Supplementary Tables and Figures

S1 Table 1 Values of transition probability estimates and the 95% credible intervals for the natural history parameters

Annual Transition probability	Non-Māori male	Non-Māori female	Māori male	Māori female
Normal epithelium to low-risk polyp, age 30	0.00070 (0.00068-0.00072)	0.00058 (0.00054-0.00061)	0.00020 (0.00000-0.00058)	0.00031 (0.00010-0.00057)
Normal epithelium to low-risk polyp, age 40	0.00080 (0.00073-0.00086)	0.00052 (0.00048-0.00057)	0.00065 (0.00029-0.00096)	0.00055 (0.00037-0.00074)
Normal epithelium to low-risk polyp, age 50	0.00183 (0.00162-0.00206)	0.00093 (0.00081-0.00107)	0.00168 (0.00130-0.00208)	0.00132 (0.00097-0.00176)
Normal epithelium to low-risk polyp, age 60	0.00549 (0.00486-0.00616)	0.00351 (0.00305-0.00403)	0.00378 (0.00305-0.00460)	0.00310 (0.00246-0.00385)
Normal epithelium to low-risk polyp, age 70	0.00974 (0.00862-0.01092)	0.00634 (0.00559-0.00715)	0.00683 (0.00540-0.00845)	0.00532 (0.00367-0.00705)
Normal epithelium to low-risk polyp, age 80	0.00413 (0.00362-0.00468)	0.00064 (0.00053-0.00077)	0.00969 (0.00738-0.01226)	0.00519 (0.00290-0.00792)
Normal epithelium to low-risk polyp, age 90	0.00053 (0.00047-0.00060)	0.00043 (0.00038-0.00049)	0.01002 (0.00735-0.01298)	0.00195 (0.00078-0.00328)
Normal epithelium to low-risk polyp, age 100	0.00050 (0.00044-0.00056)	0.00043 (0.00038-0.00049)	0.00672 (0.00469-0.00927)	0.00030 (0.00004-0.00061)
Low-risk polyp to high-risk polyp	0.208 (0.190-0.242)	0.192 (0.175-0.210)	0.192 (0.180-0.213)	0.190 (0.159-0.209)
High-risk polyp to Dukes A	0.073 (0.060-0.083)	0.119 (0.099-0.138)	0.076 (0.068-0.086)	0.066 (0.060-0.080)
Dukes A to Dukes B	0.972 (0.964-0.980)	0.985 (0.979-0.992)	0.990 (0.982-0.996)	0.999 (0.997-1.000)
Dukes B to Dukes C	0.701 (0.070-0.998)	0.600 (0.556-0.660)	0.972 (0.898-0.998)	0.986 (0.968-0.996)
Dukes C to Dukes D	0.745 (0.658-0.796)	0.620 (0.537-0.715)	0.742 (0.678-0.812)	0.737 (0.669-0.828)
Probability presenting symptomatically with Dukes A	0.147 (0.122-0.166)	0.148 (0.125-0.163)	0.133 (0.112-0.147)	0.126 (0.113-0.142)
Probability presenting symptomatically with Dukes B	0.397 (0.375-0.438)	0.324 (0.300-0.340)	0.352 (0.330-0.387)	0.347 (0.325-0.364)
Probability presenting symptomatically with Dukes C	0.772 (0.718-0.796)	0.678 (0.624-0.701)	0.694 (0.624-0.725)	0.669 (0.638-0.707)
Probability presenting symptomatically with stage D	0.965 (0.956-0.973)	0.979 (0.971-0.988)	0.977 (0.966-0.985)	0.970 (0.957-0.977)

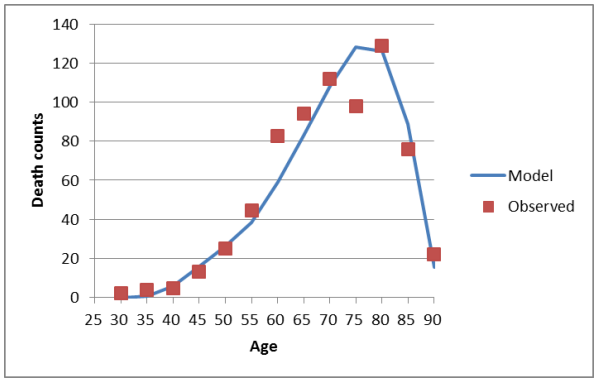
Estimates are from our Metropolis Hastings calibration: using prior values from Whyte et al (2011) [1] and New Zealand cancer incidence and survival by stage; and calibrated against New Zealand CRC death counts.

