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BC Colon Screening Program

Screening for colorectal cancer saves lives. It is more effective when undertaken in an organized screening program.

ABSTRACT: Screening for colorectal cancer reduces colorectal cancer–related morbidity, mortality, and incidence. Screening is most effective when administered through an organized program. The BC Colon Screening Program uses a biennial fecal immunochemical test to screen average-risk individuals from 50 to 74 years of age. The program facilitates colonoscopy for those with a positive fecal immunochemical test or as a primary screening strategy for individuals with a high-risk family history. The program is responsible for the technology infrastructure, recalling participants for repeat testing, setting quality standards, and monitoring participant outcomes. A comprehensive quality assurance and improvement program underpins screening activities and includes regular feedback to participating physicians and health authorities.

Screening for colorectal cancer

Colorectal cancer is the third-most-common cancer diagnosis in British Columbia and the second-leading cause of cancer death. It will affect approximately 1 in 14 men and 1 in 16 women during their lifetime.[1]

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Screening for colorectal cancer detects cancer at an earlier stage of disease, which reduces associated morbidity and mortality and leads to the detection and removal of precancerous colorectal lesions, thereby reducing colorectal cancer incidence. In Canadian modeling studies, several colon screening strategies have been shown to be cost-effective.[2] Screening for colorectal cancer with a biennial fecal occult blood test such as the fecal immunochemical test, preferably conducted through a screening program, is one of the strategies recommended by the Canadian Task Force on Preventive Health Care.[3]

Why screen for colorectal cancer?

- It reduces deaths due to colorectal cancer.
- It reduces diagnoses of colorectal cancer.
- It reduces colorectal cancer treatment morbidity (stoma, adjuvant radiation/chemotherapy).
- It is cost-effective.

The best evidence for screening is derived from trials that randomly assign individuals to a control group (no invitation to screen) or to a group that receives an invitation to be screened. **Table 1** presents the pooled results from randomized controlled trials that assessed annual or biennial guaiac fecal occult blood tests (gFOBTs), 1- or 2-time flexible sigmoidoscopy, and colonoscopy.[4,5] The results are the intention to screen results, which reflect analysis of the entire cohort, whether or not they participated in screening. The period for detecting meaningful differences in colorectal cancer incidence and mortality is at least 10 years. While the meta-analysis of pooled gFOBT trials did not demonstrate a decrease in overall colorectal cancer incidence,[4] there was a reduction in late-stage colorectal cancer incidence: relative risk = 0.92 (95% CI, 0.85-0.99).[3] Colon screening did not reduce all-cause mortality.[3,4]

The gFOBT has been supplanted by the fecal immunochemical test. Several brands are available, which produce either qualitative (positive or negative) or quantitative (mcg globin/g feces) results. Fecal immunochemical tests contain antibodies to human globin, are more specific than gFOBTs, and do not require dietary or medication restrictions. Furthermore, fecal immunochemical tests require a single sample of stool compared with the three specimens required with gFOBTs. These factors have contributed to improved participation in screening

TABLE 1. Results from randomized controlled trials on colon screening.

Test	Trial	CRC incidence RR (95% CI)	CRC mortality RR (95% CI)	Follow-up (years)
gFOBT[4]	Pooled results 5 trials	1.02 (0.93-1.12) 0.90 (0.77-1.04)	0.91 (0.84-0.98) 0.78 (0.65-0.93)	19.5 30.0
Flexible sigmoidoscopy[4]	Pooled results 4 trials	0.78 (0.74-0.83)	0.74 (0.68-0.80)	11.0–17.0
Colonoscopy[5]	NordICC trial	0.82 (0.70-0.93)	0.90 (0.64-1.16)	10.0

CRC = colorectal cancer; RR = relative risk; gFOBT = guaiac fecal occult blood test.

with fecal immunochemical tests compared with gFOBTs.[6] Fecal immunochemical tests also have improved sensitivity in detecting colorectal cancer and high-risk precancerous lesions compared with gFOBTs.[6]

Three trials are currently comparing the results of fecal immunochemical tests with those of colonoscopy.[7-9] A Spanish study (COLONPREV)[7] and a Swedish study (SCREESCO)[8] have published their preliminary results following the first and second rounds of fecal immunochemical test screening, respectively. Both studies report that the group randomly assigned to receive a fecal immunochemical test had a higher participation rate, a similar colorectal cancer detection rate, and a lower high-risk precancerous lesion detection rate compared with the group that underwent a colonoscopy. The final results on differences in colorectal cancer incidence, stage, and mortality will be published when 10 years of follow-up have been completed.

