Rapid Synthesis

Identifying Features of Screening Approaches for People at Increased Risk for Colorectal Cancer

31 August 2020

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Rapid Synthesis:
Identifying Features of Screening Approaches for People at Increased Risk of Colorectal Cancer

30-day response

31 August 2020

McMaster Health Forum

The McMaster Health Forum's goal is to generate action on the pressing health-system issues of our time, based on the best available research evidence and systematically elicited citizen values and stakeholder insights. We aim to strengthen health systems – locally, nationally, and internationally – and get the right programs, services and drugs to the people who need them.

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Timeline

Rapid syntheses can be requested in a three-, 10-, 30-, 60- or 90-business-day timeframe. This synthesis was prepared over a 30-business-day timeframe. An overview of what can be provided and what cannot be provided in each of the different timelines is provided on McMaster Health Forum's Rapid Response program webpage (www.mcmasterforum.org/find-evidence/rapid-response).

Funding

The rapid-response program through which this synthesis was prepared is funded by the Canadian Partnership Against Cancer. The McMaster Health Forum receives both financial and in-kind support from McMaster University. The views expressed in the rapid synthesis are the views of the authors and should not be taken to represent the views of the Canadian Partnership Against Cancer or McMaster University.

Conflict of interest

The authors declare that they have no professional or commercial interests relevant to the rapid synthesis. The funder played no role in the identification, selection, assessment, synthesis or presentation of the research evidence profiled in the rapid synthesis.

Merit review

The rapid synthesis was reviewed by a small number of policymakers, stakeholders and researchers in order to ensure its scientific rigour and system relevance.

Acknowledgments

The authors wish to thank David Armstrong and Paul James for their insightful comments and suggestions.

Citation

Bhuiya AR, Scallan E, Sharma K, Wilson MG. Rapid synthesis: Identifying features of screening approaches for people at increased risk of colorectal cancer. Hamilton, Canada: McMaster Health Forum, 31 August 2020.

Product registration numbers

ISSN 2292-7999 (online)

KEY MESSAGES

Questions

- What are appropriate criteria for defining individuals at average and increased risk of colorectal cancer, (CRC) and optimal approaches for managing CRC screening for individuals at average and increased risk?
- What are the features of screening programs in Canada and common comparator countries that have implemented an increased risk of CRC screening-management system?

Why the issue is important

- Colorectal cancer (CRC) is the second leading cause of cancer deaths and the third-most commonly diagnosed cancer in Canada.
- To ensure appropriate triage and management for CRC, there is a need to ensure screening programs are identifying individuals deemed to be at 'increased risk' of developing colorectal cancer.
- Individuals at increased risk of CRC are not identified in some provinces in Canada and are therefore not being screened according to established guidelines.
- This rapid synthesis was requested to identify features of screening programs to inform how to address this issue.

What we found

- We conducted a synthesis of clinical practice guidelines and systematic reviews, as well as a jurisdictional scan of screening programs that have implemented an increased risk of CRC screening-management system.
- We identified 14 clinical practice guidelines produced in Canada (n=4), the United States (n=6), one or more European countries (n=3), and one that had a general international focus, as well as six systematic reviews, of which three were assessed high methodological quality and three of medium quality.
- When defining individuals at average CRC risk, most guidelines included those who are above the age of 50 years with no personal or family history of CRC, with no hereditary syndromes (such as familial adenomatous polyposis or Lynch syndrome), and without a history of abdominal or pelvic radiation, previous cancer or history of inflammatory bowel disease. Additionally, we found similarities among the guidelines when describing different screening approaches such as fecal immunochemical test (FIT), fecal occult blood test (FOBT), flexible sigmoidoscopy (FS), CT colonography, and colonoscopy.
- There were consistencies when defining an individual at increased CRC risk, which include: 1) personal history of adenomatous polyps; 2) personal history of inflammatory bowel disease, 3) signs or symptoms of CRC; 4) abdominal or pelvic radiation; 5) personal history of CRC; 6) suspected or confirmed hereditary syndromes (such as familial adenomatous polyposis or other polyposis syndromes, Lynch syndrome; and/or 7) family history of CRC in one or more first-degree relatives (FDR), and in certain situations, reviewing the family history of second-degree relatives (SDR). All of the guidelines identified colonoscopy as the recommended screening test approach. Generally, the surveillance interval after a normal colonoscopy in an average-risk individual was either every five to 10 years, starting at age 50 years, or 10 years prior to the earliest diagnosis of an FDR. Some guidelines recommended additional genetic counselling and testing for further risk assessment in patients with suspected hereditary syndromes.
- We found Canadian provinces and territories have implemented formal or informal processes for managing patients at higher risk of colorectal cancer (CRC). In general, there is limited public information available regarding how and when patients or their care providers are notified about when or how to screen patients throughout their care pathway.
- There are variable approaches to CRC risk stratification and screening processes among the other countries we reviewed (Australia, New Zealand, U.K., U.S.). The specific pathway varies between jurisdictions, but once patients are part of an official screening program there is communication between screening program members and referring physicians (including take-home screening tests or referrals for colonoscopy).
- Generally, there is limited information available regarding tools and approaches for collecting information on personal and/or family-health history.

QUESTIONS

- What are appropriate criteria for defining individuals at average and increased risk of colorectal cancer, (CRC) and optimal approaches for managing CRC screening for individuals at average and increased risk?
- What are the features of screening programs in Canada and common comparator countries that have implemented an increased risk of CRC screening-management system?

WHY THE ISSUE IS IMPORTANT

Colorectal cancer (CRC) is the second leading cause of cancer deaths, and the third-most commonly diagnosed cancer in Canada.(1; 2) In 2020, 73 Canadians will be diagnosed with CRC every day. Specifically, it is estimated that one in 14 Canadian men and one in 18 Canadian women will develop CRC in their lifetime. The incidence and death rates have been declining over the years partly due to improvements in CRC screening programs across Canada.(3)

To ensure appropriate triage and management for CRC, there is a need to ensure screening programs are identifying individuals deemed to be at 'increased risk' of developing colorectal cancer due to familial or personal-health histories. Though definitions vary, individuals at 'average risk' for CRC generally refers to people between the ages of 50-74 years of age, with no personal history of CRC, polyps, inflammatory bowel disease or symptoms of CRC, and no family history of CRC, familial adenomatous polyposis or hereditary non-polyposis colorectal cancer. As a result of the assumption of 'average risk' in organized screening approaches in some provinces, individuals at increased risk are not receiving referral to screening or follow-up according to established guidelines.

This rapid synthesis was requested by the Canadian Partnership Against Cancer to support partners in Manitoba to identify features of screening programs to inform how to address this issue.

Box 2: Identification, selection and synthesis of research evidence

We identified research evidence (systematic reviews and clinical practice guidelines) by searching (in July 2020) ACESSSS (https://www.accessss.org/), the Cancer Guidelines Database from CPAC (https://www.partnershipagainstcancer.ca/tools/cancer-guidelines-database/), HealthEvidence (www.healthevidence.org), Health Systems Evidence (www.healthsystemsevidence.org), and the International Guideline Library from the Guidelines International Network (GIN) (www.g-i-n.net/library/international-guidelines-library/international-guidelines-library). Our search strategies used for each database were limited to those published since 2015 and in English (based on the scope provided by the requestor) and used terms and categories outlined below.

- ACCESSSS: colorectal cancer screen* (n=109 summary clinical texts, five systematic guidelines and 58 systematic reviews. Single studies not reviewed)
- Cancer Guidelines Database (CPAC): colorectal (filter under "cancer type" AND screening (filter under "continuum of care" (n=38)
- HealthEvidence: colorectal (open search term) AND cancer (category under intervention strategy) AND cancer (category under topic area) (n=22)
- Health Systems Evidence: colorectal screen* (open search term) AND cancer (category under the diseases filter) AND overviews of reviews, systematic reviews of effects and systematic reviews addressing other questions (categories under type of document) (n=11)
- International Guideline Library (GIN): colorectal screen* (n=8)

Results were assessed by one reviewer for inclusion. A document was included if it fit within the scope of the questions posed for the rapid synthesis.

For each systematic review we included in the synthesis, we documented the focus of the review, key findings in relation to the questions posed for the rapid synthesis, last year the literature was searched (as an indicator of how recently it was conducted), methodological quality using the AMSTAR quality appraisal tool (see the Appendix for more detail), and the proportion of the included studies that were conducted in Canada. For clinical-practice guidelines, we documented the focus of the guideline, the country(ies) included as the focus of the guideline, the publication date, key findings in relation to the questions posed for the rapid synthesis, and a quality appraisal based on the AGREE instrument (if provided by the database indexing the guideline). We then used this extracted information to develop a synthesis of the key findings from the included reviews and guidelines.

