# Cost Benefit Analysis Template

## Section A Descriptive Information

| | |
|---|---|
| Vote | Health |
| Responsible Minister | Hon Dr Jonathan Coleman |
| Initiative title | National Bowel Screening Programme |

| Funding Sought ($m) | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 & outyears | TOTAL |
|---|---|---|---|---|---|---|
| Operating | s9(2)(f)(iv) active consideration | | | | | 72.319 |
| Capital | | | | | | - |

**Problem Definition**

*A description of the problem or opportunity that this proposal seeks to address, and the counterfactual.*

New Zealand has one of the highest rates of bowel cancer in the developed world. When compared with other OECD countries, in 2011 (the latest year for which figures are available for this comparison), New Zealand had the fifth highest rate of bowel cancer mortality. The development of bowel cancer is preventable in many cases and is highly treatable when identified in the early stages. The high cancer mortality rates in New Zealand are, therefore, amenable to change. Bowel cancer is the third most commonly registered cancer (after prostate and breast) and is the second most common cause of cancer death (after lung cancer).

New Zealanders are more likely to be diagnosed with advanced stages of bowel cancer than people in Australia, the United States and the United Kingdom. This translates directly to death rates, which are 35% higher in New Zealand than Australia for women and 24% higher for men. There are population variations in cancer incidence, with higher rates for older people (94% occurring in those aged 50 or over), males, non- Māori/non-Pacific, and the most deprived (Quintile 5).

The proposed rollout of a national bowel screening programme over the next 2-4 years will capitalise on the outcomes of the bowel screening pilot (currently underway in the Waitemata DHB region), as well as on the concurrent investment which has been made in colonoscopy services. If the proposal does not go ahead then we lose an opportunity to reduce bowel cancer mortality rates in New Zealand.

Whilst bowel cancer is a significant cause of ill health and death, there are notable variations within the New Zealand population:

- Age: Bowel cancer incidence increases with age, with 94% of cases occurring in those aged 50 or over. The number of new cases of bowel cancer each year is projected to increase by 15% for men and 19% for women[1]. The age distribution of colorectal cancer is shown in Figure 1. Survival is marginally better for younger people with colorectal cancer.

[1] Ministry of Health Interim Evaluation Report of the Bowel Screening Pilot: Screening Round One 24 February 2015

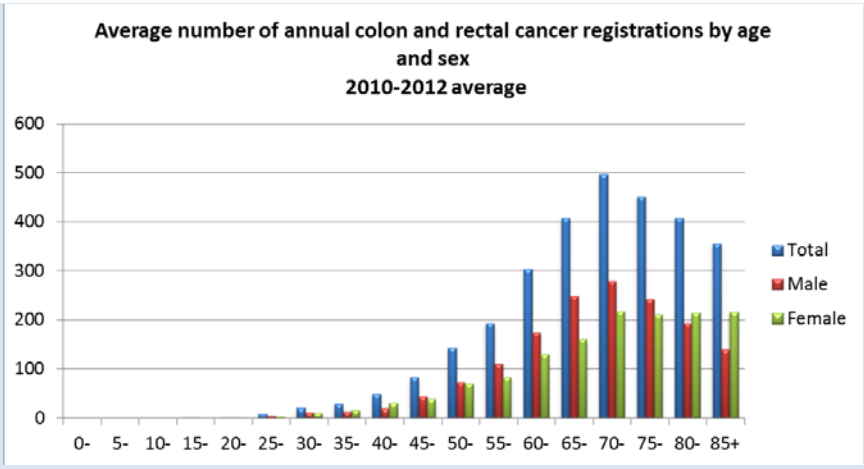


Figure 1: Colorectal Cancer Registrations by Age and Sex
Source: Ministry of Health 2015: New Zealand Cancer Registry

- Gender: Worldwide, colorectal cancer is more common in men than in women and this is also true in New Zealand. It is the second most commonly registered cancer for men after prostate cancer and the second most common for women after breast cancer. Historically, the colorectal cancer rates in New Zealand women have been higher than for women in any of the other 32 countries within the international screening network.[2] Colorectal cancer is the second most common cause of cancer death for both men and women, after lung cancer.

- Ethnicity: Rates of colorectal cancer vary between population groups. Rates of colorectal cancer in the Asian population are lower than for other ethnicities with 18.3 per 100,000 population in 2012. Pacific people experienced a rate of 27.0 and Māori a rate of 33.3. Those in other population groups showed a rate of 45.3 registrations per 100,000 population. Rates of death for colorectal cancer are higher for non-Māori (compared to Māori) and for males (compared to females). Māori accounted for 5% of all colorectal cancer deaths between 2003 and 2012[3].