Colon screening programs

Colon screening activities can be divided into programmatic and opportunistic. Programmatic screening is organized, serves a defined population, is supported by technology infrastructure, encompasses quality assurance, and monitors important outcomes such as colorectal cancer incidence, stage, and related mortality. For these reasons, screening in an organized program is recommended where available. The Canadian provinces and territories have implemented or announced plans to implement population-based screening.[10] Implementation of population-based screening has been shown to improve screening participation and important clinical outcomes of reduced colorectal cancer incidence and related deaths.[11,12]

BC Colon Screening Program

The BC Colon Screening Program, implemented on 15 November 2013, offers biennial fecal immunochemical testing to average-risk individuals and provides a follow-up colonoscopy for abnormal results. BC chose a quantitative fecal immunochemical test with a low positivity cutoff of 10 mcg globin/g feces to maximize sensitivity. Individuals with a high-risk family history of colorectal cancer are offered colonoscopy; individuals with a personal history of precancerous lesions are offered a fecal immunochemical test or colonoscopy, as per the BC Guidelines.[13,14] A high-risk family history is defined as a single first-degree relative diagnosed with colorectal cancer before the age of 60 years or two or more first-degree relatives diagnosed at any age. In June 2015, the Northern Health Authority, representing 5.5% of the screening age–eligible BC population, withdrew from the provincial program to follow local screening processes.

Eligibility criteria for the BC Colon Screening Program are as follows:

Who is eligible?

- Average-risk asymptomatic individuals from 50 to 74 years of age.
- High-risk family history, from 40 years of age or 10 years younger than the earliest affected relative to 74 years of age.
- Personal history of precancerous lesions, when due for colonoscopy to 74 years of age.

Who is not eligible and requires individualized care?

- Personal history of colorectal cancer.
- Personal history of Crohn disease or ulcerative colitis.
- Hereditary colon cancer syndrome (e.g., Lynch syndrome).
- Lower gastrointestinal symptoms or new iron-deficiency anemia.

Eligible British Columbians are referred to the Colon Screening Program by their primary care provider, with either a lab requisition form to complete a fecal immunochemical test or a colonoscopy referral form for higher-risk individuals **[Figure 1]**. Once individuals are registered, the Colon Screening Program organizes colonoscopy referrals when required and recalls participants for future fecal immunochemical testing or colonoscopy when due. The following data are collected and stored: participant demographics, participant satisfaction, fecal immunochemical test values, colonoscopy results, pathology results, unplanned medical events that occur in the 14 days following colonoscopy, colorectal cancer diagnoses, colorectal cancer stage, and colorectal cancer–related mortality.

Participation

In 2021, 59% of eligible BC residents were up-to-date with colon screening, defined as having completed a fecal immunochemical test within the past 30 months or a colonoscopy within the last 10 years. Approximately 40% of British Columbians are screened through the Colon Screening Program; an additional 20% access screening outside the program in an opportunistic fashion. Individuals are more likely to be up-to-date with screening if they are participating in the Colon Screening Program (odds ratio = 7.43 [95% CI, 7.38-7.48, $P < .05$]). These results were derived from MSP data and do not account for individuals who are recommended to undergo shorter-interval colonoscopy, such as those with a high-risk family history of colorectal cancer.

In BC, more than 90% of fecal immunochemical tests performed on 50- to 74-year-olds are registered in the Colon Screening Program. In 2020, 33.1% of age-eligible individuals had completed a fecal immunochemical test under the Colon Screening Program in the previous 30 months: 53% were female, and the mean age was 62 years. Screening participation was lowest in the cohort between 50 and 60 years of age.