WHAT WE FOUND

We conducted a synthesis of research evidence related to recommendations from clinical practice guidelines and systematic reviews, as well as an analysis of screening programs that have implemented an increased risk of CRC screening-management system in

Canadian provinces and territories, and in Australia, New Zealand, the United Kingdom and the United States (in the Dartmouth-Hitchcock Health System, Johns Hopkins and Kaiser Permanente). The findings from each component are provided below.

Findings from clinical practice guidelines and systematic reviews

We identified 14 relevant clinical practice guidelines, which included findings on defining average and increased risk among individuals in addition to optimal screening approaches for both risk groups. The guidelines were produced in Canada (n=4), the United States (n=6), one or more European countries (n=3), and one with a general international focus. In addition, we identified six systematic reviews, of which three were assessed as high methodological quality and three of medium quality. We provide detailed findings from these documents in Table 1 with more details provided in Appendix 1 (for guidelines) and Appendix 2 (for systematic reviews).

Defining individuals at average CRC risk

We found consistencies among the guidelines when defining individuals at average CRC risk, which typically included those who are above the age of 50 years with no personal or family history of CRC, with no risk factors (e.g., hereditary syndromes such as familial adenomatous polyposis or Lynch syndrome), without a history of abdominal or pelvic radiation due to previous cancer, or a history of inflammatory bowel disease.(4-9) One guideline from 2017 by the US Multi-Society Task Force on Colorectal Cancer recommended that the African-American population group should begin CRC screening at age 45.(10) The upper-bound age slightly diverged in two guidelines, where a 2019 guideline published by the Clinical Effectiveness Research Group included individuals between the ages of 50 and 79 years with a life expectancy of at least 15 years,(9) and the 2019 American Society of Clinical Oncology defined it as individuals from 50 to 75 years old.(5)

Regarding other age intervals, two U,S. guidelines described that individuals aged 76 years and older should consult their providers to determine whether a CRC screening is appropriate for their health and their usual care routine.(6; 7) One of the two guidelines discouraged CRC screening among individuals over the age of 85.(6)

Additionally, two of the six identified reviews provided a description or definition of an individual at average CRC risk.(11; 12) These reviews generally described individuals with average risk and those who are asymptomatic and do not have CRC risk factors.(11; 12) One review included adults who were aged 40 years or older in addition to the aforementioned criteria.(11)

Optimal screening approaches for individuals at average CRC risk

We found consistencies among the guidelines and supporting evidence when describing different screening approaches for populations including individuals with average CRC risk. Fecal immunochemical test (FIT), fecal occult blood test (FOBT, including gFOBT), and flexible sigmoidoscopy (FS) were commonly recommended options as population-based screening approaches,(5-8; 10; 13) with some guidelines broadly describing CT colonography and colonoscopy as more costly approaches for individuals meeting a certain criteria.(5-8; 10; 14)

There was some divergence on the primary or first-tier screening approach among the guidelines that described which screening approach is optimal. For example, a 2016 guideline by the Canadian Task Force on Preventive Health Care recommended screening average-risk adults aged 50 to 59 with FOBT (gFOBT or FIT) or FS, based on reported benefits and cost-effectiveness. When comparing FIT to gFOBT, the guidelines indicate that FIT has a higher sensitivity, with most provincial programs in Canada using FIT as the primary screening approach. Additionally, the guidelines do not recommend colonoscopy as the screening approach for this population group.(13) However, a recent 2019 guideline by the German Guideline Program

in Oncology recommended colonoscopy as the standard screening test (with FS or FOBT as alternatives if a patient refuses a colonoscopy).(9) A 2017 guideline from the U.S. Multi-Society Task Force on Colorectal Cancer recommended FIT or colonoscopy as the first-tier screening approach.(10)

Regarding population-based screening approaches, a high-quality network meta-analysis reported a 21% reduction in the incidence of CRC due to FIT screening, but the authors reported that additional cohort studies are needed to ascertain the long-term effects of this screening approach.(15) Additionally, one medium-quality review found that annual or biennial screening with FIT are cost-effective compared to a 10-year interval of colonoscopy.(16) FS was associated with a 21-30% reduction,(15; 17; 18) but one-medium quality review found insufficient evidence to suggest screening intervals.(12) Regarding FS, the guidelines frequently mentioned a surveillance interval of every five to 10 years, with some reporting the use of annual FIT in combination with FS. Lastly, we found consistency among the systematic reviews that describe the benefits of FS. The reviews reported a reduction in CRC-related mortality due to FS.(11; 12; 15-18)

Regarding individual-based screening approaches, four U.S. guidelines described CT colonography as an option, with a recommended interval of every five years if the initial test result is negative.(5; 7; 10; 14) For colonoscopy, all the guidelines recommended a 10-year surveillance interval. Guidelines from the 2013 recommendations of the Canadian Association of Gastroenterology and the 2016 recommendations from the U.S. Multi-Society Task Force on Colorectal Cancer described consistent surveillance intervals based on the results of a baseline colonoscopy: 1) a 10-year interval after identifying no polyps or small (<10 mm) hyperplastic polyps in rectum or sigmoid; 2) five- to 10-year interval after the presence of one to two small (<10 mm) tubular adenomas; 3) five-year interval after presence of sessile serrated polyp(s) <10 mm with no dysplasia; 4) three-year interval after the presence of three to 10 adenomas, one or more tubular adenomas greater or equal to 10 mm (could be shortened if polyps are large or removed piecemeal), one or more villous adenomas, adenoma with high grade dysplasia (HGD), or sessile serrated polyp with dysplasia; and 5) one-year interval after the confirmation of serrated polyposis syndrome based on WHO definition.(4; 10) Regarding the evidence on colonoscopy as a screening approach, one high-quality review and one medium-quality review found limited evidence on the effectiveness of CRC screening using colonoscopy.(12; 18) The authors suggest that the direct evidence from the benefits of FS may be comparable to the benefits of a colonoscopy. The reviews did not mention suggested screening intervals for colonoscopy.

Defining individuals at increased CRC risk

There were consistencies when defining an individual at increased CRC risk among the eight national and international clinical practice guidelines (1; 4; 6; 10; 13; 14; 19; 20) and one medium-quality review.(12) Similarities in criteria included:

- personal history of adenomatous polyps, inflammatory bowel disease (e.g., ulcerative colitis, Crohn colitis), signs or symptoms of CRC, and/or abdominal or pelvic radiation;(4; 6; 9; 13)
- personal history of CRC;(6; 13)
- suspected or confirmed hereditary syndromes (such as familial adenomatous polyposis or other polyposis syndromes, Lynch syndrome);(6; 13; 20) and/or
- family history of CRC in one or more first-degree relatives (FDR), or in certain situations, reviewing family history of second-degree relatives (SDR).(1; 4; 6; 9; 10; 12; 13; 20)

Some national and international guidelines described specific subcategories or age of diagnosis when discussing family history of CRC. The clinical practice guidelines published in 2018 by the Canadian Association of Gastroenterology Banff Consensus defined five risk subcategories for CRC among individuals with:

1) two or more FDRs with CRC;
2) one FDR with CRC;
3) one or more FDRs with advanced adenoma;

4) one ore more secondary-degree relatives (SDRs) with CRC; and
5) one or more FDR with any non-advanced adenoma.(1)

There was some variance among the guidelines related to family history of CRC. Two U.S. guidelines from the US Multi-Society Task Force on Colorectal Cancer (10) and the American Cancer Society (6) defined an individual at increased risk when they have a FDR with CRC diagnoses before the age of 60 years.(6; 10) As part of their definition of increased CRC risk, two guidelines published in 2019 by the European Society of Gastrointestinal Endoscopy (ESGE) and the German Guideline Program in Oncology included individuals who have an FDR or SDR with a CRC diagnosis before the age of 50 years.(9; 20) However, the 2018 guideline by the Canadian Association of Gastroenterology Banff Consensus strongly recommends screening for adults with one or more FDR with CRC, regardless of the FDR's age of diagnosis.(1)

Two guidelines briefly outline the presence of adenomatous polyps (adenomas). For example, the 2019 international guidelines from the National Comprehensive Cancer Network described an individual with increased CRC risk as someone with personal or family history of 10 or more adenomatous polyps, two or more hamartomatous polyps, or five or more serrated polyps proximal to sigmoid colon.(19) Additionally, the German Guideline Program in Oncology reported a population risk group to include those with multiple (≥ 3) or large (> 1 cm) adenomas.(9)

Optimal screening approaches for individuals with increased CRC risk

We found consistencies among the eight guidelines and one medium-quality review that described screening approaches for individuals with increased CRC risk.(1; 4; 6; 10; 12-14; 19; 20) All the guidelines mentioned colonoscopy as the screening approach for individuals with increased CRC risk, with a 2018 guideline published by the Canadian Association of Gastroenterology Banff Consensus describing FIT as a secondary option.(1) This guideline describes specific surveillance intervals and starting ages based on whether an individual has one or more FDRs with CRC, one or more SDRs with CRC, FDRs with advanced adenoma, or FDRs with non-advanced adenoma.(1)