  Colorectal cancer is one of the few cancers for which Māori show lower registration and death rates than non-Māori. However, whilst colorectal cancer occurs less frequently in Māori compared to non-Māori, once diagnosed, Māori are more likely to die of colorectal cancer than non-Māori. This may be attributed to the higher rates of co-morbidity[4] (making treatment more challenging) found in Māori and disparities in access to cancer treatment, and highlights the need for proactive follow-up once a diagnosis has been made[5]. Māori are also more likely to present at a later stage at diagnosis, impacting their survival. Between 2003 and 2012, the non-Māori mortality rate for colorectal cancer showed a slight downward trend. Rates for Māori were more variable. The mortality rates by ethnic group and sex and shown in Figure 2.

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2 Surveillance of people at increased risk of colorectal cancer, http://www.bpac.org.nz/BPJ/2012/may/colorectal.aspx, referencing National Cancer Institute. International Cancer Screening Network, https//appliedresearch.cancer.gov/icsn./olorectoal/moertality.thml (accesses May 2012)

3 Ministry of Health 2015: New Zealand Cancer Registry

4 Cancer, Comorbidity and Care: Key findings from the C3 (Quantitative) Study, http://www.otago.ac.nz/wellington/otago067851.pdf

5 Surveillance of people at increased risk of colorectal cancer, http://www.bpac.org.nz/BPJ/2012/may/colorectal.aspx,

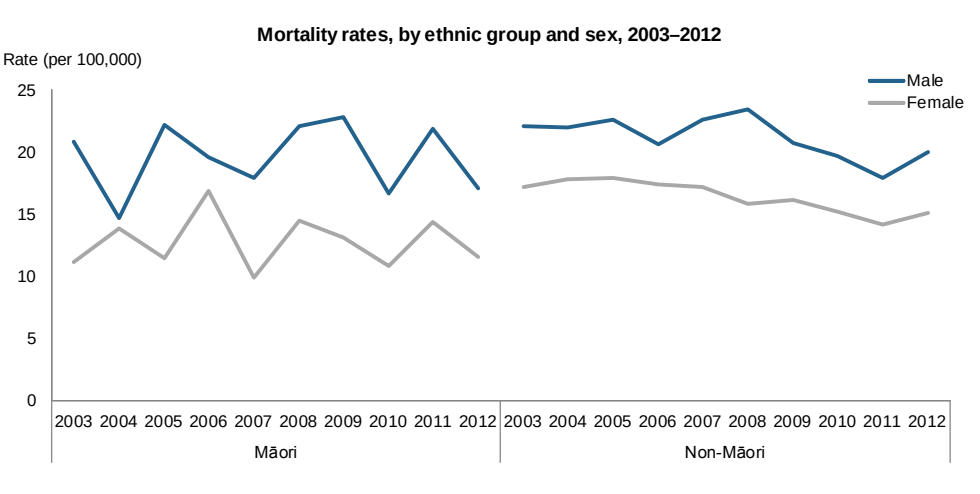



Figure 2: Mortality rates by ethnic group and sex, 2003-2012
Source: Ministry of Health 2015
Note: Rates are expressed per 100,000 population and age-standardised to the WHO World Standard Population.

- Deprivation: Survival rates for people diagnosed with colorectal cancer vary significantly by deprivation quintile. Between 1998-99 and 2010-11, the 5-year relative survival rate increased from 60.5% to 69.2% for Quintile 1-2 (the least deprived). Over the same period for Quintile 5 (the most deprived), the rate remained relatively constant with a small increase from 55.4% to 55.9%. Survival by deprivation quintile is shown in Figure 3.

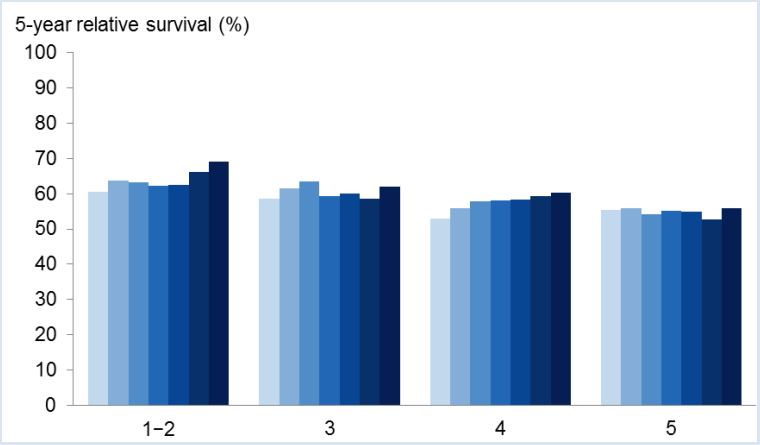



Figure 3: Bowel cancer 5-year relative survival, by deprivation quintile, 1998-2011
Source: Ministry of Health 2015: New Zealand Cancer Registry, New Zealand Mortality Collection

## Benefits of Bowel Screening

The single most important benefit from a national bowel screening programme is the reduction in mortality and increase in quality, and length, of life for individual people. Other benefits are listed in Table 1.

