control groups. A participating subject was one who had accepted at least one FOB test offer.
Study design
The study was a randomised controlled trial that was conducted in 92 general practices in and around Nottingham, UK. The trial was not blinded. The duration of follow-up was more than 20 years. No loss to follow-up was reported.

Analysis of effectiveness
The analysis of the clinical study was conducted on an intention to treat basis. The primary health outcomes used were the compliance rate, positive test rate, detection rate and survival rate. The patients in the two groups were not shown to have been comparable at analysis. However, in the 'Discussion' section, the author briefly reported "there was no evidence of significant differences in stage distribution or gender composition between the intervention and control groups".

Effectiveness results
The overall compliance with FOB screening was 58%.

The positive FOB test rate was 1.51%.

The overall detection rate was 0.17%.

The survival rate at the reference date (April 2003) was 39.6% of the participant group compared with 32.2% of the control group (odds ratio 14.41; p<0.01).

Clinical conclusions
Screening led to survival gains compared with no screening.

Measure of benefits used in the economic analysis
The measure of health benefit was the number of life-years saved. The life expectancies were compared using a Kaplan-Meier analysis. The benefits were discounted at a rate of 2%.

Direct costs
The perspective adopted was not reported. Discounting was carried out, which was appropriate since the costs were incurred during more than 2 years. A discount rate of 6% was used. The unit costs were not presented separately from the quantities of resources used. The direct costs estimated were for the FOB tests, investigations (colonoscopy) and treatment. The costs of the FOB test included the test kit, administration, return postage, and its development by a nurse. The resource use data were based on an audit within the trial. The unit costs were derived from studies published between 1991 and 1993. All the costs were adjusted to 2002 prices using the GDP deflator.

Statistical analysis of costs
No statistical analysis of the costs was performed.

Indirect Costs
The indirect costs were not included.

Currency
UK pounds sterling (§).

Sensitivity analysis

One-way sensitivity analyses were assessed using Monte Carlo simulation. All the parameters were varied across the ranges of their confidence intervals (CIs).

**Estimated benefits used in the economic analysis**
The median Kaplan-Meier survival gain for each participant was 1.12 years (95% CI: 0.06 - 2.18).

The total undiscounted survival gain was 1,058 life-years in the participant group (788 life-years when discounted at 2%).

**Cost results**
The total costs of the screening programme amounted to 1,248,327.

**Synthesis of costs and benefits**
The incremental cost-effectiveness ratio (ICER) of the screening programme was 1,584 (95% CI: 717 - 8,612) per life-year gained.

The ICER was relatively insensitive to plausible variations in the assumed discount rate for the costs.

The ICER was far more sensitive to variations in the discount rate for the benefits. Discounting at the same rate as for the costs (6%) raised the ratio by 77.4%. When the benefits were undiscounted, the ratio fell by 25.5%.

If the highest Kaplan-Meier survival estimate was used, the ICER fell by 23.3%.

When the unit costs of the FOB test, investigation and treatment were doubled, the ICER rose by 59.6% for the FOB test, 27.5% for investigation and 12.9% for treatment.

**Authors' conclusions**
Although the number of cases detected by screening was relatively modest in relation to the number of patients invited, the combination of the survival gains accruing to those participating in screening and the costs of the programme were sufficient to yield a low cost-effectiveness ratio overall.

**CRD COMMENTARY - Selection of comparators**
The rationale for the choice of the comparator (no screening) was clear. You should decide if this represents a valid comparator in your own setting.

**Validity of estimate of measure of effectiveness**
The estimate of effectiveness should have been internally valid given the use of a randomised controlled trial. However, the lack of blinding could have introduced bias into the results. In addition, the measure of outcomes was not really appropriate. The author did not evaluate the number of false-positive results, although the sensitivity of the FOB test was only 50%. The impact of the false results on quality of life would have been appropriate for assessing the real effectiveness of FOB screening. Studies have reported that the socioeconomic status of patients is a major factor in FOB screening compliance. The author did not compare this variable between the two groups, but acknowledged that a disproportionate representation of higher socioeconomic classes could lead to disproportionately-favourable outcomes. In addition, patients in the two groups were not shown to be comparable at baseline. The lack of power calculations, which should have been conducted to ensure the sample size was appropriate for the study question, represents a strong limitation to the internal validity of the analysis.

**Validity of estimate of measure of benefit**
The summary benefit measure (number of life-years saved) was derived directly from the effectiveness study. The use of quality-adjusted survival would have been appropriate to account for the overall consequences of screening. The benefits were not discounted at the same rate as the costs, and no reason for this was reported.

**Validity of estimate of costs**
The perspective adopted was not reported. The indirect costs associated with the false results of FOB tests were not included in the analysis. Due to the high number of expected false results, the conclusions about the costs and ICER would have changed if the indirect costs had been included. The resource use data were derived from actual data. A 6% discount rate was used. Only gross categories of costs were presented and a breakdown of all the cost items was not provided. However, no details of cost items in each gross category were reported. Only the quantities of tests sent, investigations and treatments received were reported. The costs were treated stochastically. Sensitivity analyses were performed on the discount rate.

**Other issues**
The author compared the findings with those of their earlier study and stated that the present conclusions were much the same as the earlier ones. The issue of the generalisability of the study results to other settings was not addressed. Sensitivity analyses were performed on all parameters, using their confidence intervals as ranges of variation. The author discussed some of the main limitations to the validity of the analysis.

**Implications of the study**
The screening programme is cost-effective. The ICER for FOB screening in the Nottingham trial is lower than the equivalent ratio for the national breast cancer screening programme. The estimates place Nottingham FOB screening well up the league table of cost-effective interventions more generally.

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