Reference:

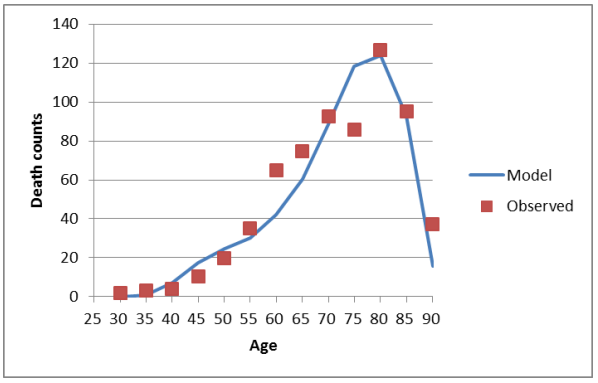
1. Whyte S, Walsh C, Chilcott J: Bayesian Calibration of a Natural History Model with Application to a Population Model for Colorectal Cancer. *Med Decis Making* 2011, 31:625–641.

S2 Fig 1 Model predicted versus observed average colorectal cancer mortality counts per year (2007-2010) by age, sex and ethnicity.

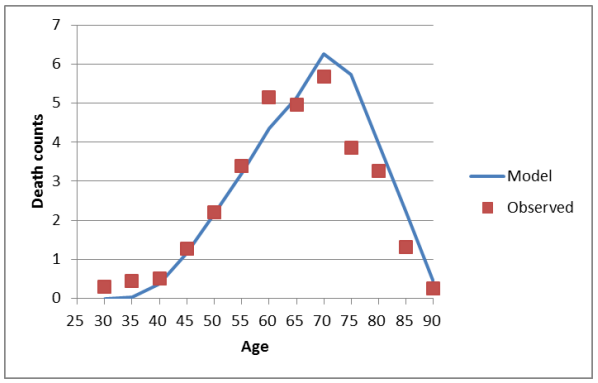
Non-Māori males



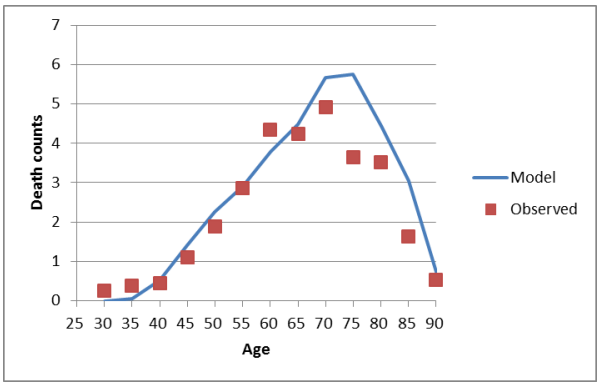
Non-Māori females



Māori males

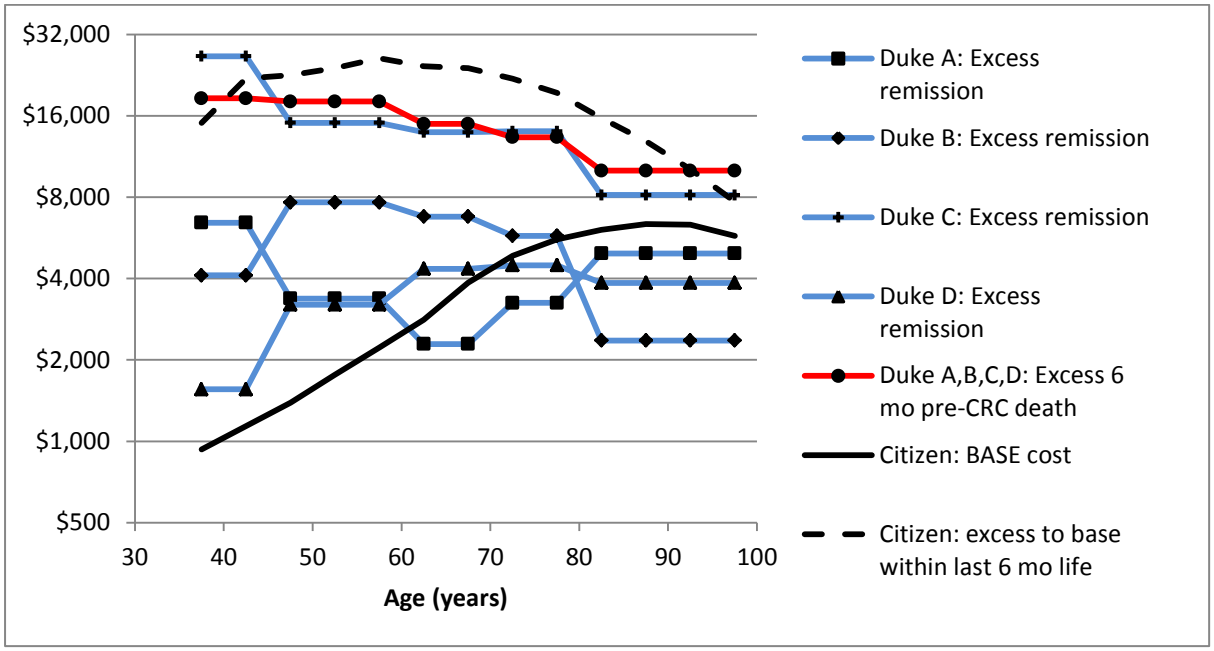


Māori females

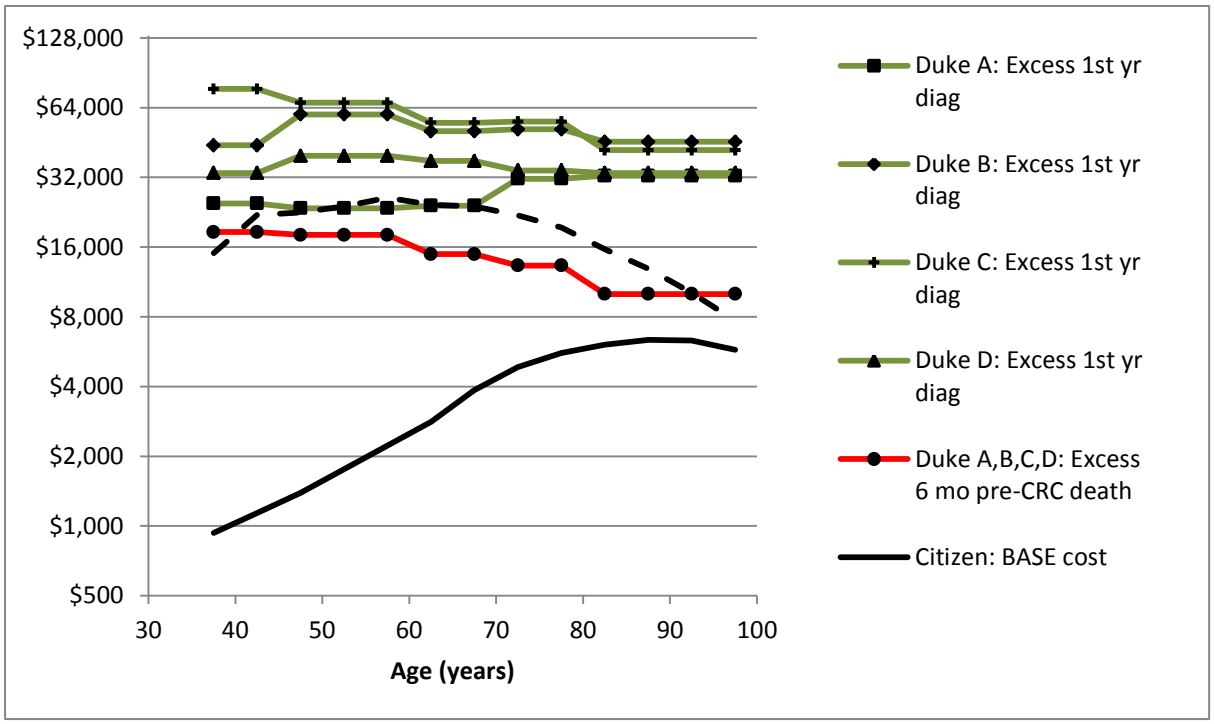


S3 Fig 2 Health systems cost inputs by Dukes stage and clinical phase (y-axis log scale) for males (female cost inputs available on request from author)

a) Health system costs (2011) for males, excess costs for CRC remission



b) Health system costs (2011) for males in the first year of CRC diagnosis.