Table 1: Anticipated Benefits of a National Bowel Screening Programme

| Main Benefits | Beneficiary | Description and Possible Measures |
|---|---|---|
| Improved health outcomes | Individual<br>Society | Screening should result in a reduction in bowel cancer incidence and mortality, and an improvement in quality and length of life. Improved health outcomes may be measured through:<br>• Reduction in bowel cancer mortality<br>• Progress towards the OECD average bowel cancer rates<br>• Increase in people diagnosed with bowel cancer who need no further |

| | | |
|---|---|---|
| | | treatment following colonoscopy<br>• Increase in percentage of cancers diagnosed at the earlier stages |
| Cost effective health care | DHBs<br>State | Screening should be cost-effective. All international studies show that bowel screening is cost-effective. Cost effectiveness could be measured through:<br>• Cost effectiveness (cost of screening for quality life years gained)<br>• Cost savings (cost of screening vs cost of treatment) |
| Improved service delivery | Individual<br>DHBs | The implementation of a national bowel screening programme will impact on wider service delivery, and should result in improved services including and beyond bowel screening. This could be measured through:<br>• Increase in the number of patients discussed at multi-disciplinary meetings (MDM)<br>• Reduction in patients with bowel cancer with first presentation at Emergency Department<br>• Implementation of quality standards for screening will encourage the implementation of quality standards for symptomatic services<br>• Increase in number of endoscopy units using an electronic endocsopy reporting system that allows clinicians to monitor quality of the endoscopic procedure |

One of the key outcomes of screening is stage shift, where cancer is diagnosed at an earlier stage. Where pre-clinical disease or very early stage cancer are detected, these may be treated immediately with no further treatment required. This improves quality and length of life, as treatment for later-stage cancer (e.g. radiotherapy, chemotherapy) can be intrusive and unpleasant, and the chance of survival reduces rapidly with more advanced stage cancers. Screening may also identify other, non-cancer conditions which may be treated, resulting in an improved quality of life. In the Bowel Screening Pilot, 39% of patients were diagnosed at Stage 1 (localised cancer) compared with 13% in the PIPER study (of the non-screened population)[6]. Diagnosis at Stage 2 and 3 was broadly similar for screened and non-screened populations, but diagnosis at Stage 4 (where cancer has spread to other organs) was significantly lower in the Pilot, with only 8% diagnosed at that stage compared with 24% of the unscreened population. The comparisons are shown in Table 2.

Table 2: Stage of Diagnosis - Bowel Screening Pilot and PIPER study

**Bowel cancer ONLY** **Rectal cancers (N=47) have been removed**

50-74

| Stage of diagnosis | New Zealand: Bowel Screening Pilot (20012-2015) aged 50-74 | | New Zealand: PIPER study (2007-2008) aged 50-79 | |
|---|---|---|---|---|
| | Stage distribution - No. | Stage distribution - % | Stage distribution - No. | Stage distribution - % |
| i | 78 | 39% | 367 | 13% |
| ii | 49 | 24% | 774 | 27% |
| iii | 42 | 21% | 723 | 25% |
| iv | 16 | 8% | 699 | 24% |
| Unknown (or non metastatic for PIPER) | 17 | 8% | 293 | 10% |
| **Total** | **202** | **100%** | **2856** | **100%** |

[6] The PIPER Project Final report 7 August 2015, Health Research Council reference: 11/764

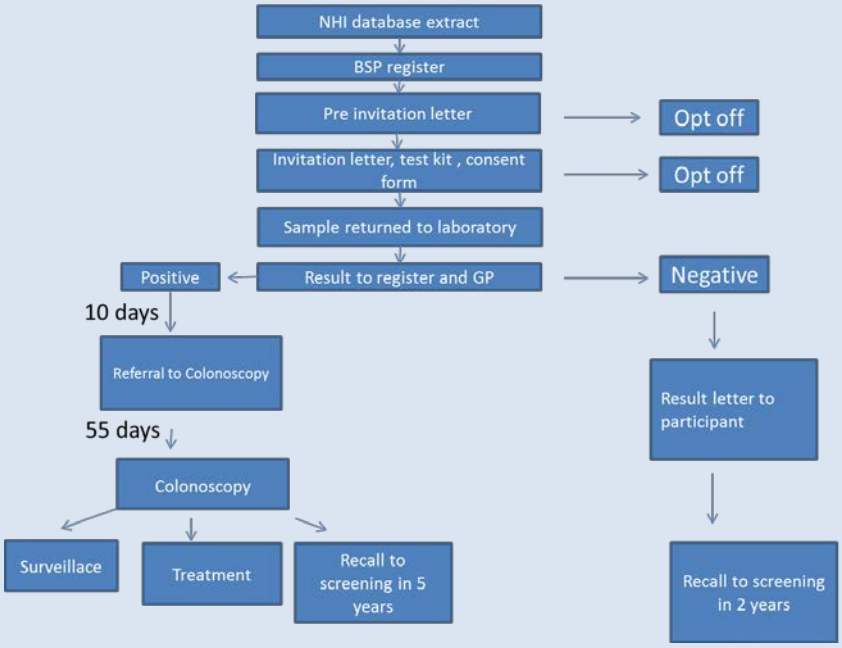
Initiative Description

*A description of what the initiative will provide or produce and how this will address the problem or opportunity.*

Introduce a bowel screening programme to people age 60-74, including the cost of ongoing surveillance colonoscopies, to reduce mortality from bowel cancer.