Retention rate is the proportion of patients who return for a subsequent round of screening; it is an important indicator of long-term participation. If individuals do not return to screen again, it becomes increasingly difficult to maintain participation. Retention rate in the BC Colon Screening Program is approximately 56%. Notably, retention improved to 64% in 2019 when fecal immunochemical test requisitions were mailed directly to participants, which obviated the need for individuals to visit their primary care provider. There continue to be barriers to accessing fecal immunochemical testing, and provinces

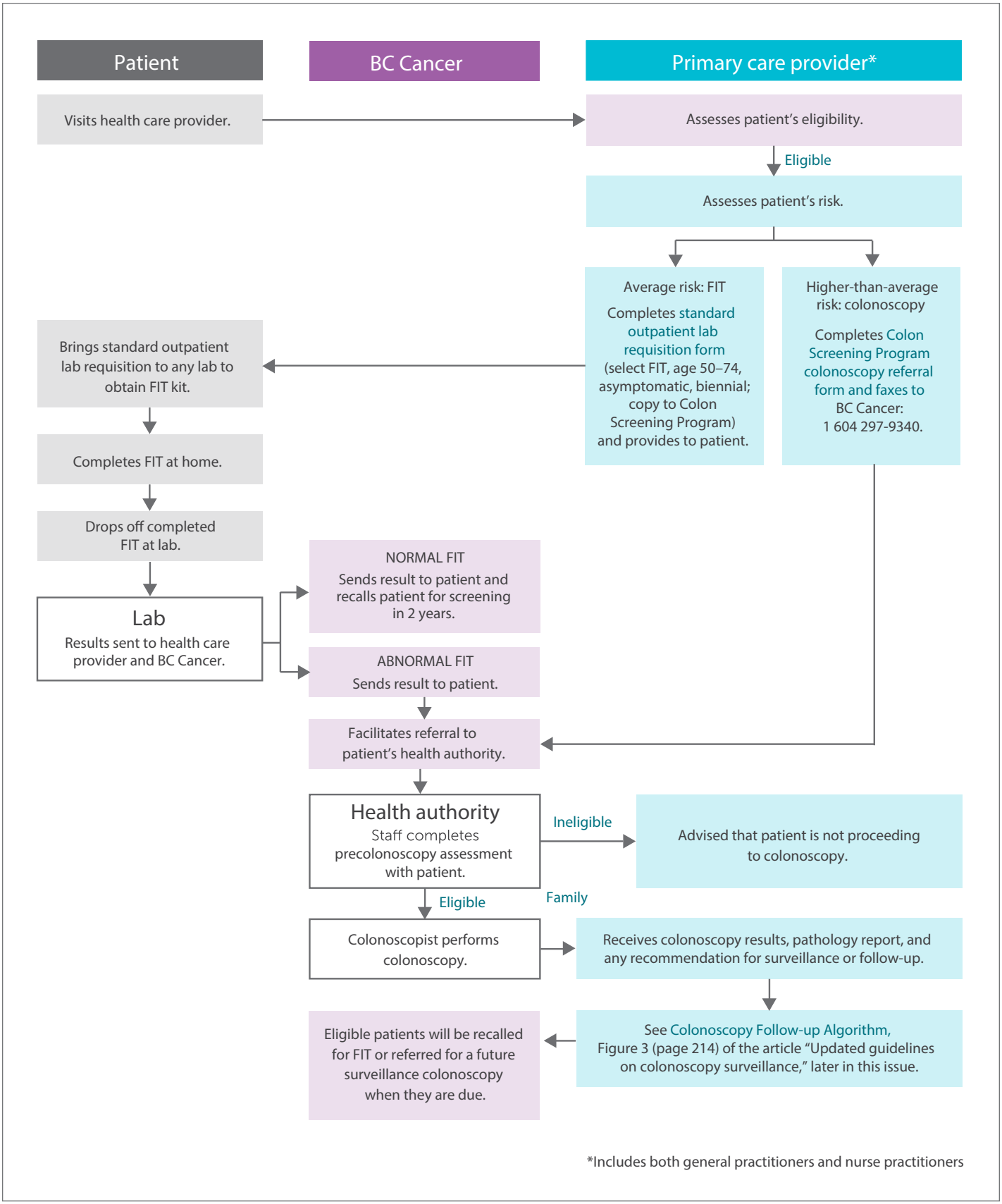

FIGURE 1. Colon screening patient pathway.
FIT = fecal immunochemical test.

