Options for screening for colorectal cancer in the Royal Air Force: a cost-effectiveness evaluation

Daniels K, McKee M

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 the use of faecal occult blood tests (FOBTs) to detect pre-symptomatic colorectal cancer and its precursor lesions as part of periodic medical examinations and screenings. The options were to start FOBTs at one of the following ages: 30, 35, 40, 45, 50, 55 or 60.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised RAF personnel aged 30 or over.

Setting
The study setting was primary care. The economic study was carried out in the UK.

Dates to which data relate
Effectiveness data were derived from studies and reports published between 1998 and 1994. The price year would appear to have been 1992.

Source of effectiveness data
Effectiveness data were derived from a review and synthesis of the literature.

Outcomes assessed in the review
The outcomes assessed in the review were: the RAF population by age band and sex, and the 5 yearly average ages of RAF personnel since 1975; the expected age-sex incidence of colorectal cancer in the RAF; the actual incidence and prognosis of colorectal cancer in the RAF; the survival rate by Duke's Stage at diagnosis; the sensitivity of FOBT; the lead time; and the prevalence of positive FOBT results.

Study designs and other criteria for inclusion in the review
Not reported.

Sources searched to identify primary studies
Criteria used to ensure the validity of primary studies
Not reported.

Methods used to judge relevance and validity, and for extracting data
Not reported.

Number of primary studies included
Data from 10 published studies and records were used. Data specific to the RAF, such as the determination of the population at risk and the actual incidence of colorectal cancer in the RAF were derived from RAF records.

Methods of combining primary studies
The baseline FOBT sensitivity was derived from three studies. The value determined for this study was estimated from the value that most closely corresponded to two studies and was within the range of a third study.

Investigation of differences between primary studies
The authors did not investigate the differences between the primary studies.

Results of the review
Over a third of the RAF population were below 25 years of age, nearly three quarters under 35 and over four-fifths under 40. The average age of RAF personnel was within the range 30.5 +/- 0.9 years since 1975.

Age specific rates among the general population were applied to the age-sex distribution of the RAF population. The colorectal cancer rate per 100,000 males (females) ranged between 0.26238 (0.22086) for those aged 15-19, 6.56314 (5.85549) for those aged 35-39, and 127.200 (91.6895) for those aged 60-64.

From January 1969 to June 1994 there were 103 colorectal cancer cases occurring in the RAF population. The average incidence over this period was 4.04 per annum, which was slightly greater than the current incidence predicted from national data of 3.60 per annum.

The 5-year survival rates for those with colorectal cancer at Duke’s stage A, B, C or D at diagnosis, were respectively, 80%, 60%, 30%, and 10%.

The baseline FOBT sensitivity for colorectal cancer was estimated to be 55%. FOBT would have an additional sensitivity of two-thirds the initial value for colorectal cancers diagnosed between one and two years later, and one third of this level for colorectal cancers diagnosed between two and three years later.

The baseline prevalence of FOBT results was assumed to be 5%.

Measure of benefits used in the economic analysis
The measure of benefits used in the economic analysis was the number of cases detected. Multiplying the RAF population by the colorectal cancer incidence gave the number of cases detected. This was then multiplied by the sensitivity of FOBT to detect cancers, which was then multiplied by the lead-time effect to obtain the number of cases potentially detected.

Direct costs
Resource use and costs were not reported separately. The direct costs to the RAF, which in this case was the third party payer, were included in the analysis. The costs included were: the costs of the FOBT; the personnel costs of testing; the costs of subsequent investigation, which included NHS staff costs assumed to be comparable to those for the RAF; and the costs of colonoscopies. It is unclear if further costs were included in the analysis. FOBT costs were obtained from the manufacturers of the tests. Personnel costs of testing were calculated as the full capitation costs of a senior aircraftman for the time taken to undertake one test, with the information being supplied by RAF laboratories. Additional supply and transport costs were assumed to be negligible, as they would involve existing transport channels. Total costs were reported, which were calculated by multiplying the number in each age group by the cost of the FOBT test, and added to the product of the number of positive FOBT and the cost of a colonoscopy. As all costs were incurred over a short time period, discounting was not relevant and hence was not performed. The price year was not explicitly reported.

**Statistical analysis of costs**
Costs were treated as point estimates (i.e., the data were deterministic).

**Indirect Costs**
Indirect costs were not included.

**Currency**
UK pounds sterling (€).

**Sensitivity analysis**
The authors undertook a sensitivity analysis by varying the costs of a full investigation of FOBT positive cases; using a more expensive FOBT test; an improvement in the specificity of FOBT and thus a reduction in the prevalence of positive FOBTs; and a sensitivity of FOBTs of 90%.

**Estimated benefits used in the economic analysis**
The estimated benefits of starting FOBTs at one of the following ages were:
- 30-34 years: 0.253519 cases detected;
- 35-39 years: 0.573216 cases detected;
- 40-44 years: 0.858858 cases detected;
- 45-49 years: 0.852925 cases detected;
- 50-54 years: 0.478361 cases detected;
- 55-59 years: 0.067783 cases detected; and
- 60-64 years: 0.006985 cases detected.