The bowel screening programme will mail a screening test, a faecal immunochemical test (FIT) to eligible people aged 60-74. The FIT detects trace amounts of blood which may indicate the presence of bowel cancer. Those participants who have a positive FIT result will be offered a colonoscopy. The colonoscopy can detect polyps and cancers if they are present. Those with bowel cancer will be referred on for treatment. Those who have a negative FIT result will be returned to the screening programme and re-invited in two years' time while they remain eligible.

The screening pathway is based on international best practice and mirrors the bowel screening pilot pathway. The attached diagram outlines the bowel screening pathway.




The programme will have an eligible population of around 700,000 men and women aged 60-74 who will be invited over a two year period (a screening round). The first year at full capacity will see around:

350,000 people invited
210,000 people return an FIT kit through the mail
9300 people have a colonoscopy
700 have a cancer detected

A central laboratory/coordination centre will be established to manage the distribution of invitations as well as processing of FIT kits and results notification. This will be supported by a centralised IT system. The IT system will be linked to DHB systems to enable endoscopy and histopathology information to be collected. Ideally there will also be linkages to the New Zealand Cancer Registry and to primary care providers to enable positive test management.

Four regional centres will be established to oversee participants who require a colonoscopy. Regional centres will be responsible for monitoring the quality of colonoscopies undertaken in the region, awareness raising, active follow up of non-responders and ensuring the quality standards for the programme are met consistently across the region.

DHBs will undertake colonoscopies for their populations and will report through to a regional centre.

In addition to screening people age 60-74, ongoing surveillance costs incurred by the DHBs are included. One of the consequences of bowel screening is that some people will be identified as being at increased risk of bowel cancer. These individuals would require ongoing colonoscopies. The additional surveillance colonoscopies generated by a national bowel screening programme would be funded ensuring people at increased risk of bowel cancer receive appropriate care.

Those participants with cancer will be treated at their DHBs under usual care and are not included in this funding bid. Those people diagnosed with bowel cancer through the screening programme would have been diagnosed and treated by their DHB at some stage in the future. The screening programme just identifies them earlier (and likely at a more treatable stage) hence these costs are just bought forward.

The programme will be established following national (and international) best practice guidelines. Quality indicators will be monitored and published regularly at a national level by the Ministry of Health.

## Alternative Options Considered

The Programme business case presented four options, with option 4 as the preferred option. Cabinet agreed to this option in August 2016.

### Option 1 – Do nothing

The pilot would discontinue and people would only have access to colonoscopy if they had symptoms or are at increased risk of bowel cancer. This option was discarded because New Zealand has one of the highest rates of bowel cancer in the developed world and the benefits of a national bowel screening programme would not be realised.

Option 2 – Basic: Screening to people aged 60-74, no primary care involvement in results management and no funding for surveillance colonoscopies.

Introduce a screening programme to people age 60-74 but only fund the basic screening pathway. This option was seen as being achievable given the current workforce capacity and the screening programme would generate an additional 9300 colonoscopies in the first full year.

This option was discounted as it did not include primary care involvement and did not include ongoing surveillance colonoscopies. Surveillance colonoscopies are currently undertaken and funded by DHBs many of whom struggle to keep up with referrals. Therefore it is unlikely that DHBs could undertake the additional surveillance colonoscopies if they were not funded. The recent gains made with additional funding to DHBs to reduce wait times for colonoscopies would be lost. Because the referral to surveillance was as a result of screening, there is a duty of care to that patient to have the complete screening process funded.
This option did not involve primary care in positive results management, which has been shown to be beneficial to promoting equity and engagement in bowel screening. By not involving primary care a bowel screening programme would be less aligned with the principles of the New Zealand Health Strategy.

Option 3 – Integrated: Screening to people aged 60-74, primary care involved in results management, but no funding for surveillance colonoscopies.

Introduce a screening programme to people age 60-74 and enable positive FIT results to be managed by the patient's primary care provider, which is more in line with the principles of the New Zealand Health Strategy. The programme would be funded for a more integrated screening pathway but not for ongoing surveillance colonoscopies.

This option was discounted as it did not include ongoing surveillance colonoscopies. As mentioned in Option 2, surveillance colonoscopies are currently undertaken and funded by DHBs many of whom struggle to keep up with referrals. Therefore it is unlikely that DHBs could undertake the additional surveillance colonoscopies if they were not funded. The recent gains made with additional funding to DHBs to reduce wait times for colonoscopies would be lost. Because the referral to surveillance was as a result of screening, there is a duty of care to that patient to

have the complete screening process funded.

The Cabinet approved option
Option 4 – Complete: Screening to people aged 60-74, primary care involved in results management, and funding for surveillance colonoscopies.