(Source: BC Colon Screening Program)

that mail kits to participants report retention rates approximately 10% higher than those recorded in BC.

Fecal immunochemical test performance

BC uses a single-specimen quantitative fecal immunochemical test with a positivity cutoff of 10 mcg globin/g feces (OC-SENSOR, Eiken Chemical Co., Ltd., Tokyo, Japan), which is available at all outpatient laboratories. Once the stool specimen has been added, the kit must be analyzed within 15 days, because the globin can degrade with time, which can lead to false-negative results.

Fecal immunochemical test performance characteristics vary across brands, but the OC-SENSOR is commonly used worldwide and has been studied extensively. A systematic review and meta-analysis of studies that assessed fecal immunochemical test performance characteristics, using colonoscopy as the gold standard, reported sensitivity and specificity in the detection of colorectal cancer as 88% and 91%, respectively, based on the same brand and cutoff used in BC.[15] However, the true value of fecal immunochemical testing is realized with regular serial testing over time.[16] For instance, the Taiwanese Nationwide Colorectal Cancer Screening Program, which includes OC-SENSOR (cutoff of 20 mcg globin/g feces) as one of the two fecal immunochemical test brands used, reported a 34% reduction in advanced-stage colorectal cancer (adjusted relative risk = 0.66 [95% CI, 0.63-0.70]) and a 40% reduction in colorectal cancer mortality (adjusted relative risk = 0.60 [95% CI, 0.57-0.64]) after 10 years of follow-up.[17]

In BC, the overall fecal immunochemical test positivity rate is 9.8% and is slightly higher for first-round screening compared with a subsequent fecal immunochemical test following a previous negative one. Positivity increases with age and is higher in males, which is a reflection of the increased prevalence of colorectal neoplasia.

In 2020, of the nearly 20 000 participants in the BC Colon Screening Program who had a positive fecal immunochemical test and were referred for colonoscopy, 73% completed the colonoscopy: 2% were diagnosed with colorectal cancer, and 19% had a high-risk precancerous lesion removed. The number of participants needed to be screened to detect one individual with colorectal cancer was 684, and the number needed to detect one individual with colorectal cancer or a high-risk precancerous lesion was 56. Of those with a positive fecal immunochemical test, the number needed to receive a colonoscopy to detect one individual with colorectal cancer was 44, and the number needed to detect one individual with colorectal cancer or a high-risk precancerous lesion was 5.

Individuals with a positive fecal immunochemical test who do not undergo a follow-up colonoscopy are at an increased risk of dying from colorectal cancer compared with patients who undergo appropriate follow-up.[18] Patient navigation has been shown to increase patient compliance with follow-up colonoscopy.[19] Patient navigation is an integral part of the BC Colon Screening Program and is the responsibility of health authority patient coordinators—nurses trained in navigating a patient through the precolonoscopy and postcolonoscopy periods **[Box]**; their roles are to assess, educate, schedule, and follow up with each patient undergoing colonoscopy and to liaise with primary care providers and specialists as needed. Because most screening program participants are otherwise healthy, some jurisdictions have trained clerks to screen patients who are referred for colonoscopy to identify those with comorbid medical conditions and to book a precolonoscopy assessment with a patient coordinator. The remaining patients receive educational information and are scheduled for colonoscopy by the clerk. All participants receive a postcolonoscopy phone call from the patient coordinator.

Quality assurance and improvement

An important cornerstone of programmatic screening is a robust quality assurance program that influences screening policy and day-to-day practice **[Figure 2]**. The BC Colon Screening Program monitors clinical outcomes through regular audits and measures the results against established benchmarks when available. To oversee

BOX. Patient navigation in the BC Colon Screening Program.