The guidelines described the initial screening at age 50 years, or 10 years prior to the earliest diagnosis of an FDR. Regarding the surveillance interval, the guidelines recommended either five or 10 years (which is dependent on the number and type of adenomas detected). Some guidelines provided specific recommendations for individuals with hereditary syndromes. For example, the 2019 guidelines from ESGE recommended individuals start colonoscopy surveillance from 25 years of age for individuals with MLH1 and MSH2 mutation, or with hereditary CRC without polyposis, and from 35 years of age for MSH6 and PMS2 mutation carriers. For these risk groups, the guidelines recommended colonoscopy with a surveillance interval of every two years given that the initial result was negative.(20)

Table 1: Summary of criteria identified from systematic reviews and clinical practice guidelines for defining individuals at average and increased risk of CRC, and optimal approaches for managing CRC screening for individuals at average and increased risk

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
Clinical practice guidelines – Screening	• Topic focus: Clinical Practice Guideline on Screening for Colorectal Cancer in Individuals With a Family History of Nonhereditary Colorectal Cancer or Adenoma • Jurisdictional focus: Canada • AGREE II score (if available): Not available • Guideline producer: The Canadian Association of Gastroenterology Banff Consensus • Date published: 2018	• Not reported	• Not reported	• Five risk categories for adults with: o one FDR with CRC; o two or more FDRs with CRC; o one or more FDRs with advanced adenoma; o one or more secondary-degree relatives (SDRs) with CRC; and o one or more FDR with any non-advanced adenoma.	• Overall, the group strongly recommends screening for adults with one or more FDR with CRC. • Adults with history of one FDR with CRC: o colonoscopy with FIT as a second-line option; o start screening between ages 40 to 50 , or 10 years younger than the diagnosis of FDR; and o five to 10-year screening intervals for colonoscopy, or one to two-year screening intervals with FIT. • Adults with two or more FDRs with CRC: o colonoscopy; o start screening at age 40 or 10 years younger than the earliest diagnosis of an FDR; and o five-year screening interval. • Adults with one or more FDR with advanced adenoma: o colonoscopy or FIT (no preferred screening test); o start screening at age 40 to 50 or 10 years younger than the earliest diagnosis of an FDR; and

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
					o five- to 10-year screening interval with colonoscopy or one- to two-year interval with FIT. • Adults with history of one or more SDRs with CRC: o screening (with no mention of preferred screening test); o start screening at age 50; and o follow screening intervals according to average-risk guidelines. • Adults with one or more FDR with non-advanced adenoma: o follow average-risk guidelines.
	• Topic focus: Referral of Patients With Suspected Colorectal Cancer by Family Physicians and Other Primary Care Providers • Jurisdictional focus: Canada • AGREE II score (if available): Not available • Guideline producer: Cancer Care Ontario • Date published: 2017	• Not reported	• Not reported	• Personal history of polyps or IBD	• Early referral to specialists
	• Topic focus: Recommendations on Screening for Colorectal Cancer in Primary Care • Jurisdictional focus: Canada	• Not reported	• Adults aged 50 to 59 (based on weak recommendation with moderate-quality evidence):	• Previous CRC or polyps, inflammatory bowel disease • Signs or symptoms of CRC • History of CRC in one or more first-degree relatives • adults with hereditary syndromes (e.g., familial	• Not reported

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
	• AGREE II score (if available): 85.4% (Rigour) • Guideline producer: Canadian Task Force on Preventive Health Care • Date published: 2016		○ stool tests (gFOBT or FIT) or flexible sigmoidoscopy (FS) ○ two-year screening interval for FOBT, 10-year interval for FS adults aged • Do not screen adults aged 75 and older (weak recommendation with low-quality evidence) • Do not use colonoscopy as the primary screening test for CRC (weak recommendation with low-quality evidence)	adenomatous polyposis, Lynch syndrome)	
	• Topic focus: Early Detection for Colorectal Cancer: ASCO Resource-Stratified Guideline • Jurisdictional focus: U.S. • AGREE II score (if available): Not available • Guideline producer: American Society of Clinical Oncology • Date published: 2019	• Adults aged 50 to 75 who are at average risk with no family history of colorectal cancer	• Screening tests include: ○ a highly sensitive gFOBT or FIT annually; ○ flexible sigmoidoscopy every five years; ○ flexible sigmoidoscopy every 10 years plus FIT ever year; or ○ colonoscopy every 10 years. ○ With a positive result from a non-colonoscopy CRC screening, a clinician should perform a colonoscopy. If there are abnormal screening results, an individual should be referred to	• Not reported	• Not reported

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
			an endoscopy or surgery.		
	• Topic focus: Colorectal screening for average-risk adults • Jurisdictional focus: U.S. • AGREE II score (if available): Not available • Guideline producer: American Cancer Society (ACS) • Date published: 2018	• No history of adenomatous polyps or CRC • No risk factors (e.g., family history; suspected or confirmed hereditary CRC syndrome such as familial adenomatous polyposis or Lynch syndrome) • No history of abdominal, pelvic radiation due to previous cancer • No history of inflammatory bowel disease	• Start screening adults at age ≥ 45 with: o a high-sensitivity stool-based test or a visual examination based on preference, and if positive, to undergo colonoscopy. • Continue screening average-risk adults from ≥ 50 to 75 years • Adults aged 76 to 85 should consult with their clinicians to determine if CRC screening is appropriate with their usual care routine • Adults over the age of 85 are discouraged from CRC screening. • Recommended stool-based tests and intervals include: o fecal immunochemical test (every year); o high-sensitivity, guaiac-based fecal occult blood test (every year); or o multitarget stool DNA test (every three years). • Recommended structural examinations include:	• History of adenomatous polyps • Familial or personal history of CRC before the age of 60 • History of inflammatory bowel disease • Suspected or confirmed hereditary CRC syndrome • Suspected or confirmed history of abdominal or pelvic radiation	• Family history and genetic counselling referrals for hereditary syndromes

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
			o colonoscopy (every 10 years); o CT colonography (every five years); and o flexible sigmoidoscopy (every five years).		
	• Topic focus: ACR Appropriateness Criteria Colorectal Cancer Screening • Jurisdictional focus: U.S. • AGREE II score (if available): 67.7% (Rigour) • Guideline producer: American Cancer Society (ACS) • Date published: 2018	• Not reported	• CT colonography for initial CRC screening among adults with average risk from the age of 50 or older • If the initial screening test is negative, the recommended interval is every five years • For positive results, FOBT or FIT are recommended	• Adults with hereditary nonpolyposis colorectal cancer, ulcerative colitis, or Crohn colitis	• Colonoscopy
	• Topic focus: Colorectal Cancer Screening: Recommendations for Physicians and Patients from the U.S. Multi-Society Task Force on Colorectal Cancer • Jurisdictional focus: U.S. • AGREE II score (if available): 60.4% (Rigour) • Guideline producer: The US Multi-Society Task Force on Colorectal Cancer • Date published: 2017	• Not reported	• Start screening at age 50, with exceptions for African-Americans who are recommended to start screening at age 45 years • Recommended screening approaches include (ordered in preference): o colonoscopy (every 10 years) or annual FIT (strong recommendation with moderate-quality evidence) for colorectal neoplasia; o CT colonography (every five years), FIT-fecal DNA (every three	• Adults with a first-degree relative (FDR) who was diagnosed less than aged 60, or has two FDRs with CRC or documented advanced adenoma	• Family colorectal cancer type X o Colonoscopy o Every three to five years (starting age 10 years before age at diagnosis of the youngest affected FDR) • CRC or advanced adenoma in a FDR less than aged 60, or two FDR at any age or o Colonoscopy o Every five years (starting age 10 years before age of diagnosis of the youngest affected FDR or age 40, whichever is earlier) • Single FDR diagnosed at ≥ 60 years with CRC or advanced adenoma

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
			years), or flexible sigmoidoscopy (every five to 10 years) (strong recommendation with high-quality evidence); or o capsule colonoscopy, if it is available and if the previous screening tests are declined by the patient (weak recommendation with low-quality evidence).		• Average-risk screening approach starting at 40 years
	• Topic focus: Colorectal screening recommendations for asymptomatic and at average risk adults • Jurisdictional focus: U.S. • AGREE II score (if available): Not available • Guideline producer: US Preventive Services Task Force (USPSTF) • Date published: 2016	• No family history of genetic conditions or disorders that increase the risk of CRC (e.g., Lynch syndrome or familial adenomatous polyposis) • No history of inflammatory bowel disease or CRC	• Screening recommended for adults aged 50 to 76 • Adults aged 76 to 86 should be based on clinician consultation and the person's overall health, while those who have never been screened would likely benefit more • Screening approaches and intervals for adults currently not in surveillance programs include: o gFOBT (annual); o FIT (annual); o FIT-DNA (one to three years); o colonoscopy (10 years); o CT colonography (five years); o flexible sigmoidoscopy (five years); and	• Not reported	• Not reported

