*Increasing bowel cancer testing rates through GP health-care package would reduce incidence and prove cost-effective.*

Treating bowel cancer is expensive and the cost is rapidly rising. In the past decade costs have increased for cancers at all stages (in particular Stages 3 and 4), largely due to increased chemotherapy options and the introduction of more effective but expensive drug regimens (1). Increased treatment costs are a stimuli for the considerable effort in the areas of prevention and early detection.

The National Bowel Cancer Screening Program (NBCSP) based on a faecal occult blood test (FOBT) was introduced in mid-2006 to people aged 55 and 65, and was extended in 2009 to include people aged 50. It is due to be expanded to biennial testing in 2020, with gaps filled annually until this time (2). This delay in full implementation is related to the perceived cost of the NBCSP as well as infrastructure and logistical difficulties (3).

There are concerns with aspects of the structure of the NBCSP, such as the target age group and screening intervals (3). Incidence of bowel cancer for people aged 40 to 50 is rising (4), and recent evidence suggests that the incidence for people aged under 40 is also increasing (5). This is important given that people aged under 50 are relatively productive contributors to the Australian economy (6).

The screening interval in the NBCSP is two years but some studies have shown greater benefit from shorter screening intervals. Studies of FOBT and subsequent colonoscopy for a positive test in patients aged 55-64 years show a reduction in mortality of 19% from biennial screening and 29% from annual screening (1). As this study was limited to patients aged 55-64 years, caution should be used when extrapolating these results to other age cohorts. A recent study emphasised that, with biennial screening, the NBCSP will result in 35,000 fewer deaths in the coming 40 years (2).

The Gut Foundation, in conjunction with Deloitte Access Economics, performed a cost-effectiveness study of screening between the ages of 40 and 70 years (7). The study is publicly-available and contains details on the methodology, data and results.

Three interventions were studied:

1. Biennial immunochemical FOBT (iFOBT) starting at age 40 and ceasing at age 70.
2. Annual iFOBT for the same period.
3. Colonoscopy at age 40, then at age 50, and five yearly intervals thereafter until 70.

The comparator was no screening and standard care when diagnosed symptomatically. The NBCSP was not used as a comparator due to a lack of publicly-available data at the time that the study was undertaken.

Three techniques were used to examine the proposed interventions.

A. Cost-effective analyses (CEAs) compare the monetary cost of achieving a particular non-monetary objective, e.g. deaths averted or life years saved. All CEAs of the screening interventions involved an analysis of: program costs e.g. costs of screening kits, and diagnostic and pathology tests; screening results e.g. number of bowel cancer cases detected (true positives), missed (false negatives), or otherwise (false positive and true negatives); bowel cancer stage incidence rates for true positive and false negative cancers;

treatment costs and health outcomes per person associated with each pathway (true positive, false positive, true negative, false negative); and overall outcomes on health-care cost savings and avoidance of disability adjusted life years (DALYs) from earlier stage detection and treatment. Costs are not discounted to present values, since they are assumed to be incurred in a single year. The incremental cost-effectiveness ratios (ICERs) presented in the analysis have been calculated from the non-rounded estimates of costs and DALYs.

B. Disability adjusted life years can be estimated. Some DALYs would be incurred as a result of annual and biannual iFOBT screening due to complications and very rarely deaths from colonoscopy procedures (8). Some DALYs would also be averted from screening. These are calculated into the benefits of reduced chances of developing bowel cancer with screening.

C. The World Health Organization (WHO) makes recommendations in relation to cost-effectiveness benchmarks. A highly cost-effective intervention is determined as being less than the gross domestic product per capita, which in Australia was approximately $60,000 per DALY averted in 2011 (9).

Results

The results of the cost-effectiveness modelling are presented in Table 1 (note that some results may not add due to rounding). The results are expressed for:

- Total financial costs: these include costs such as mail-outs and kits, pathology tests, general practitioner (GP) appointments, colonoscopies for participating patients with positive results and patients in the colonoscopy intervention program, and perforations from colonoscopies. The financial costs in the model are limited to health-care costs only.

- Total financial benefits: these include benefits from better survival and cases of bowel cancer averted, and health-care cost savings from earlier treatment and cases of bowel cancer averted.

- Total costs: these include financial costs, as well as economic costs from DALYs lost, such as from patient non-participation or from false-negative test results.

- Total benefits: these include financial benefits, as well as economic benefits from fewer cases of bowel cancer and improved survival rates.

- Net DALYs averted: net DALYs averted by the intervention.

- ICER (societal perspective): net financial costs divided by net DALYs averted.

- ICER (health-care perspective): net financial health-care costs divided by net DALYs averted.