S4 Table 2 Model validation: percentage reduction (95% confidence or uncertainty interval) in colorectal cancer mortality in MSLT model, selected RCTs and selected other simulation models

Age at commencement of screening	FOBT guaiac, biennial	FOBT guaiac, annual	FOBTi biennial	FOBTi annual
NZ BODE^3 model, non-Māori males and females combined				
Imperfect adherence	*Screened at least once (58.3% screen probability each wave, as per non-Māori in NZ pilot), 15 years of follow up, screening stops age 74 years*			
45-49 yrs	24.5%	39.9%	40.4%	58.8%
50-54 yrs	22.3%	39.4%	37.0%	58.3%
55-59 yrs	24.1%	39.4%	39.9%	58.4%
60-64 yrs	22.4%	39.4%	37.3%	58.5%
65-69 yrs	19.9%	33.9%	34.1%	52.1%
70-74 yrs	9.7%	21.6%	17.6%	35.7%
100% adherence	*15 years of follow up, screening stops age 74 years*			
45-49 yrs	37.1%	55.2%	56.5%	73.1%
50-54 yrs	34.0%	54.8%	52.2%	72.7%
55-59 yrs	36.6%	54.8%	56.1%	72.9%
60-64 yrs	34.2%	54.9%	52.9%	73.1%
65-69 yrs	31.1%	48.7%	50.0%	67.4%
70-74 yrs	15.9%	32.9%	28.1%	50.0%
100% adherence	*Follow up for remainder of lives, screening stops age 74 (for comparison with MISCAN and SimCRC)*			
50-54 yrs	34.4%	52.4%	52.4%	68.3%
Randomized trials				
Nottingham RCT, people screened at first wave, median follow-up 11 yrs [1]				
45-74 yrs	27% (10%-43%)			
**Minnesota RCT, adherence 75%/78% per invite in annual/biennial screening offered 1976-82 and reinstituted 1986-92, cumulative reduction at 18 years follow-up* [2]				
50-80 yrs	21%	33%		
Funen RCT, adherence 1stscreen 67%, 2ndto 9th screens 91%, 17 years follow-up [3]				
45-75 yrs	16% (11% incl complications)			
Goteborg RCT, screened at least once, mean follow-up 15.8 yrs (8.7 yrs since last screen) [3]				
	24% (8%-37%)			
Simulation studies, single age cohort (age 50) screened annually from 50 to 75 years of age, and followed-up over rest of lives [30]				
MISCAN		66.0% (Hemoccult SENSA), 55.3% (Hemoccult II)		64.6%
SimCRC		81.2% (Hemoccult SENSA), 69.0%		80.0%