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
			○ flexible sigmoidoscopy with FIT (10 years plus FIT every year). • An update of the recommendations is currently in progress.		
	• Topic focus: Genetic/Familial High-Risk Assessment: Colorectal, Version 3.2019 • Jurisdictional focus: International • AGREE II score (if available): Not available • Guideline producer: National Comprehensive Cancer Network (NCCN) • Date published: 2019	• Not reported	• Not reported	• Polyposis syndromes and Lynch syndrome (LS) increase the chance of CRC • Further assessment is required for adults with (based on NCCN's stepwise assessment): ○ personal or family history of more than 10 adenomatous polyps; ○ two or more hamartomatous polyps; or ○ five or more serrated polyps proximal to sigmoid colon. • Evaluation of Lynch syndrome include: ○ personal diagnosis of CRC before aged 50; ○ one or more FDR diagnosed with CRC before aged 50; and/or ○ one or more FDR or SDR diagnosed with Lynch syndrome before aged 50.	• The NCCN's risk assessment for individuals with genetic or familial risk for CRC involves: ○ genetic counselling (based on results of MSI and/or immunochemistry for DNA MMR proteins, and personal and family history of cancer); and ○ patient education from clinicians with genetic expertise.
	• Topic focus: Colorectal cancer screening with faecal immunochemical testing, sigmoidoscopy or colonoscopy: a clinical practice	• Adults aged 50 to 79 with no history of CRC and life expectancy of at least 15 years	• Screen adults with an estimated 15-year risk above 3% (low-quality evidence):	• Not reported	• Not reported

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
	• Jurisdictional focus: Multiple – Norway, U.S., Switzerland, Canada, Saudi Arabia, U.K., Netherlands • AGREE II score (if available): Not available • Guideline producer: Clinical Effectiveness Research Group • Date published: 2019		o fecal immunochemical test (every year or every two years); or o a single sigmoidoscopy; or o colonoscopy.		
	• Topic focus: Endoscopic management of Lynch Syndrome and of Familial Risk of CRC • Jurisdictional focus: Europe • AGREE II score (if available): Not available • Guideline producer: European Society of Gastrointestinal Endoscopy (ESGE) • Date published: 2019	• Not reported	• Not reported	• Lynch syndrome and familial risk of CRC • Lynch syndrome is defined as "constitutional pathogenic variant in one of the mismatch pair genes, MLH1, MSH2, MSH6, PMS2, or the deletions in the 3' region of the EpCAM gene". • Familial risk is defined as an adult "with two or more first-degree relatives (FDR) with CRC or one FDR with CRC below the age of 50 years".	• Screening approach and interval for individuals with Lynch syndrome include (strong recommendations and moderate quality): o start colonoscopy surveillance from 25 years of age for individuals with MLH1 and MSH2 mutation and, from 35 years of age for MSH6 and PMS2 mutation carriers; and o colonoscopy every two years for asymptomatic individuals. • Screening and interval for individuals with familial risk include (strong recommendation and moderate quality): o follow-up after polyp excision based on guidance for the general population; o start colonoscopy from the age of 40; and o five-year screening interval

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
	• Topic focus: Evidence-Based Guideline for Colorectal Cancer • Jurisdictional focus: Germany • AGREE II score (if available): 65.6% (Rigour) • Guideline producer: German Guideline Program in Oncology • Date published: 2019	• Adults who do not belong to a CRC risk group	• Colonoscopy (recommended as standard screening test) • Start screening at age 50 • 10-year interval • FS or an annual FOBT can be used as screening approach if a patient refuses a colonoscopy	• Adults with FDR or SDR who had CRC before age 50 have an increased chance of developing CRC (and other familial risk) • Adults with multiple (≥ 3) or large (> 1 cm) adenomas • Adults with inflammatory bowel disease • Adults with documented or suspected hereditary colorectal cancer	• Start screening with colonoscopy 10 years before the age of a diagnosed FDR with CRC or aged 40-45 (based on which comes first), with 10-year intervals if the initial screening was free of polyps. • For adults with FDRs with detected adenoma: o colonoscopy 10 years before the age of the initial diagnosis of the FDR; and o 10-year interval if the initial screening was clear. • Adults with hereditary syndromes that elevates the risk of CRC should receive genetic counselling before the age of 25. • Adults with hereditary colorectal cancer without polyposis should undergo annual colonoscopies from the age of 25.
Clinical practice guidelines – Surveillance	• Topic focus: Colorectal cancer surveillance after index colonoscopy • Jurisdictional focus: Canada • AGREE II score (if available): Not available • Guideline producer: Canadian Association of Gastroenterology (CAG) • Date published: 2013	• Normal baseline colonoscopy examination with no increased risk due to personal or family history	• CRC surveillance intervals after baseline colonoscopy: o 10-year interval after identifying no polyps or small (<10 mm) hyperplastic polyps in rectum or sigmoid; o five to 10-year interval after the presence of one to two small (<10 mm) tubular adenomas; o five-year interval after presence of sessile	• Personal or family history of adenoma	• For adults with an FDR ≥60 years of age or who has two or more FDRs of any age with CRC, the surveillance interval is shortened to five years after identifying: o no polyps; o small (<10 mm) hyperplastic polyps in rectum or sigmoid (further pathological results are required, and recommend re-entry to screening program after 10 years); and

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
			serrated polyp(s) <10 mm with no dysplasia; o three-year interval after the presence of three to 10 adenomas, one or more tubular adenomas greater or equal to 10 mm, one or more villous adenomas, adenoma with HGD, or sessile serrated polyp with dysplasia; and o one-year interval after the confirmation of serrated polypsis syndrome based on WHO definition.		o the presence of one to two small (<10 mm) tubular adenomas. • Colonoscopy is the preferred screening method.
	• Topic focus: Guidelines for Colonoscopy Surveillance After Screening and Polypectomy: A Consensus Update by the US Multi-Society Task Force on Colorectal Cancer • Jurisdictional focus: U.S. • AGREE II score (if available): Not available • Guideline producer: U.S. Multi-Society Task Force on Colorectal Cancer • Date published: 2016	• Not reported	• CRC surveillance intervals after baseline colonoscopy: o 10-year interval after identifying no polyps or small (<10 mm) hyperplastic polyps in rectum or sigmoid; o five- to 10-year interval after the presence of one to two small (<10 mm) tubular adenomas; o five-year interval after presence of sessile serrated polyp(s) <10 mm with no dysplasia; o three-year interval after the presence of three to 10 adenomas, one or	• Not reported	• Not reported

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
			more tubular adenomas greater or equal to 10 mm, one or more villous adenomas, adenoma with HGD, or sessile serrated polyp with dysplasia; and o one-year interval after the confirmation of serrated polypsis syndrome based on WHO definition.		
Systematic reviews	• Topic focus: Colorectal cancer screening in average risk population • AMSTAR score: 7/10 • Last year searched: 2014	• Not reported	• The review reported strong evidence to support the use of fecal tests for occult blood (gFOBT) and flexible sigmoidoscopy (FS) for screening people at average risk of colorectal cancer. The authors indicated that annual or biennial screening using gFBOT reduces CRC-related mortality among individuals with average risk of CRC. • There is insufficient evidence to suggest the age at which to start initial screening and subsequent FS intervals. • The review reported that there is no direct evidence to support the use of colonoscopy to screen	• An adult with one or more FDR with CRC	• Colonoscopy • Start screening at the age of 50 or 10 years prior to when FDR was diagnosed

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
			individuals at average risk for CRC (but benefits of flexible sigmoidoscopy may reflect benefits and harms of a colonoscopy). • No studies met the inclusion criteria for screening intervals for colonoscopy.		
	• Topic focus: Screening for colorectal cancer • AMSTAR score: 8/10 • Last year searched: 2015	• Not reported	• Guaiac fecal occult blood testing (gFOBT) resulted in a relative reduction of 18% in mortality related to colorectal cancer, over a median follow-up period of 18.25 years. • Flexible sigmoidoscopy (FS) screening was associated with a 26% reduction in colorectal cancer mortality over a medium follow-up period of 11.3 years. This type of screening resulted in a significant reduction of incidence of late-stage cancer. • gFOBT and FS had no effects on all-cause mortality. • Colonoscopy screening every 10 years yielded the greatest net health benefit when compared to annual screening by fecal occult blood test or low-	• Not reported	• Not reported

