Policy1-Bowel

Model description

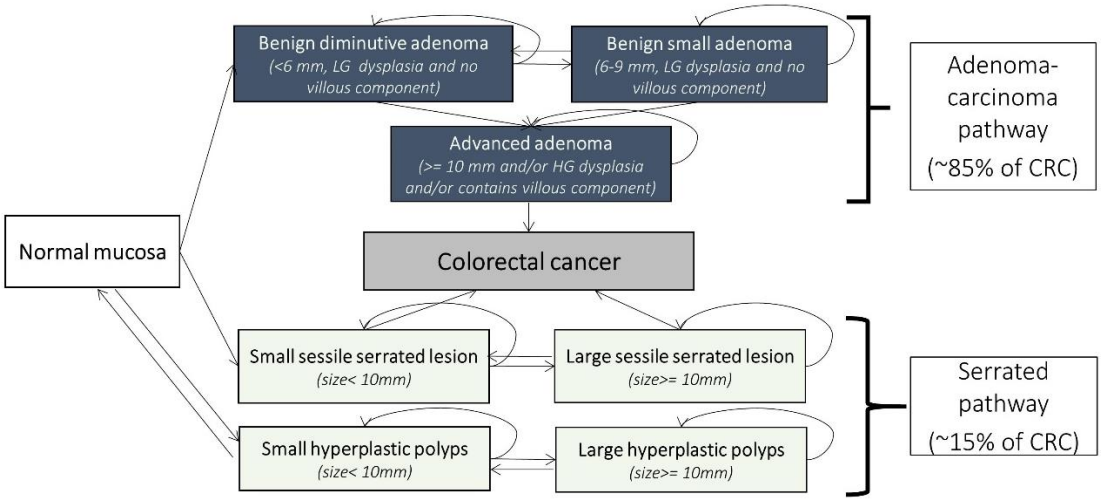
The Policy1-Bowel microsimulation platform was used to model CRC and screening via the NBCSP. The natural history model simulates the development of pre-cancerous lesions and CRC via two biological pathways (i.e. the conventional adenoma-carcinoma pathway and the serrated pathway) in individuals. Policy1-Bowel have been used to evaluate a number of bowel screening questions in Australia (1-6). The model is implemented in in C++. Detailed technical and non-technical descriptions of the model, which include model assumptions, data sources, and model calibration and validation results have been published elsewhere (1,7).

For the purposes of this analysis, we modelled the impacted 2020 and 2021 screening cohorts, i.e. those aged 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, or 74 in either of those years. This corresponds to those born between 1945 to 1971 inclusive. For the age and sex breakdown of this cohort, both in Australia and in individual states and territories, ABS projections were used (1).

We simulated 2 million men and 2 million women in each of the relevant cohorts, and the results were subsequently reweighted to match population projections for Australia or individual state or territory estimated by the ABS (1).

Policy1-Bowel works on an annual timestep. Therefore, to reproduce the effect of the screening pause, we assume that participation in the NBCSP for the year is reduced proportionally to the time for which the program is paused. For instance, to model a six month pause, we assume that participation in 2020 is decreased by half from the observed rates of ~40% to a diminished rate of ~20%.

Figure 1 - Policy1-Bowel model schematic diagram



Data sources

The model has been extensively calibrated and validated to the Australian setting, including detailed modelling of the NBCSP; selected parameter values and data sources are included in Table NBCSP1, and a detailed technical appendix can be found in Lew et al [6].

Table 1 – Key model parameters used by Policy1-Bowel.

Key model parameter	Value	Reference
iFOBT test characteristics (per person)		
Specificity for any adenoma	94.8%	Obtained via calibrating to iFOBT positivity rates observed in NBCSP and colonoscopy outcomes among positive iFOBT (1)
Sensitivity for conventional adenoma of any size	15.2%	
Sensitivity for conventional adenoma > 5mm	30.2%	
Sensitivity for conventional adenoma >10mm	41.5%	
Sensitivity for CRC	58.6%	
Colonoscopy test detection rate (per lesion)		
Conventional adenoma 1-5 mm	79%	Van Rijn et al 2006 (8)
Conventional adenoma 6-9 mm	85%	
Conventional adenoma ≥10mm	92%	
Sessile serrated lesions (any size)	78%	
CRC (any stage)	95%	
Colonoscopy completion rate	100% to the end of cecum	Based on values used in Lew et al (1)
Colonoscopy adverse event probability		
Non-fatal adverse event	0.27%	AIHW 2015 (9)
Death	0%	AIHW 2015 (9), Jentschura et al 1994 (10)
Baseline colonoscopy compliance rate		
Follow-up colonoscopy after positive iFOBT result	71%	AIHW 2015 (9)
Surveillance colonoscopy	80%	Based on values used in Lew et al (1)
5-year survival rate in patient with symptomatically-detected CRC		
Stage 1 cancer	86.9%	Morris et al 2007 (11)
Stage 2 cancer	73.0%	
Stage 3 cancer	42.4%	
Stage 4 cancer	9.5%	
Relative 5-year survival of screen-detected CRC versus symptomatically-detected CRC		
Stage 1 cancer	1.1	Parente et al 2015, Gill et al 2014, Pande et al 2013 (12-14)
Stage 2 cancer	1.2	
Stage 3 cancer	1.4	
Stage 4 cancer	2.3	

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