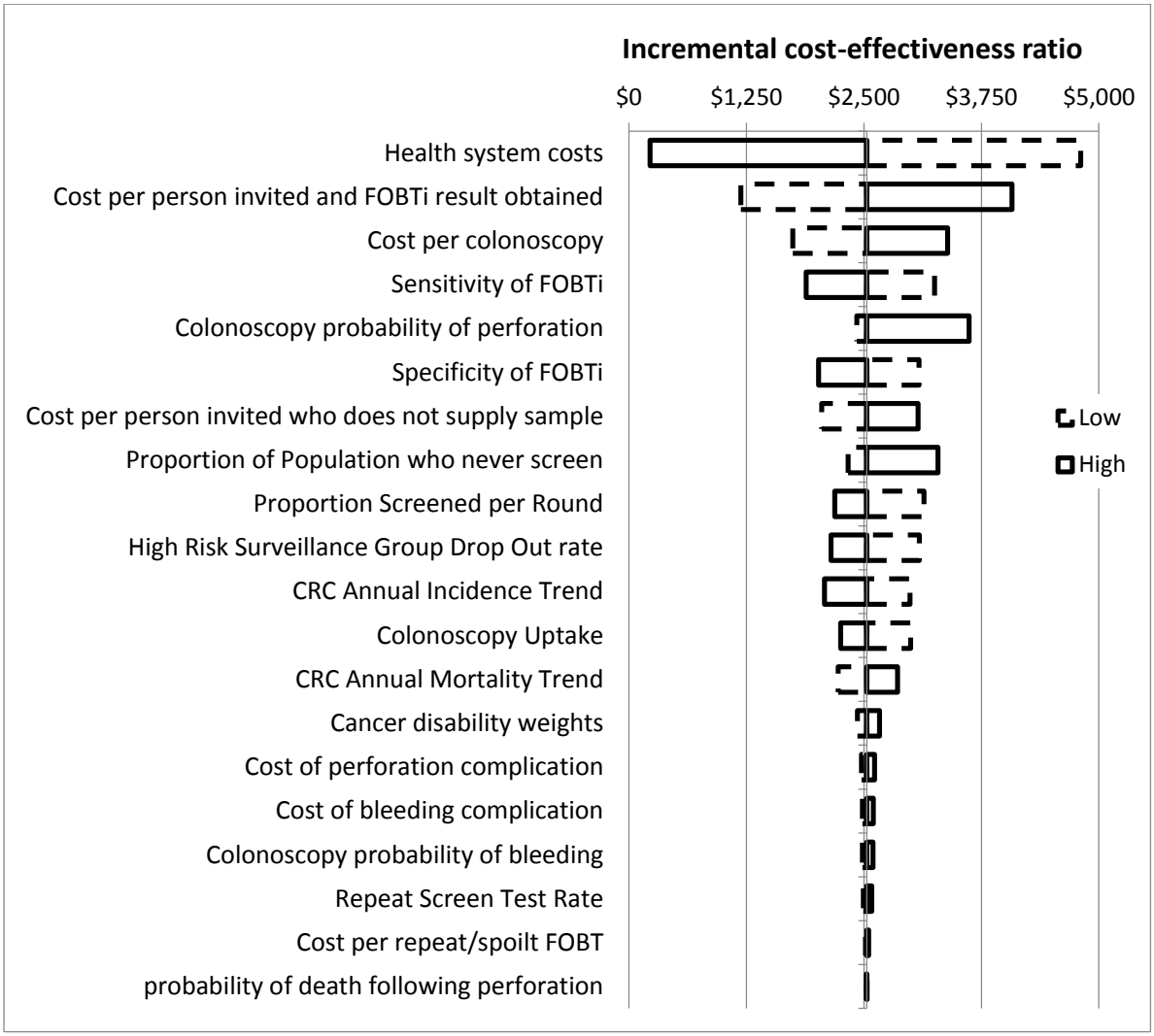
		(Hemoccult II)		

*The Minnesota trial enrolled volunteers (thus the high adherence), but the control arm also likely contaminated by some screening. Therefore, the percentage reduction in CRC mortality among actual participants is like higher than reported

References:

1. Scholefield J, Moss S, Sufi F, Mangham C, Hardcastle J: Effect of faecal occult blood screening on mortality from colorectal cancer: results from a randomised controlled trial. *Gut* 2002, 50:840–844.
2. Mandel J, Church T, Ederer F, Bond J: Colorectal Cancer Mortality: Effectiveness of Biennial Screening for Fecal Occult Blood. *J Natl Cancer Inst* 1999, 91:434–437.
3. Hewitson P, Glasziou P, Irwig L, Towler B, Watson E, Thisted R: Screening for colorectal cancer using the faecal occult blood test, Hemoccult (Review). In.: The Cochrane Collaboration; 2011.