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
			sensitivity guaiac tests; however, RCTs did not find benefits of colonoscopy screening for CRC.		
	• Topic focus: Updated systematic review for the US Preventive Services Task Force on screening for colorectal cancer • AMSTAR score: 9/11 • Last year searched: 2016	• Asymptomatic adults aged 40 and older with no CRC risk factors	• Mortality was lower in adults with self-reported screening colonoscopy (compared to adults who have never had screening endoscopy), FS, and biennial screening with gFOBT. gFOBT demonstrated consistent reduction in mortality. • There is no evidence of serious harms from stool testing and adverse events with diagnostic colonoscopies for CRC screening. • The review did not include results of microsimulation decision models that address intervals and frequency of screening.	• Not reported	• Not reported
	• Topic focus: Impact of colorectal cancer screening on cancer-specific mortality in Europe: A systematic review • AMSTAR score: 7/10 • Last year searched: 2018	• Not reported	• Cancer-specific mortality was reduced by 8-16% among patients who underwent guaiac fecal occult blood testing (gFOBT). • Flexible sigmoidoscopy was associated with a 21	• Not reported	• Not reported

Evidence source	Document characteristics	Average CRC risk		Increased CRC risk	
		Screening criteria	Features of approaches for managing CRC screening	Screening criteria	Features of approaches for managing CRC screening
			to 30% mortality reduction.		
	• Topic focus: Effectiveness of screening modalities in colorectal cancer: A network meta-analysis • AMSTAR score: 5/11 • Last year searched: 2016	• Not reported	• Screening approaches such as guaiac fecal occult blood testing (gFOBT), fecal immunohistochemical testing, flexible sigmoidoscopy, and colonoscopy reduced the incidence of colorectal cancer by 13% among the average-risk population.	• Not reported	• Not reported
	• Topic focus: Efficacy and cost-effectiveness of fecal immunochemical test versus colonoscopy in colorectal cancer screening: A systematic review and meta-analysis • AMSTAR score: 8/10 • Last year searched: 2016	• Not reported	• Fecal immunochemical testing is similar to a one-time colonoscopy with respect to detecting colorectal cancer based on screening one time (except in cases where adenomas or advanced adenomas need to be detected). • Annual or biennial fecal immunochemistry blood tests are cost-effective compared to a colonoscopy every 10 years.	• Not reported	• Not reported

Findings from jurisdictional scan

We identified relevant insights from Canadian provinces and territories, and in Australia, New Zealand, the United Kingdom and the United States (in the Dartmouth-Hitchcock Health System, Johns Hopkins and Kaiser Permanente), which included identifying any examples of specific tools for CRC screening from the programs we reviewed. We provide detailed findings from these documents in Table 2 (for Canadian provinces and territories) and Table 3 (for other countries). Details about the specific tools we identified are provided in Appendix 3.

Insights from Canadian jurisdictional scanning

Several provinces and territories in Canada have implemented formal or informal processes for managing patients at higher risk of CRC. Commonly used family or personal-health history indicators of higher risk for CRC include close relatives (generally first-degree relatives and in some jurisdictions first- and second-degree relatives) with a history of colorectal cancer, certain hereditary diseases (including familial adenomatous polyposis), and inflammatory bowel disease. Those with a personal history of colorectal cancer or polyps, or those who present with symptoms, typically enter a direct diagnostic pathway rather than a screening protocol. Generally, information on personal and family history is collected by a patient's primary-care provider and used to inform the chosen screening pathway for patients at higher risk of CRC.

Once an assessment of higher risk has been made, the pathway to access screening varies by province. In some provinces, such as British Columbia, there is a centralized process for higher-risk patients to be directed to the appropriate follow-up care and screening. This involves physicians faxing a colonoscopy referral to BC Cancer, in order to register patients into the higher-risk stream of the screening program. In other provinces, such as Nova Scotia, primary-care providers are responsible for determining appropriate follow-up care, screening needs and making referrals. Appropriate screening for higher-risk patients varies between jurisdictions. For instance, fecal immunochemical tests (FIT) may be appropriate for patients with higher-risk family histories in some jurisdictions, where other jurisdictions direct patients straight to colonoscopy. Further, some provide the option of a medical genetics referral if a patient's family history indicates further investigation.

Insights from international jurisdictional scanning

Similar to the Canadian context, international jurisdictions differ in terms of the approach to risk stratification and screening process for patients entering CRC screening programs. For instance, Australia splits patient risk into three categories, using information such as patient age, symptoms, family history, and personal medical history. Largely, primary-care physicians are responsible for conducting this initial risk assessment. Certain programs, such as Johns Hopkins Colon Cancer Screening Clinic in the United States, accept self-referrals from patients interested in engaging with the screening process.

Once an assessment of higher risk has been made, the pathway to screening typically involves either a take-home fecal occult screening test or referral to endoscopy. Here, endoscopy refers to colonoscopy; while flexible sigmoidoscopy is also an endoscopic screening tool that has been implemented in some jurisdictions (e.g., the Registered Nurse-Performed Flexible Sigmoidoscopy program in Ontario), this is reserved for average-risk patients. Further, access to flexible sigmoidoscopy may be limited in certain parts of Canada, resulting in many Canadians being screened using FIT or FOBT. The specific pathway varies between jurisdictions, but once patients are part of an official screening program there is communication between screening program members and referring physicians. Some jurisdictions have employed novel tools to ensure adequate follow-up of results. For instance, the New Hampshire Colorectal Screening Program has implemented Patient Navigation Services that ensure endoscopy follow-up. This program aims to address barriers to colorectal screening that may place patients at higher risk, including health insurance issues, experiences with homelessness, and poor access to services.

Tools for CRC screening

Certain resources, such as endoscopy referral forms and surveillance guidelines, have been implemented by some jurisdictions to standardize the process for screening. Generally, there is limited information available regarding approaches for improving adherence to screening intervals. In Canada, primary-care physicians and provincial cancer programs serve as the primary patient-navigation tools in Alberta and British Columbia respectively. Furthermore, in the Northwest Territories, screening intervals for higher-risk patients are flexible and determined based on the results of a higher-risk patient's previous colonoscopy.

Table 2: Summary of features of screening programs in Canada that have implemented an increased risk of CRC screening-management system

Province/ territory	Program details	Information collected on personal and/or family-health history to support triage to appropriate CRC screening tests	Features of implementation of an increased risk of CRC screening-management system using personal and/or family health history	Approaches used to improve adherence to surveillance intervals
British Columbia	*Program name*: BC Cancer Colon Screening *Population(s) served*: Whole province	• What information is collected to calculate personal risk of CRC? o Age (50-74) o Family history (first-degree relative diagnosed with colon cancer under the age of 60; two or more first-degree relatives diagnosed at any age) o Personal medical history (history of adenomas) • Processes and tools used to collect information o Risk assessment is conducted by primary-care physician who collects information on personal and family history o If screening is indicated, a requisition for colonoscopy (higher than average risk) is provided to the patient • Who is collecting the data? o The requisition is copied to the Colon Screening Program	• Who is notified? o Patients who are determined to be higher than average risk by their primary-care providers are referred to the Complete Colon Screening Program through BC Cancer • How are they notified? o BC Cancer receives a faxed copy of the screening form for all higher-risk patients • When are they notified? o BC Cancer is notified upon referral of the patient into the screening program • Who makes a referral? o Primary-care physicians are responsible for identifying higher-risk patients o All patients are registered into the Colon Screening Program through a requisition o The Program refers the patient to the Health Authority for appropriate follow-up	• BC Cancer assumes responsibility for the coordination of results and recall of patients for follow-up testing o If cancer or IBD is detected on colonoscopy, patients are discharged from the program and followed by specialist or primary-care provider
Alberta	*Program name*: Alberta Colorectal Screening Program (ACRCSP) *Population(s) served*: Whole province, which is split into five zones (Edmonton, Calgary,	• What information is collected to calculate personal risk of CRC? o Age (50-74) o Family history (first-degree relative with colorectal cancer and/or high-risk adenomas o Personal medical history (colorectal cancer or polyps)	• Who is notified? o For patients identified as higher risk, primary-care providers fill out the ACRCSP Standardized Referral Form to inform the triage process • How are they notified?	• The Screening for Life program integrates primary-care physicians as essential navigators in the screening process o Evidence has shown that recommendation by family doctor is the