The patient coordinator:

- **Contacts the patient and completes a precolonoscopy assessment:**
  - Indication for colonoscopy is confirmed.
  - Medical history is taken with particular attention to comorbidities that may increase the risk of colonoscopy-related adverse events (e.g., antithrombotic use; diabetes; cardiac, respiratory, and renal disease).
- **Is responsible for patient education:**
  - Oral and written information on what to expect before, during, and after colonoscopy.
  - Bowel preparation and diet restrictions.
  - Risks of colonoscopy.
  - Sedation options and the need for an accompanying adult to and from the hospital.
- **Coordinates with primary care providers, specialists, local thrombosis clinics, and the colonoscopist, as required, to navigate:**
  - Pericolonoscopy changes in medications.
  - Precolonoscopy specialist consultations.
- **Schedules the colonoscopy appointment:**
  - To improve patient compliance and satisfaction, patient coordinators offer various dates, times of day, and, when possible, colonoscopy sites.
- **Communicates with providers and the Colon Screening Program:**
  - If a patient does not meet the eligibility criteria or they decline colonoscopy, this is communicated to their referring provider to ensure appropriate follow-up.
- **Contacts the patient 14 days postcolonoscopy:**
  - To determine if the patient had any unplanned medical events the day before (during the bowel preparation) and up to 14 days following colonoscopy.
  - To communicate colonoscopy results and future screening recommendations.

these activities, the program established a provincial quality management committee with physician colonoscopy leads from each health authority and representation from primary care, pathology, lab medicine, and operations.

Colonoscopy performance

Ensuring high-quality colonoscopy is essential to colon screening success. The BC Colon Screening Program mandates that all colonoscopy sites actively participate in a quality assurance initiative, the Canada-Global Rating Scale.[20] A high-quality colonoscopy is safe, effective, and comfortable. Colonoscopy effectiveness refers to the detection of colorectal cancer and precancerous lesions and the complete removal of all precancerous lesions. Postcolonoscopy colorectal cancer refers to colorectal cancer that is diagnosed following a colonoscopy in which colorectal cancer was not detected and is attributed, in part, to missed colorectal cancer and missed or incompletely resected precancerous lesions. To minimize the risk of postcolonoscopy colorectal cancer, the bowel preparation must be adequate, the colonoscopy must be complete to the cecum, and the colonoscopist must inspect the entire colonic mucosa and have the technical skill to completely resect precancerous lesions or, in the case of advanced lesions, refer to an expert colonoscopist. Colonoscopy performance at an aggregate and individual physician level is monitored in the Colon Screening Program. For example, adenoma detection rate is a quality indicator of colonoscopy and is associated with patient-, procedure-, and physician-related variables.[21] Patients of physicians who have a lower adenoma detection rate have a higher risk of developing and dying from postcolonoscopy colorectal cancer.[22,23] Each year, physicians in the Colon Screening Program who perform colonoscopy receive a report detailing their individual adenoma detection rate, among other colonoscopy indicators, and whether they are meeting the benchmarks. The Colon Screening Program also supports direct observation of procedural skills,

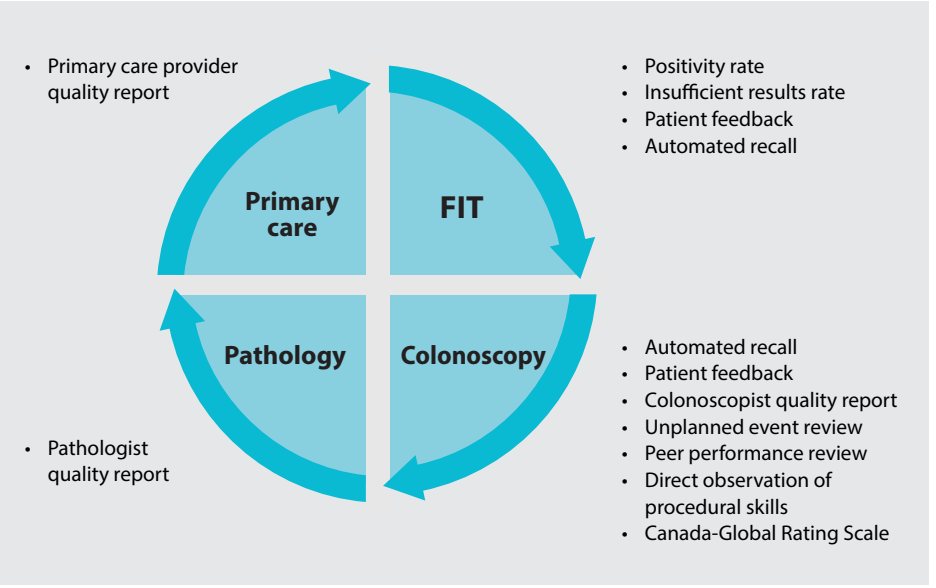

FIGURE 2. Quality assurance in the BC Colon Screening Program.
FIT = fecal immunochemical test.