S5 Fig 3 Tornado plots* for one-way sensitivity analyses of the total population incremental cost-effectiveness ratio (ICER †)



*The Tornado plot is used to understand the contribution of parameter uncertainty to the ICER. For example, uncertainty around future health system costs has the largest impact on the ICER (the widest bar above). It can also be used to demonstrate how the ICER value changes when using low (2.5th percentile) and high (97.5th percentile) values of each parameter; a one way sensitivity analysis.

† All sensitivity analyses had positive QALY gains, but sometimes negative net costs. Thus no positive ICERs arose due to both negative costs and negative QALYs, and no negative ICERs arose due to positive costs and negative QALYs. Therefore, for convenience we proceeded with a Tornado Plot for the ICER that included some negative values (all in the southeast quadrant of the cost-effectiveness plane).

S6 Table 3 Optimal CRC screening age-range for Māori.

Next age-group (extension) considered	Comparator age-group								
	vs no screening	vs 65-69	vs 65-74	vs 60-74	vs 60-79	vs 55-79	vs 50-79	vs 50-84	vs 45-84
50-54	$14,652								
55-59	$7,583								
60-64	$3,936								
65-69	**$2,450**								
70-74	$3,779								
60-69	$4,320	$7,399							
65-74	$3,645	**$6,565**							
60-74	$5,202		**$8,095**						
65-79	$5,525		$13,590						
55-74	$7,131			$15,134					
60-79	$6,003			**$14,272**					
55-79	$7,885				**$15,032**				
60-84	$7,215				$30,143				
50-79	$10,414					**$27,592**			
55-84	$8,501					$31,226			
45-79	$14,197						$47,577		
50-84	$11,112						**$30,300**		
45-84	$14,552							**$50,001**	
50-89	$11,577							113,743	
40-84	$17,322								**$82,151**
45-89	$15,154								$103,043

ICERs (expected values only) for biennial screening of the 2011 population modelled out to death, by five year group compared to no screening, then extensions to wider age-groups based on marginal ICERs

More favorable ICERs within each grouping (more cost-effective QALY gain) are in bold

Discount rate 3%.

S7 Table 4 Optimal CRC screening age-range for non-Māori

Next age-group (extension) considered	Comparator age-group								
	vs no screening	vs 65-69	vs 65-74	vs 60-74	vs 60-79	vs 55-79	vs 50-79	vs 45-79	vs 45-84
50-54	$10,889								
55-59	$5,497								
60-64	$1,270								
65-69	**cost saving**								
70-74	cost saving								
60-69	$1,007	$5,960							
65-74	cost saving	**$1,261**							
60-74	$1,309		**$5,436**						
65-79	$1,345		$9,514						
55-74	$3,291			$14,559					
60-79	$2,116			**$10,252**					
55-79	$4,063				**$13,522**				
60-84	$3,552				$40,542				
50-79	$6,094					**$22,069**			
55-84	$4,851					$44,088			
45-79	$8,870						**$32,592**		
50-84	$7,056						$40,828		
40-79	$10,611							$51,585	
45-84	$9,425							**$44,203**	
40-84	$11,335								**$48,601**
45-89	$10,185								$241,782

ICERs (expected values only) for biennial screening of the 2011 population modelled out to death, by five year group compared to no screening, then extensions to wider age-groups based on marginal ICERs

Discount rate 3%. More favorable ICERs within each grouping (more cost-effective QALY gain) are in bold