This option was chosen as it is achievable in terms of capacity and is supported by the sector. It is more in line with the principles of the New Zealand Health Strategy, and more likely to ensure DHBs are able to safely manage surveillance colonoscopy demand as a result of screening. Analysis of the pilot data shows that an age range of 60-74 years, with an increased positivity threshold (ie the level at which blood is detected in the sample) compared with the pilot (which is similar to levels used in other OECD countries):

- will detect the most cancers possible within an achievable number of colonoscopies
- will minimise the risk of adverse events from colonoscopy when compared to the number of cancers detected
- is the most cost effective age range.

## Section B Impact Analysis

Impact Analysis

*An explanation of who is impacted (winners and losers), what the impacts are (costs and benefits), and when the impacts will be realised and for how long. The impacts should be quantified and monetised if possible.*

### Headline Benefits

#### Stage shift, reduced treatment costs and increased survival

Bowel cancer screening will produce a pronounced shift in the proportion of patients being diagnosed with cancers at an earlier stage (ie the cancer is less advanced). In the unscreened population only 13% of all cancers are found at Stage 1, in the screened population 39% of cancers are found at Stage 1. This has massive implications for treatment costs and survival outcomes.

*NB - Stage shift will only be noted in people who have had their cancers found via screening – approximately 700 cancers per year for Round 1, and approximately 260 cancers per year for Round 2 and beyond. Please note that this assumes that all DHBs come online together, in 2017. The reality is that all DHBs will come online over a three year period.*

Cancers identified at the earlier stages are much more likely to survive. Of those people diagnosed with localised bowel cancer (stage I or Stage II are used here as a proxy for localised disease), 96% of people will survive to the 5 year mark, compared to stage IV cancer where only 11% survive this length of time. See Figure 4 for a diagram of the benefits of screening on cancer registration rates and how this relates to treatment cost benefit and stage shift benefit.

#### Reduction in the mortality rate from bowel cancer

International publications estimate a reduction in the mortality rate of between 16% and 22% (for the cohort screened) 8-10 years following the implementation of a screening programme. Values vary depending on country, test type, the age of the screening cohort and the positivity threshold. The 2016 cost-effectiveness report from Sapere Research Group7 estimated a reduction in bowel cancer incidence of 35 percent, and a reduction in bowel cancer mortality of 39 percent (based on pilot parameters), over the lifetime of the cohort modelled.

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[7] Draft: The cost effectiveness of bowel cancer screening in New Zealand: a cost-utility analysis based on pilot results. Sapere research group, 23 May 2016

## Quality adjusted life years (QALYs) saved

Analysis of data from the bowel screening pilot has shown that the QALY gain for a Programme using an age-range of 60-74 and a positivity threshold of 200ngHb/ml buffer would result in a QALY gain of 0.0607 (22 days) per person invited. The price of a QALY is currently estimated as $54,707.

## Other benefits

### Reduction in the incidence of bowel cancer

Locating and removing pre-cancerous lesions (eg advanced adenomas or serrated polyps) may prevent a diagnosis of bowel cancer in the future. A recent Italian study showed that screening with FIT for people aged 50-69 reduced bowel cancer incidence by 10% in the 8-10 years following the implementation of the programme. It may be that NZ will also show a similar reduction in incidence.

### Less Emergency Department (ED) admissions required

Earlier diagnosis of bowel cancer can only reduce the number of ED admissions. NZ has a much higher rate of bowel cancer diagnosed via ED than other countries with screening. No NZ ED data for bowel cancer is available, but the recent PIPER study showed that 34% of colon cancers and 14% of rectal cancers were first identified via an ED attendance. We could assume a 20% reduction in ED visits for the 700 cancers diagnosed, a reduction in 140 ED visits per year.

### Decrease in hospice/palliative care requirements

A higher rate of survival from bowel cancer will result in a lower requirement for hospice services.

### Increase in workforce

Those aged 60 to retirement age are more likely to be retained in the workforce if diagnosed with bowel cancer early. These people will have additional benefits for society as carers (eg grandparents caring for children whilst parents work). There will also be fewer carers required for those who were diagnosed earlier than they would have been without screening.

### Identification of known genetic cancers in more families

Additional detection of familial cancer genes, and the subsequent reduction in cancer incidence and mortality rates could have a significant impact on hospital resources. The current Familial Gastrointestinal Service has provided an estimated cost benefit of $11M annually in saved hospital costs. This would only increase if more families were identified as colorectal cancer gene carriers and they received prophylactic treatment for bowel cancer.

### Raising awareness, the halo effect, and OECD ‘standing’

National advertising campaigns will encourage awareness of colorectal cancer symptoms which may encourage earlier detection in the unscreened population. Symptomatic, surveillance, pathology and cancer services may improve in quality and timeliness due to the imposed rigor of the new screening programme. NZ is often quoted as having some of the highest rates of bowel cancer in the OECD, yet does not have a screening programme. New Zealand needs to make progress towards achieving average OECD bowel cancer rates.