	South, North and Central)	• Processes and tools used to collect information o Risk assessment is conducted by primary-care physician who collects information on personal and family history o If screening is indicated, a requisition for an asymptomatic fecal immunochemical test (FIT; for average risk or people with first-degree relatives with advanced adenoma) or colonoscopy (higher than average risk) is provided to the patient o Alberta Health provides a list of target populations to Cancer Services for recruitment; invitational letters provided in FIT kits • Who is collecting the data? o Centralized labs analyze results and share information with ACRCSP, physicians and patients o ACRCSP collects data on all patients entering the screening process	o The referral form is sent to ACRCSP via fax • When are they notified? o Referrals are made once patients are identified as higher risk • Who makes a referral? o Physicians are responsible for the initial referral into the screening program o Triage and booking of procedures is carried out by an ACRSCP nurse navigator o Physicians receive copies of colonoscopy results and abnormal FIT tests and are responsible for the booking of follow-up screening o Follow-up is conducted according to the provincial post-polypectomy surveillance guidelines	"strongest predictor of completing CRC screening"
Saskatchewan	*Program name*: Saskatchewan Screening Program for Colorectal Cancer *Population(s) served*: Whole province	• What information is collected to calculate personal risk of CRC? o The Screening Program for Colorectal Cancer mails FIT kits to all residents between the ages of 50 and 74 who have not been diagnosed with colorectal cancer within the past five years o Primary-care physicians perform screening for higher-risk patients requiring colonoscopy, taking into account family and personal history	• Who is notified? o The Saskatchewan Program for Colorectal Screening is notified of colonoscopy results • How are they notified? o Notified by endoscopy nurse using the Procedure Room Screening Colonoscopy Indicator Sheet • When are they notified? o Notification of colonoscopy screening results are sent to the Saskatchewan Cancer	• For higher-risk patients who have received a colonoscopy, the Screening Program receives the date of the test and automatically calculates the next FIT mailing date to ensure follow-up

		• Processes and tools used to collect information o All residents over the age of 50 receive a FIT kit in the mail from the Saskatchewan Cancer Agency o Certain higher-risk patients may require a FIT test (first-degree relatives with advanced adenoma) • Who is collecting the data? o Primary-care physicians are responsible for collecting data that stratifies patients based on risk factors	Agency after the procedure is complete • Who makes a referral? o Physicians make the initial referral to colonoscopy for higher-risk patients o Endoscopy nurses act as navigators for clients with abnormal FIT/colonoscopy results; these navigators facilitate preparation and booking of screening through a pooled referral system	
Manitoba	*Program name*: ColonCheck *Population(s) served*: Whole province	• What information is collected to calculate personal risk of CRC? o Age (50-74) o Personal history of colorectal cancer, adenomas, inflammatory bowel disease, other colon cancer syndromes o Family history of colorectal cancer o Symptoms of colon cancer • Processes and tools used to collect information o ColonCheck home-screening tests (fecal occult blood tests; FOBTs) can be acquired by the patient completing an online form, phoning the organization, or asking their primary-care physician o Recruitment is carried out via direct mail, through other screening programs, and through health providers • Who is collecting the data? o Primary-care physicians are responsible for stratifying patients based on risk	• Who is notified? o Higher-risk individuals are notified through screening program or directly from their healthcare provider o Colonoscopy reports of patients participating in the program are sent to ColonCheck o For higher-risk patients for whom FOBT may be indicated (first-degree relatives with advanced adenoma) ColonCheck is notified of results and follows up with patient/health provider • How are they notified? o Certain endoscopists and colonoscopy facilities have partnerships with ColonCheck allowing for exchange of results o However, some primary-care physicians refer patients directly to colonoscopy, rather than going through the program	• Official partnerships between endoscopy clinics and the ColonCheck program ensures results are reported in a timely and standardized way

		○ ColonCheck receives results of home-screening tests that place patients at higher risk and require further testing	• When are they notified? ○ ColonCheck is notified after results of tests are known • Who makes a referral? ○ Patients can enroll in FOBT independently or through a primary-care physician ○ Primary-care physicians can make direct referrals to colonoscopy ○ A ColonCheck Follow-Up Coordinator books a colonoscopy or sends a referral to partnering facilities if abnormal FOBT results	
Ontario	*Program name*: Cancer Care Ontario ColonCancerCheck *Population(s) served*: Ontario	• What information is collected to calculate personal risk of CRC? ○ Age (50, or 10 years before age of relative when diagnosed with colon cancer) ○ Personal history of colorectal cancer, adenomas, inflammatory bowel disease, other colon cancer syndromes ○ Family history of colorectal cancer ○ Symptoms of colon cancer • Processes and tools used to collect information ○ The program sends letters to all residents of Ontario ages 50-74 ○ Mobile screening coaches travel between communities in Ontario providing cancer-screening services • Who is collecting the data? ○ Primary-care physicians or screening coaches are responsible for collecting data on high-risk populations	• Who is notified? ○ Higher-risk individuals are notified through screening program or directly from their healthcare provider ○ If patients are deemed to be at increased risk due to family history and do not have a family doctor, they are assigned a provider through ColonCancerCheck • How are they notified? ○ The Gastrointestinal Endoscopy Data Submission Portal allows Ontario hospitals to submit colonoscopy data; primary source of data in the province as all hospitals must participate ○ Primary-care providers are informed of results and are responsible for further follow-up according to the recommendations for post-polypectomy surveillance • When are they notified?	• A number of hospitals each year receive government funding to provide extra colonoscopies for high-risk people. These hospitals must report their data to Cancer Care Ontario. Data allows ColonCancerCheck to communicate gaps in screening to physicians.

			○ Results are available on the portal once the hospital has shared this data • Who makes a referral? ○ Primary-care physicians are responsible for the initial colonoscopy referral	
Quebec	*Program name*: Programme québécois de dépistage du cancer colorectal *Population(s) served*: All asymptomatic people aged 50 to 74 and those younger than 50 with increased risk	• What information is collected to calculate personal risk of CRC? ○ History of colorectal cancer in parents, grandparents, and great-grandparents and age of diagnosis in family history ○ History of colorectal cancer in siblings or children ○ Personal history of colorectal cancer ○ Presence of colorectal polyps ○ History of intestinal diseases such as ulcerative colitis or Crohn's disease ○ History of certain hereditary diseases such as familial adenomatous polyposis • Processes and tools used to collect information ○ Patient consultation with their doctor • Who is collecting the data? ○ Patient reporting or doctor-collected	• Who is notified? ○ No information available. • How are they notified? ○ No information available. • When are they notified? ○ For people with two grandparents (from opposite sides of the family) diagnosed with colorectal cancer or adenomatous polyps, normal screening (iFOBT) is started at age 40 ○ People in the following situations are referred for their first colonoscopy at age 40 or 10 years younger than the earliest diagnosis of colorectal cancer in the family. They are then referred for colonoscopy every five subsequent years. ▪ One parent with colorectal cancer or adenomatous polyps diagnosed before age 60 ▪ Two parents diagnosed with colorectal cancer or advanced adenomatous polyps ▪ One parent and one grandparent (from the same side of the family) diagnosed with colorectal cancer • Who makes a referral?	• No information available

			o No information available	
New Brunswick	*Program name*: New Brunswick Colon Cancer Screening Program *Population(s) served*: People aged 50 to 74 who are at average risk and those at increased risk	• What information is collected to calculate personal risk of CRC? o First degree relatives with a history of colorectal cancer (parents, sibling or child) o Personal history of colorectal cancer or colorectal polyps o Family history of Hereditary Non-Polyposis Colorectal Cancer or Familial Adenomatous Polyposis o Personal history of inflammatory bowel disease • Processes and tools used to collect information o No information available • Who is collecting the data? o Patient reporting to primary-care practitioner	• Who is notified? o No information available • How are they notified? o No information available • When are they notified? o No information available • Who makes a referral? o No information available	• The New Brunswick Colon Cancer Screening Clinical Practice Guidelines outline management strategies for individuals presenting with various risk factors • However, specific implementation strategies for the recommended management and adherence to screening of these individuals is not provided
Nova Scotia	*Program name*: Colon Cancer Prevention Program (CCPP) *Population(s) served*: All Nova Scotians aged 54 to 74 and those at higher risk	• What information is collected to calculate personal risk of CRC? o The Nova Scotia Health Authority defines the following as contributing to higher risk ▪ Family history (parent, sibling, or child) of colon cancer ▪ Hereditary conditions such as familial adenomatous polyposis or hereditary non-polyposis colon cancer ▪ Long-standing inflammatory bowel disease ▪ History of uterine, ovarian, breast, or small bowel cancer ▪ Previous colorectal polyps or cancer o Those with warning signs of colon cancer, such as blood in stool or changes in bowel habits, are also	• Who is notified? o No information available • How are they notified? o No information available • When are they notified? o No information available • Who makes a referral? o No information available	• No information available

		encouraged to speak to their physician regarding their screening needs • Processes and tools used to collect information o Patients and physicians determine screening needs if there is a higher-risk situation • Who is collecting the data? o Physician collect patient information and arrange for appropriate screening		
Prince Edward Island	*Program name*: Colorectal Cancer Screening Program *Population(s) served*: People aged 50 to 74 and those at increased risk	• What information is collected to calculate personal risk of CRC? o Family history of colorectal cancer o Personal history of colorectal cancer or polyps o The following symptoms ▪ Change in bowel movements ▪ Blood in stool ▪ Long-standing diarrhea or constipation ▪ Weight loss or fatigue ▪ Extreme vomiting • Processes and tools used to collect information o Consultation with healthcare provider • Who is collecting the data? o Primary healthcare provider	• Who is notified? o No information available • How are they notified? o No information available • When are they notified? o Those who are symptomatic are immediately referred for diagnostic workup o Those with first degree family history of colorectal cancer or adenoma are referred for their first colonoscopy at age 40 or 10 years younger than the earliest diagnosis of colorectal cancer in the family. They are then referred for colonoscopy every five subsequent years • Who makes a referral? o No information available	• No information available
Newfoundland and Labrador	*Program name*: Colon Cancer Screening Program *Population(s) served*: People aged 50 to 74 and those who may be higher risk	• What information is collected to calculate personal risk of CRC? o The following place someone in the higher-risk category of the program ▪ Family history of colon cancer ▪ Personal history of colon cancer	• Who is notified? o The family doctor or other healthcare provider can provide a referral to the Provincial Medical Genetics Program if appropriate • How are they notified? o No information available • When are they notified?	• No information available

