# Implenomics

# Background

- New cancer screening tests are currently in various stages of development and could revolutionize early detection of cancer.
- These tests will differ in cost, sensitivity and specificity for polyps and cancer detection, and in screening intervals.
- Although screening colonoscopy can remove polyps and prevent colorectal cancer, patients are not always willing to undergo invasive screening and endoscopy capacity is constrained.
- Stool and blood-based tests offer alternative approaches for screening and early detection, but they differ in their screening performance and cost.
- The objective of this modeling study is to evaluate current and future colorectal cancer screening tests to assess life years saved and cost-effectiveness based on recent guidelines that recommend screening from age 45 years to 75 years.

# Methods

- We used a validated microsimulation model with three interlinked components -- risk assessment, natural history, and screening/treatment modules -- based on the framework presented in Figure 1.
- The USPSTF recommends multiple screening tests. The most frequently used are colonoscopy every 10 years (Colo-10), fecal immunochemical test annually (FIT-1), fecal DNA-FIT every one to three years (fDNA-1 and fDNA-3).
- Blood-based testing could be available for colorectal cancer in the future. We assess testing intervals of one and three years (cfDNA-1 and cfDNA-2).
- The screening test performance characteristics and cost are presented in Table 1
- Adherence to repeated screening as well as adherence to follow-up colonoscopy were assessed to determine the impact on effectiveness measures and incremental cost-effectiveness ratios.
- All effectiveness and cost measures were discounted at a 3% rate.



### Figure 1. Framework for Modeling Colorectal Cancer Prevention

# Assessing the Effectiveness and Cost of Technologies to Screen for Colorectal Cancer

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### **Table 1. Screening Test Perform**

	FIT	fDNA	cfDNA	Colonoscopy
Sensitivity for small polyps (<=5mm)	7.0	15.0	_	75.0
Sensitivity for medium polyps (6- 9mm)	7.0	15.0	_	85.0
Sensitivity for large polyps (>=10mm)	22.0	42.0	13.0	95.0
Sensitivity for cancer	74.0	94.0	83.0	95.0
Specificity	97.0	91.0	90.0	86.0
Cost	\$42	\$512	\$895	\$1,608

## Results

- Figure 2 presents the colorectal cancer cases and deaths for each screening test and specified screening interval. Colo-10 is the most effective approach.
- Figure 3 shows the colorectal cancer deaths based on different adherence rates. At 50% adherence, there is much less variation in colorectal cancer deaths compared to the 100% adherence.
- Table 2 provides the incremental cost effectiveness ratios and highlights that low adherence with follow-up colonoscopy has a substantial impact on effectiveness and cost.



### Figure 2. Colorectal Cancer Cases and Deaths

Note: Colorectal cancer cases and deaths per 1,000 40-year-olds



### Table 2. Outcomes per 1,000 40-year-olds by strategies

	Undiscounted			Discounted at 3%						
	Stool or blood tests	All colonoscopies		Life years saved	Additional cost	Incremental cost effectiveness ratios				
100% screening and follow-up colonoscopy adherence										
FIT-1	18,735	1,628		103	Savings					
Colo-10		3,863		111	\$721,617	\$6,491				
fDNA-3	7,020	1,601		98	\$934,064	\$9,490				
fDNA-1	13,398	2,322		109	\$3,744,086	\$34,253				
cfDNA-3	7,971	1,080		68	\$3,936,711	\$57,745				
cfDNA-1	16,991	1,758		86	\$9,382,409	\$108,735				
100% screening and 50% follow-up colonoscopy adherence (selected tests)										
FIT-1	21,552	1,232		88	Savings					
fDNA-3	7,964	1,149		76	\$1,335,581	\$17,581				
cfDNA-1	20,562	1,258		74	\$11,340,152	\$154,031				

• Although most screening tests are within the acceptable threshold of costeffectiveness, blood-based tests as currently priced have the highest incremental cost per life year saved compared to no screening.

- effectiveness.

- reduce cost-effectiveness.
- their impact on cost-effectiveness.

# **Contact Information**

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![](_page_0_Figure_58.jpeg)

# Conclusion

• High adherence with FIT-based screening results in cost savings and high level of

• Adherence to screening recommendations have a substantial impact on effectiveness and can vary by test and screening interval.

• For stool and blood-based test, high adherence to follow-up colonoscopy after abnormal findings is essential to maximize effectiveness and cost-effectiveness. • Interventions to increase screening and diagnosis adherence will increase cost and

• Future analysis should further evaluate the role of these interventions and