### Improvements in data collection, data sharing and IT systems

Improvements required for a properly functioning NBSP IT system may also benefit other DHB service areas, data collection and data sharing. This will ultimately result in better information being collected by the Ministry (for use in benchmarking, and evaluating service delivery and outcomes).

## Costs

### Colonoscopy and pathology related capacity

Bowel cancer screening will require additional colonoscopist capacity, additional theatre capacity, nurses, pathologists and technicians.  This includes the need for additional surveillance colonoscopies.

### Adverse events following colonoscopy

82 minor or intermediate events arose from people who received the 8000+ colonoscopies performed in the Bowel screening pilot until 31 March 2016.  An additional 14 events were deemed serious; one of these required an admission to ICU.

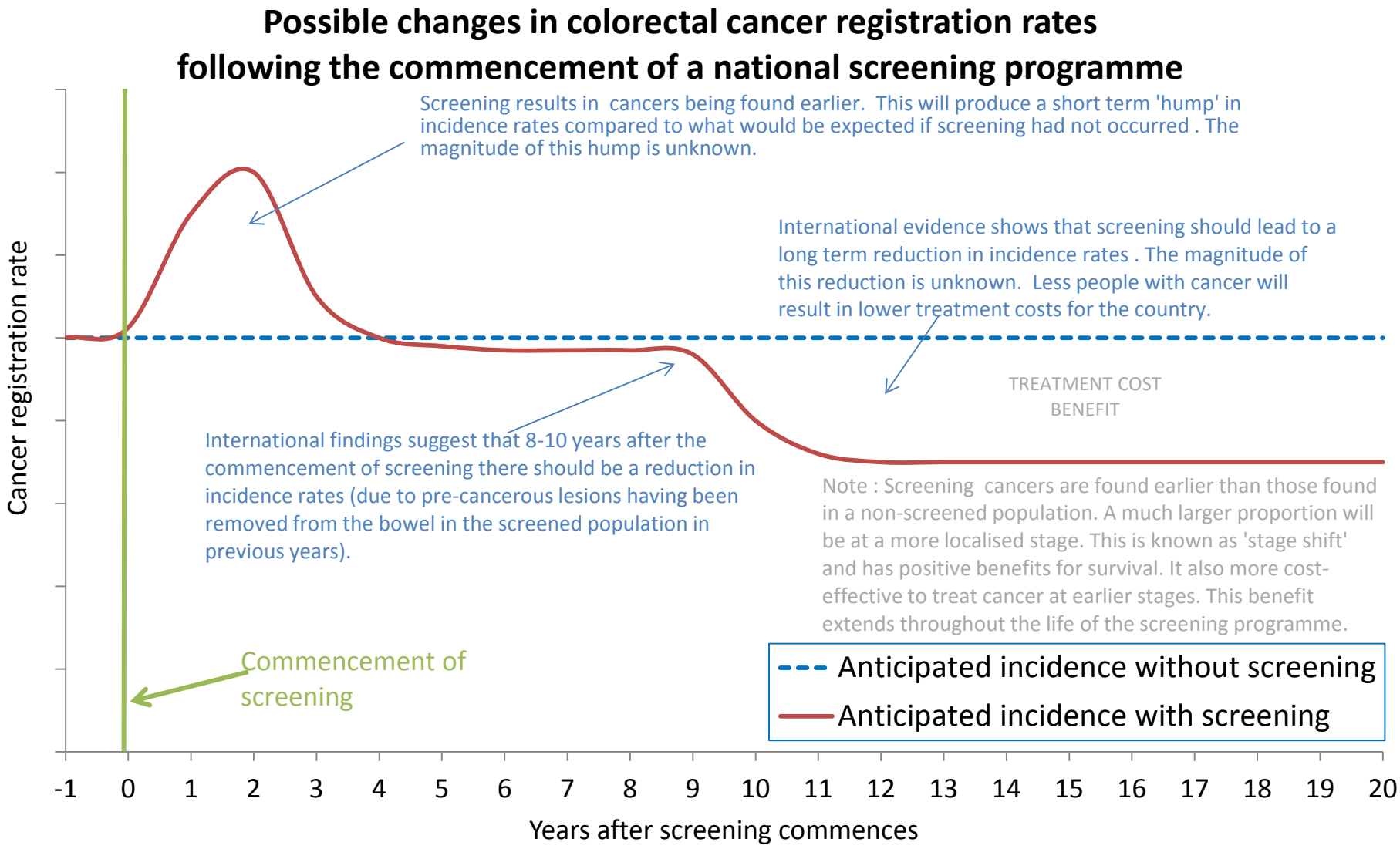
### Additional retirees

More people survive longer in the pensionable age-band, increasing pressure on government funding.  However, this is offset by some retirees performing child minding activities making it easier for their parents to work benefitting society and the Crown.

### Mental health considerations

People waiting for a colonoscopy following a positive test may become anxious if wait times are too long.