BC CANCER COLON SCREENING
Provincial Health Services Authority

Colon Screening Program Quality Report (2019 Results)

Colon Screening Statistics	YOUR RESULTS (2019)[1]	PROVINCIAL RESULTS (2019)[2]
Registrations		
Average Risk Patients (FIT screening)	176	270,443
Higher Than Average Risk Patients (colonoscopy screening)	2	3,033
FIT Results		
FIT Positivity Rate[3] (%)	8.8%	11.9%
Colonoscopy		
Average Risk Patients		
Number of patients with positive FIT that had a colonoscopy	13 (76.5%)	19,865 (62.1%)
Number of cancers identified[4]	0 (0.0%)	365 (1.9%)
Number of pre-cancerous polyps identified[5]	6 (46.2%)	11,125 (56.7%)
Higher Than Average Risk Patients		
Number of patients with a family history/personal history that had a colonoscopy[6]	2 (100.0%)	1,963 (64.7%)
Number of cancers identified[7]	0 (0.0%)	4 (0.2%)
Number of pre-cancerous polyps identified[8]	0 (0.0%)	1,072 (55.1%)
Inappropriate Referrals		
Number of patients referred for FIT outside of the eligible age range (50-74)	3 (1.7%)	13,245 (4.9%)
Number of patients referred to colonoscopy with inaccurate family history	0 (0.0%)	98 (3.3%)
Number of patients with a normal FIT recalled prior to 21 months[9]	5 (4.4%)	20,335 (15.0%)
Number of patients that underwent FIT when colonoscopy was the next recommended screening test	0 (0.0%)	263 (2.0%)

FIGURE 3. Example of the BC Colon Screening Program primary care provider quality report.
FIT = fecal immunochemical test. (Source: BC Colon Screening Program)

whereby two trained assessors observe a colonoscopist perform two colonoscopies and complete a validated tool that assesses technical and nontechnical skills.[24] Formative feedback on whether the colonoscopist is meeting standards is provided. Direct observation of procedural skills achievements have been associated with precancerous lesion detection rates.[21] Peer support and hands-on courses on colonoscopy skills improvement are available to colonoscopists who participate in the program.

At the outset of the Colon Screening Program, the quality of colonoscopy performance in BC was unknown. When inviting asymptomatic individuals to undergo a colonoscopy, it is important to ensure the procedure is safe. All unplanned medical events that occur in the pericolonoscopy period are identified, and those that result in death, hospital admission, or additional procedures are carefully reviewed by the committee to determine whether a colonoscopy-related serious adverse event has occurred. These results are reported in aggregate form and to individual colonoscopists. In the BC Colon Screening Program, the rate of serious adverse events associated with colonoscopy is consistent with that of other jurisdictions and meets accepted benchmarks.[25]

Primary care providers who refer patients to the program receive a regular quality report **[Figure 3]**. Quality reports are also sent to pathologists and health authorities.

Summary

Screening for colorectal cancer saves lives. It is more effective when undertaken in an organized screening program. The benefits of the BC Colon Screening Program include the following:

- Automatic recall in 2 years, with mailed laboratory requisition for fecal immunochemical tests.
- Facilitated referral for surveillance colonoscopy when due.
- Patient navigation.
- Audit of outcomes.
- Quality assurance initiatives.

In late 2023, the BC Colon Screening Program will mark the 10-year anniversary of its province-wide implementation, an important time horizon for colon screening outcomes. Over the next several years, the results of the program will become evident and will be shared with the BC medical community. ■

Competing interests

None declared.

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