		▪ Personal history of inflammatory colitis or Crohn's disease o The following are noted as risk factors or symptoms but do not necessarily place someone in the higherrisk category and consultation with a healthcare provider is recommended ▪ Age (age 50 or older) ▪ Diet higher in red meat or low in fibre ▪ Lack of exercise ▪ Obesity ▪ Smoking and/or excess alcohol use ▪ Changes in bowel movements and/or blood in stool ▪ Abdominal pain, discomfort, or cramps ▪ Tiredness • Processes and tools used to collect information o Patient consultation with their family doctor or healthcare provider • Who is collecting the data? o Family doctor or healthcare provider	o No information available • Who makes a referral? o Family doctor or another healthcare provider	
Yukon	*Program name*: ColonCheck Yukon *Population(s) served*: People aged 50 to 74 with average risk	• What information is collected to calculate personal risk of CRC? o Family history of colon polyps or colon cancer o Personal history of colon polyps o Person history of inflammatory bowel disease • Processes and tools used to collect information o Those at higher risk are encouraged to talk to their	• Who is notified? o No information available • How are they notified? o No information available • When are they notified? o No information available • Who makes a referral? o A patient's primary-healthcare provider is responsible for determining appropriate testing for those at higher risk	• No information available

		healthcare provider to determine appropriate screening • Who is collecting the data? o Patient consultation with their healthcare provider		
Northwest territories	*Program name*: NWT Colorectal Screening Guidelines *Population(s) served*: Adults aged 50 to 74 with average risk, those with increased risk, and those with special risk	• What information is collected to calculate personal risk of CRC? o A patient is classified as increased risk if one of the following scenarios applies ▪ One immediate family member (parent, sibling or child) diagnosed with colorectal cancer before age 60 ▪ Two immediate family members diagnosed with colorectal cancer at any age o A patient is classified as special risk if one of the following scenarios applies ▪ Family history of certain genetic syndromes including hereditary nonpolyposis colorectal cancer, familial adenomatous polyposis, and attenuated adenomatous polyposis ▪ Long-standing inflammatory bowel disease such as Crohn's colitis or ulcerative colitis • Processes and tools used to collect information o Patients are to talk to their primary-care provider if they are at increased or special risk, and the primary-care provider is to complete a referral to a specialist • Who is collecting the data? o Primary-care provider provides initial point of contact for	• Who is notified? o Patients with increased risk are referred for screening colonoscopy o Patients with special risk are referred to a specialist to determine appropriate care o Patients presenting with signs or symptoms of colorectal cancer are referred for diagnostic workup • How are they notified? o No information available • When are they notified? o Patients at increased risk commence screening colonoscopies at age 40 or 10 years before any family member was diagnosed with colorectal cancer, whichever comes first o Patients with signs or symptoms of colorectal cancer are immediately referred for diagnostic workup • Who makes a referral? o Primary-care provider determines appropriate course of action or makes referral when patient presents with increased or special risk	• For patients with increased risk, the frequency at which screening colonoscopies are conducted is determined by the results of previous colonoscopy, specifically findings of polyps, adenomas, and/or cancer • If negative or hyperplastic polyps are found, follow up colonoscopy is conducted in five to 10 years • If one to two small tubular adenomas are found, follow up colonoscopy is conducted in five years • If three to 10 adenomas, large adenomas, adenoma(s) with villous features, or adenoma(s) with high grade dysplasia are found, follow-up colonoscopy is conducted in three years • If more than 10 adenomas are found, the endoscopist's discretion is used to determine if more intensive follow-up is needed and genetic counselling is to be considered

		patients and makes appropriate referral		• If colorectal cancer is detected, patients are immediately referred to a surgeon
Nunavut • No official screening program identified				

Table 3: Summary of features of screening programs in comparator countries that have implemented an increased risk of CRC screening-management system

Country	Program details	Information collected on personal and/or family-health history to support triage to appropriate CRC screening tests	Features of implementation of an increased risk of CRC screening-management system using personal and/or family-health history	Approaches used to improve adherence to surveillance intervals
Australia	*Program name*: National Bowel Cancer Screening Program *Population(s) served*: Whole country	• What information is collected to calculate personal risk of CRC? o Risk is split into three categories o Category 1: people with one relative with colorectal cancer who was diagnosed at 55 years of age or older o Category 2: People with one first-degree relative diagnosed with colorectal cancer before age 55; people with two first-degree relatives diagnosed with colorectal cancer at any age; and people with one first-degree relative and at least two second-degree relatives diagnosed with colorectal cancer at any age	• Who is notified? o The program sends an iFOBT by mail to all participants in the program • How are they notified? o Test results are sent directly to participants and primary-care providers o A national program register collects data to enhance quality and reporting • When are they notified? o Participants are notified of test results o State and territory governments provide encouragement for participants to follow up on abnormal results • Who makes a referral? o Physicians are responsible for following up on abnormal results	• No information available

		○ Category 3: People with three first- or second-degree relatives with colorectal cancer (at least one diagnosed before age 55), people with at least three first-degree relatives diagnosed at any age ○ Other information on age, symptoms, family history, personal medical history • Processes and tools used to collect information ○ Program has established clinical practice guidelines to guide physicians in appropriate categorization of risk • Who is collecting the data? ○ Primary-care providers are responsible for initial collection of risk data	and referring to colonoscopy, with further scheduling depending on the category of risk	
New Zealand	*Program name*: The National Bowel Screening Programme *Population(s) served*: Entire country	• What information is collected to calculate personal risk of CRC? ○ Age (50-74) ○ Personal history of colorectal cancer, adenomas, inflammatory bowel disease, other colon cancer syndromes ○ Family history of colorectal cancer ○ Symptoms of colon cancer • Processes and tools used to collect information ○ Primary-care physicians are responsible for collecting screening data and directing participants to correct resources	• Who is notified? ○ National Bowel Screening Program sends out invitations, testing kits, and follow-up of test results • How are they notified? ○ Physicians are notified of results by the National Coordination Centre, the operational hub of the program ○ This hub also sends patients letters of test results and informs DHBs of positive tests • When are they notified? ○ Care team and patients involved once test results of initial screening are received • Who makes a referral? ○ No information provided	• Once DHBs join the screening program, they are responsible for the follow-up and treatment of any participants within their area

		• Who is collecting the data? o District Health Boards (DHBs) collect screening data locally on behalf of the program		
United Kingdom (NHS England)	*Program name*: Bowel cancer screening *Population(s) served*: The programs serves those aged 60 to 74 with biannual home testing. The program is beginning phase-in one-time bowel scope screening at age 55. Those older than 75 can request a home-testing kit. Those with risk factors are advised to speak with their general practitioner.	• What information is collected to calculate personal risk of CRC? o Cancer Research UK identifies the following as contributing to higher risk ▪ Inherited familial adenomatous polyps (FAP) ▪ Lynch syndrome (hereditary nonpolyposis colorectal cancer) ▪ Strong family history of bowel cancer ▪ Ulcerative colitis or Crohn's disease ▪ Polyps in the bowel ▪ Personal history of bowel cancer • Processes and tools used to collect information o Patient consultation with general practitioner o In some cases, genetic testing and/or counselling may be used to collect information regarding genetic diseases • Who is collecting the data? o The initial point of contact for higher-risk patients is their general practitioner who will make judgments regarding the appropriate screening and/or referral	• Who is notified? o Depending on the risk factors present, colonoscopy services or geneticists may need to be consulted • How are they notified? o No information available regarding the management of higher -isk patients o NHS England established a timed colorectal cancer diagnostic pathway intended to improve the referral, testing, staging and communication pathway, though there is no mention of higher-risk management • When are they notified? o Cancer Research UK and Bowel Cancer UK present slightly different recommendations for screening of higher-risk patients with various risk factors (such as Lynch Syndrome or familial adenomatous polyps). No information directly from NHS England was identified • Who makes a referral? o General practitioner is main point of contact for higher-risk patients and makes referrals	• No information available