Figure 4: Benefits of screening on cancer registration rates



| Impact Summary Table | *All monetised and non-monetised impacts should be listed.* |
|---|---|

| Impacts - Identify and list<br>$m present value,<br>for monetised impacts | Option/scenario | | Assumptions and evidence<br>(quantify if possible, and use ranges where appropriate) | Evidence certainty[8] |
|---|---|---|---|---|
| | 1 | 2 | | |
| **Estimated impact on key outcomes** | | | | |
| Reduced bowel cancer mortality | | | After 8-10 years, bowel screening would reduce the bowel cancer mortality rates by at least 16-22 percent in the age group offered screening. This could be as high as 39 percent over the lifetime of the cohort modelled. | High |
| Increased proportion of bowel cancers detected at an early stage | | | In the unscreened population only 13% of all cancers are found at Stage 1, in the screened population 39% of cancers are found at Stage 1. | High |
| Reduced bowel cancer incidence rates | | | An estimated 35% reduction in bowel cancer incidence (based on pilot parameters) over the lifetime of the cohort modelled, seen 10 years following the commencement of screening. This reduction is the result of detecting and removing preclinical disease. | High |
| Increased 5-year relative survival rates | | | Cancers identified at the earlier stages are much more likely to survive. Of those people diagnosed with localised bowel cancer, 96% of people will survive to the 5 year mark, compared to stage IV cancer where only 11% survive this length of time. | High |
| **Cost of the Initiative** | | | | |
| Fiscal operating and capital costs of the initiative | s9(2)(f)(iv) | | | Medium |
| **Government Benefits/(Costs)** | | | | |
| Superannuation - Generalised | s9(2)(f)(iv) | | Increased superannuation is based on the difference between average life expectancy of 81 years with the average age of CRC death of 68 years for the projected reduction in mortality. | Medium |
| DHB funded treatment costs | | | Calculated by multiplying the number of cancers detected with the average cancer treatment cost of $31,000 per annum. Some costs can be managed through the electives programme. | Medium |
| Avoided treatment costs | | | Longer term savings due to cancer treatment costs being avoided as a result of the stage shift. | Medium |
| Stage shift savings | | | Stage shift impact of earlier treatment that reduce higher cancer treatment cost | Medium |
| Total Quantified Government Impact | | | | Medium |
| **Wider Societal Benefits/(Costs)** | | | | |
| Quality-adjusted life year (QALY) gained | s9(2)(f)(iv) | | Analysis of the data from the Bowel Screening Pilot show that the QALY gain for the NBSP using an age-range of 60-74 and a positivity threshold of 200ngHb/ml buffer would result in a QALY gain of 0.0607 (22 days) per person invited. | High |
| Total Quantified Wider Societal Impact | | | | High |
| Net Present Value of Total Quantified Societal Impacts | 1404 | - | | Medium |

[8] Rate your level of confidence in the assumptions and evidence as high (green) if based on significant research and evaluations that is applicable, medium (amber) if based on reasonable evidence and data, or low (red) if there is little relevant evidence. Colour the rating box for each impact.

## Section C Conclusions

| Conclusions<br>*What is being recommended and why?* |
|---|
| Based on data collected from many international screening programmes and pilots, bowel cancer screening has, in every case, been found to be cost effective. This is particularly true when using faecal immunochemical tests (FITs).<br><br>The evaluation of the Bowel Screening Pilot has concluded that bowel screening will save lives, with data from international studies indicating that a screening programme may reduce mortality in the population offered screening from bowel cancer by at least 16-22 percent, and potentially up to 30 percent, after 8-10 years. The evaluation also concluded that a national bowel screening programme would result in significant cost-savings from reduced treatment of bowel cancer, which outweigh the cost of screening. There is no evidence to suggest that a national bowel screening programme would not be cost effective in a New Zealand setting.<br><br>An Irish study (although using a slightly different age range than planned in New Zealand) reported that over the lifetime of the cohort screened, compared with no screening, FIT-based screening would offer a 15% fall in colorectal cancer incidence and a 36% fall in mortality. This screening scenario would have the potential to change the stage distribution of cancers in the population, such that a greater proportion would be diagnosed at an early stage.<br><br>Analyses has shown that the QALY gain for a Programme using an age-range of 60-74 and a positivity threshold of 200ngHb/ml buffer would result in a QALY gain of 0.0607 (22 days) per person invited and this value has been used in this Cost Benefit Analysis.<br><br>In addition to a large number of QALYs gained, there are also monetary benefits relating to the identification of colorectal cancer at an earlier stage when compared with no screening. This results in an overall reduction in treatment costs.<br><br>There are also innumerable societal benefits associated with saving lives, diagnosing and treating people at an earlier stage of cancer and the implications for survival. |