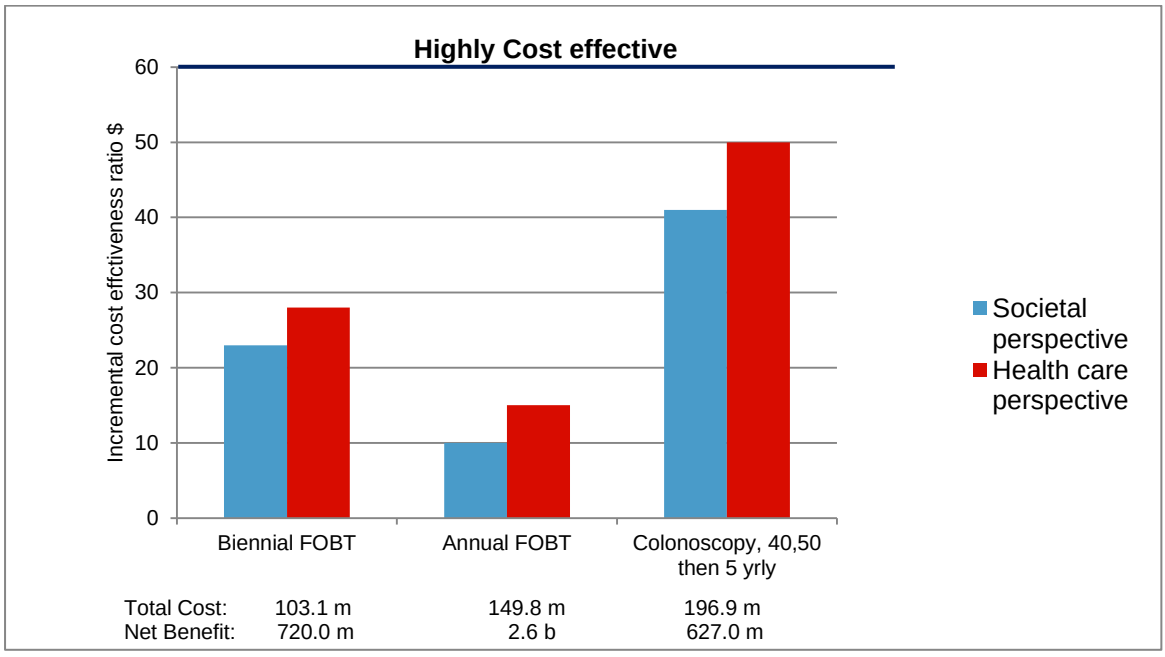
Additional modelling results are available in the report.

Table 1: Screening aged 40 to 70

| | Biennial iFOBT | Annual iFOBT | Colonoscopy |
|---|---|---|---|
| Total financial costs (health-care only, $m) | 141.2 | 273.8 | 251.2 |
| Total financial benefits (health-care only, $m) | 8.7 | 26.1 | 11.4 |
| Net financial costs (health-care only, $m) | 132.5 | 247.7 | 239.7 |
| | | | |
| Total financial costs ($m) | 141.2 | 273.8 | 251.2 |
| Total financial benefits ($m) | 38.1 | 124.0 | 54.2 |
| Net financial costs ($m) | 103.1 | 149.8 | 196.9 |
| | | | |
| Total costs ($m) | 182.6 | 353.7 | 541.6 |
| Total benefits ($m) | 902.8 | 2,907.5 | 1,169.2 |
| Net total benefit ($m) | 720.2 | 2,553.9 | 627.7 |
| | | | |
| Net DALYs averted | 4,798 | 15,756 | 4,805 |
| ICER (societal perspective) | **21,490** | **9,510** | **40,978** |
| ICER (health-care perspective) | 27,620 | 15,719 | 49,894 |

The cost-effectiveness of each program (represented by the societal and health-care ICERs) are shown in Chart 1.

Chart 1: Screening aged 40 to 70




## Discussion

This report demonstrates that annual and biennial iFOBT, and colonoscopy screening, are all highly cost-effective: from a societal perspective, the annual iFOBT is the most cost-effective ($9,510 per DALY averted), followed by the biennial iFOBT ($21,490) and colonoscopy ($40,978).

However, the financial costs of the annual iFOBT program are the highest ($273.8 million), followed by colonoscopy ($251.2 million) and the biennial iFOBT ($141.2 million). The annual iFOBT costs are approximately twice as high compared to the biennial iFOBT costs, as approximately twice as many tests are carried out. The colonoscopy costs are higher than the biennial iFOBT costs due to the higher costs associated with colonoscopy screening compared to screening via mail-outs.

The key to success of any screening program (e.g. the NBCSP) is the uptake of the program. The participation rate needs significant improvement to reduce the incidence of bowel cancer in Australia.

A solution to this dilemma could be to include bowel cancer screening and prevention in a health-care package organized by GPs. The package could be based on the annual iFOBT intervention (this includes colonoscopy for participants who receive a positive result and follow this up with their GP). Based on the results of this report by The Gut Foundation and Deloitte Access Economics, this program has the potential to save $2.6 billion (including financial and economic savings). Note that the study did not include additional administrative, staff and system costs of GPs, e.g. issuing invitations for appointments, sending reminders, and following up results.

The Gut Foundation has successfully undertaken an iFOBT study via GPs in the Riverina, to assess the results of screening people aged from 40 years. The regional population aged from 40 years was encouraged to visit their GP for an iFOBT kit. From a total of 1,409 kits, 203 were positive, including 51 positive tests for the 40-49 year age group (10). The positive tests included 14 cancers, 59 adenomas (including multiple adenomas) and 13 hyperplastic polyps. The study notes that the small sample size limits its impact, and that the high positivity rate may be due to the location of the study. The Gut Foundation plans to enlarge this study in the Port Macquarie area (in conjunction with the Rural Medical School at the University of New South Wales, and local GPs) to identify how participation and outcomes can be improved.

While this manuscript has focused on the cost-effectiveness of age-based population screening, it is important to note that bowel cancer has been identified as having the strongest genetic links of all the common cancers (5). Patients with a genetic predisposition to bowel cancer have a higher risk of contracting the diseases across all age groups, and genetic links among young bowel cancer patients may be more common than among older bowel cancer patients (5). The cost-effectiveness of screening patients younger than 40 with genetic predispositions to bowel cancer could be the subject of further research.

Bowel cancer kills an Australian every two hours. The polyp-cancer sequence and NBCSP screening data suggest many cancers could be prevented or at least diagnosed early (2). We need to act now.

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