**Cost results**
The costs of starting FOBTs at one of the following years were:
- 30-34 years: 20,905;
- 35-39 years: 14,398;
40-44 years: 12,748;  
45-49 years: 5,592;  
50-54 years: 16,137;  
55-59 years: 1400; and  
60-64 years: 89.80.

**Synthesis of costs and benefits**
Costs and benefits were combined as the cost per case detected. No incremental analysis was performed. The cost per case detected if FOBT was to be started in each of these age bands was:

30-34 years: 82,461;  
35-39 years: 25,119;  
40-44 years: 14,843;  
45-49 years: 6,557;  
50-54 years: 33,734;  
55-59 years: 20,667; and  
60-64 years: 12,856.

The authors found that a cost per case detected when starting screening at age 40 was 15,881.

Results of the sensitivity analysis showed that a 66% increase in the cost of an investigation produced a 64% increase in the cost per case detected. Quadrupling the cost of FOBT kits produced only a 3.3% increase in the cost per case detected. An improvement in the specificity of FOBT would reduce the cost per case detected by 68.2%. Setting the sensitivity at 90% would reduce the cost per case detected by 38.9%.

**Authors' conclusions**
The authors did not derive any clear conclusions from their study, reporting only that the study provided information on the costs of various FOBT screening strategies for the RAF, and other Services. However, the authors did point out that the most cost-effective age at which to introduce FOB screening appeared to be age 40.

**CRD COMMENTARY - Selection of comparators**
The authors compared different FOBT strategies, whereby the screening programme was to start in different age groups. However, the authors did not compare FOBT screening with current practice (i.e., five yearly medical examinations) that as the authors reported did not include FOBT testing.

**Validity of estimate of measure of effectiveness**
The authors did not report that a systematic literature review was undertaken to identify relevant research and minimise biases. The authors also did not report the methodology of the review of the literature, nor the sources used to identify research. When more than one study was used to derive a measure of effectiveness, the authors combined effectiveness estimates using narrative methods, rather than adopting pooling methods. The authors did not investigate the differences between the primary studies. All studies however, appeared to be relevant to the setting of the present study, as they all had a UK setting. The authors also undertook a sensitivity analysis to estimate the effect of varying
sensitivity and specificity rates of the FOBT test. Given the level of reporting on the methods of the review it is difficult to assess whether the best available evidence has been used.

**Validity of estimate of measure of benefit**
The estimate of measure of benefit was obtained by multiplying the RAF population by the colorectal cancer incidence. This was then multiplied by the sensitivity of FOBT to detect cancers, which was then multiplied by the lead-time effect to obtain the number of cases potentially detected. All of these estimates were derived from the literature or from RAF records.

**Validity of estimate of costs**
All categories of cost relevant to the perspective adopted appear to have been included in the analysis, and it would appear that no relevant costs were omitted. The authors reported that any additional supply and transport costs were assumed to be negligible as they involved existing transport channels. Resource use quantities and unit costs were not reported separately, which will limit the generalisability of the authors' results. Costs were derived from the authors' setting and from NHS reviews. Appropriate sensitivity analyses of costs were performed, with the ranges used appearing to be appropriate. As all costs were incurred over a short time period, discounting was not relevant, and appropriately was not performed. The price year was not explicitly reported but appears to have been 1992. Having to assume the price year in which costs were based will make the results of any inflationary exercise look dubious.

**Other issues**
The authors did not compare their findings with those from other studies. The issue of generalisability to other settings was partly addressed through the sensitivity analysis. The authors do not appear to have presented their results selectively. However they did not report any clear conclusions from their study. The main limitation of this study was that an incremental cost-effectiveness analysis was not undertaken to determine the most cost-effective FOBT strategy. Hence, it might not be the case that starting FOBT in the age band 45-49 years or at age 40 is the most cost-effective strategy (as reported by the authors because it had the lowest average cost per case detected). It is possible that incremental analysis may have shown that starting FOBT at a different age band would have a lower incremental cost-effectiveness ratio (i.e., an extra case detected could be achieved at a lower cost) or at a cost which society or the decision maker was willing to accept. The authors also reported limitations to their study, namely that decisions on which screening programme to undertake would ideally be derived from a randomised controlled trial, rather than from extrapolations from published data.

**Implications of the study**
The authors reported that the aim of the study was not to seek to argue for or against the introduction of a Service-wide screening programme, but to indicate the consequences of various possible options.

**Source of funding**
None stated.

**Bibliographic details**

**PubMedID**
8568748

**Other publications of related interest**

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Adenomatous Polyps /diagnosis /surgery; Adolescent; Adult; Aerospace Medicine; Colonic Polyps /diagnosis /surgery; Colorectal Neoplasms /diagnosis /epidemiology /prevention & control; Cost-Benefit Analysis; Female; Great Britain; Humans; Incidence; Male; Mass Screening /economics /methods; Middle Aged; Military Personnel; Neoplasm Staging; Occult Blood; Outcome Assessment (Health Care); Predictive Value of Tests; Prognosis; Sensitivity and Specificity; Survival Rate

**AccessionNumber**
22005008035

**Date bibliographic record published**
31/03/2005

**Date abstract record published**
31/03/2005