| Overall Ratings | |
|---|---|
| Value for Money | Strategic Alignment |
| 5 | 5 |
| Rating from 0-5. Consider monetised and unquantified impacts and evidence base.<br><br>5 High value / return confident, 4 High/medium return likely,<br>3 medium/break even confident, 2 medium/break even likely,<br>1 low/break even unclear, 0 no returns / value loss | Rating from 0-5. Consider alignment with government strategic direction and priorities, and cross-government action.<br><br>5 Strong alignment, 4 High alignment, 3 Some alignment,<br>2 Limited alignment, 1 Low alignment, 0 No alignment |

| Summary of monetised results | | |
|---|---|---|
| Use ranges for values where appropriate | Discount Rate | |
| | 6% real (default) | 3% real (sensitivity) |
| Net Present Value (NPV)[9] | s9(2)(f)(iv) [redacted] | |
| Benefit Cost Ratio (BCR)[10] | 2.7 | 2.4 |
| Return on Investment (ROI) – Societal Total [11] | 4.2 | 3.7 |
| Return on Investment (ROI) – Government[12] | 0.6 | 0.6 |

9 **Net Present Value (NPV**) - The NPV is the sum of the discounted benefits, less the sum of the discounted costs (relative to the counterfactual). This gives a dollar value representing the marginal impact on the collective living standards of all New Zealanders of the initiative, in today's dollar terms.

10 **Benefit Cost Ratio (BCR**) - The BCR is the ratio of total discounted benefits to the total discounted costs. A proposal with a BCR greater than 1.0 has a positive impact, because the benefits exceed the costs. The BCR is the same as the Return on Investment Societal Total, unless there are negative impacts in addition to the fiscal cost of the initiative. All negative impacts are included in the denominator for the BCR measure.

11 **Return on Investment (ROI) - Societal Total** - Calculate the ROI by dividing the discounted net change in wider societal impact, including benefits to government, by the discounted cost of the initiative. This can be interpreted as the impact for New Zealanders per dollar the government spends on the initiative, eg, for every $1 the government spends on this programme, New Zealanders receive benefits of $3.

12 **Return on Investment (ROI) – Government** – Calculate the ROI by dividing the discounted net change in impact for the government by the discounted cost of the initiative. This measures the discounted net marginal (fiscal) benefits to the government.

## Supporting Evidence

*ie, the bibliography*

Programme Business case & Tranche 1 Business Case National Bowel Screening Programme:

http://www.health.govt.nz/our-work/diseases-and-conditions/cancer-programme/bowel-cancer-programme/national-bowel-screening-programme/key-documents-national-bowel-screening-programme

Comparable data from Ireland showing cost effectiveness values, QALYs gained and potential reductions in incidence and mortality rates: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3305953/

Colorectal cancer screening: a global overview of existing programmes: Schreuders EH, Ruco A, Rabeneck L, et al. Gut 2015; 64:1637-1649.

## Ex-post Impact Evaluation Plan

*How will you evaluate (after the programme has been rolled out) what the effect of the programme was, particularly on the impacts listed in Section B?*

### Data collection and impact evaluation method

Most data will be collected from the BSP+ IT system, and later the NBSP IT system. However, many other of the Ministry's national collections (such as the New Zealand Cancer Registry, the Mortality Collection, the National Minimum Dataset and the National Patient Flow collection) will be utilised to fully evaluate the benefits of the NBSP.

Short term evaluation will concentrate on measuring the proportion of cancers diagnosed at earlier extent (earlier stage of disease) which is the precursor for the improvements anticipated in future survival outcomes. Short term benefits may also be monitored via evaluation of the number of advanced adenomas being found per colonoscopy. This measure can be a precursor for future drops in bowel cancer incidence rates.

Changes in survival, mortality and bowel cancer incidence will be evaluated, but improvements are generally not expected until a point at least 10 years following implementation of the Programme. These figures will also be benchmarked against OECD averages.

Evaluation of improvement in quality and consistency of care will also be monitored using a combination of qualitative and quantitative measures.

Evaluation of equity issues, adverse events and conditions that can lead to psychological harm (such as long colonoscopy wait times) will be monitored continuously throughout the Programme using data from the IT systems and the Ministry's National Collections.

A formal independent evaluation of the Programme roll-out will be undertaken in 2020/21, although details have yet to be finalised.

A full Programme benefits realisation evaluation will be commissioned after the Programme has been in place for at least 10 years. However, as detailed above, the main expected benefits can be evaluated through monitoring the survival, cancer incidence and cancer mortality rates - data readily accessible through the Ministry's National Collections.

### Funding of evaluation s9(2)(f)(iv) [redacted]

A budget of [redacted] has been allocated for the independent evaluation of the Programme roll-out.
Budget has yet to be allocated to the full Programme benefits realisation evaluation, but this is not expected to be commissioned before 2030.

### Completion dates, publication, and dissemination of findings to key stakeholders

Monitoring of short term benefits (cancer extent at diagnosis) and rates of advanced adenomas found per colonoscopy will be monitored and reported quarterly or biannually via publication on the Ministry of Health website.

Long term benefits (colorectal cancer mortality rates, incidence rates and relative 5-year survival rates) will be monitored and published from approximately 2030.

## Appendix 1 One-page Intervention Logic