United Kingdom (NHS Scotland)	*Program name*: Scottish Bowel Screening Centre *Population(s) served*: Patients aged 50 to 74	• What information is collected to calculate personal risk of CRC? o No information available • Processes and tools used to collect information o No information available • Who is collecting the data? o No information available	• Who is notified? o No information available • How are they notified? o No information available • When are they notified? o No information available • Who makes a referral? o No information available	• No information available
United States – Kaiser Permanente	*Program name*: Colorectal Cancer Screening *Population(s) served*: Members aged between 50 and 75.	• What information is collected to calculate personal risk of CRC? o Family history of colorectal cancer o Family history of advanced adenomas presenting before age 60 o Certain hereditary colorectal cancer syndromes and inflammatory bowel disease o The guidelines note that special efforts should be made to ensure African-American patients are screened using any acceptable screening modality • Processes and tools used to collect information o Patient consultation with their doctor • Who is collecting the data? o Patients' primary doctor	• Who is notified? o Patients with hereditary colorectal cancer syndromes and inflammatory bowel disease are recommended to be referred to gastroenterology • How are they notified? o No information available • When are they notified? o For patients with significant family history of colorectal cancer (a first-degree relative diagnosed before age 60 or two first-degree relatives diagnosed at any time), colonoscopy is to be started at age 40 or 10 years before the earliest diagnosis in the family o For patients with family history of advanced adenomas presenting before age 60, colonoscopy beginning at age 50 and recurring every 10 years is recommended • Who makes a referral? o No information available	• No information available
United States – Dartmouth-Hitchcock Health System (New Hampshire Colorectal Screening Program)	*Program name*: New Hampshire Colorectal Cancer Screening Program *Population(s) served*: New Hampshire residents age 50-74	• What information is collected to calculate personal risk of CRC? o Age (50+) o Personal history of colorectal cancer, adenomas, inflammatory	• Who is notified? o NHCRCSP receives a referral from physicians and enrollment form from eligible patients (New Hampshire residents aged 50-74) • How are they notified?	• Patient Navigation Services, including nurse navigators, medical oversight, and a program champion, ensures proper patient engagement with program including

		bowel disease, other colon cancer syndromes o Family history of colorectal cancer o Symptoms of colon cancer • Processes and tools used to collect information o Primary-care providers are responsible for collecting information on patient risk • Who is collecting the data? o Physicians conduct risk assessment; program enrollment form also collects data on medical history, cancer history, screening history	o The program is notified via an enrollment form or physician referral • When are they notified? o The program is notified upon referral and the patient is contacted withing five to seven days • Who makes a referral? o Primary-care physicians are responsible for the official referral into the program o Self-referral is accepted, with the program paying for primary-care appointment if necessary to complete required health screening and risk stratification	indicated follow-up after endoscopy
United States – Johns Hopkins Colon Cancer Screening Clinic	*Program name*: John Hopkins Colon Cancer Screening Clinic *Population(s) served*: Maryland and Washington, D.C. metro area	• What information is collected to calculate personal risk of CRC? o Age (50+) o Personal history of colorectal cancer, adenomas, inflammatory bowel disease, other colon cancer syndromes o Family history of colorectal cancer o Symptoms of colon cancer • Processes and tools used to collect information o Primary-care physicians either outside or a part of the screening program conduct a risk assessment o Physicians can refer a patient to the program and expedite endoscopy for higher-risk patients • Who is collecting the data? o Unclear	• Who is notified? o The Colon Cancer Screening Clinic receives patients by self-referral or physician referral • How are they notified? o Patients call either the Maryland or Washington, D.C. offices for self-referral to an appointment o Physicians can call to refer patients to clinic or endoscopy • When are they notified? o The program is notified of higher-risk patients by primary-care physician o Results of patient procedures are sent to physicians within three weeks • Who makes a referral? o Physicians or patients can refer into the program	• The Colon Cancer Screening Clinic contacts physicians within three weeks to communicate tests results and make further surveillance recommendations

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APPENDICES

The following tables provide detailed information about the clinical practice guidelines and systematic reviews identified in the rapid synthesis. The ensuing information was extracted from the following sources:

- clinical practice guidelines – focus of the guideline, producer of the guideline, jurisdictional focus, key findings, date published and AGREE II score (if available from the database that it was identified from); and
- systematic reviews - the focus of the review, key findings, last year the literature was searched, and the proportion of studies conducted in Canada.

We also include a third appendix that provides hyperlinks to examples of specific tools used as part of CRC screening programs.

For the appendix table providing details about the systematic reviews, the fourth column presents a rating of the overall quality of each review. The quality of each review has been assessed using AMSTAR (A MeaSurement Tool to Assess Reviews), which rates overall quality on a scale of 0 to 11, where 11/11 represents a review of the highest quality. It is important to note that the AMSTAR tool was developed to assess reviews focused on clinical interventions, so not all criteria apply to systematic reviews pertaining to delivery, financial or governance arrangements within health systems. Where the denominator is not 11, an aspect of the tool was considered not relevant by the raters. In comparing ratings, it is therefore important to keep both parts of the score (i.e., the numerator and denominator) in mind. For example, a review that scores 8/8 is generally of comparable quality to a review scoring 11/11; both ratings are considered "high scores." A high score signals that readers of the review can have a high level of confidence in its findings. A low score, on the other hand, does not mean that the review should be discarded, merely that less confidence can be placed in its findings and that the review needs to be examined closely to identify its limitations. (Lewin S, Oxman AD, Lavis JN, Fretheim A. SUPPORT Tools for evidence-informed health Policymaking (STP): 8. Deciding how much confidence to place in a systematic review. *Health Research Policy and Systems* 2009; 7 (Suppl1):S8).

All of the information provided in the appendix tables was taken into account by the authors in describing the findings in the rapid synthesis.

Appendix 1: Summary of findings from clinical practice guidelines about criteria for defining individuals at average and increased risk of CRC, and optimal approaches for managing CRC screening for individuals at average and increased risk

Focus of clinical practice guideline	Guideline producer	Jurisdictional focus	Key findings	Publication date	AGREE II score
Colorectal cancer screening for average-risk adults: 2018 guideline update from the American Cancer Society	American Cancer Society	U.S.	The 2018 guideline update from the American Cancer society (ACS) is based on two reports commissioned by the US Preventive Services Task Force (USPSTF), a systematic review and a simulation modelling report. The ACS defines an adult with average risk of CRC as a person without a history of adenomatous polyps or CRC, with no risk factors (e.g., family history; suspected or confirmed hereditary CRC syndrome such as familial adenomatous polypsis or Lynch syndrome), without a history of abdominal or pelvic radiation due to previous cancer, or a history of inflammatory bowel disease. There are recommendations for the following age groups with considerations: 1) begin screening adults aged 45 or older with average risk of CRC with either a high-sensitivity stool-based test or a visual examination based on preference, and if positive, to undergo colonoscopy; 2) regular screening in adults aged 50 or older; 3) adults with average risk and in good health may continue CRC screening until the age of 75; adults aged 76 to 85 should consult with their clinicians to determine if CRC screening is appropriate; adults over the age of 85 are discouraged from CRC screening. In terms of the different types of screening, the ACS notes considerations for CRC screening tests and interval for stool-based tests: 1) fecal immunochemical test (every year); 2) high-sensitivity, guaiac-based fecal occult blood test (every year); and 3) multitarget stool DNA test (every three years). For structural examinations, ACS recommends the following: 1) colonoscopy (every 10 years); 2) CT colonography (every five years); and 3) flexible sigmoidoscopy (every five years). The ACS defines an adult with increased or high risk for developing CRC as a person with history of adenomatous polyps, familial or personal history of CRC before the age of 60, history of inflammatory bowel disease, suspected or confirmed hereditary CRC syndrome or a history of abdominal or pelvic radiation. The current ACS guidelines do not focus on this subset of individuals given that additional screening or testing information is required, such as family history and genetic-counselling referral for hereditary syndromes.	2018	Not reported
Colorectal cancer screening with faecal immunochemical testing, sigmoidoscopy or colonoscopy: a clinical practice	Clinical Effectiveness Research Group (Oslo University Hospital)	Multiple – Norway, U.S., Switzerland, Canada, Saudi Arabia, U.K., Netherlands	The following clinical guidelines focus on initial CRC screening of adults aged 50 to 79 with no history of CRC and life expectancy of at least 15 years. Based on a low GRADE score, the authors do not recommend screening for adults with an estimated 15-year CRC risk below 3%. Adults with an estimated 15-year risk above 3% are recommended for screening with the following options: 1) fecal immunochemical test (every year); 2) fecal immunochemical test (every two years); 3) a single sigmoidoscopy; or 4) colonoscopy (reported weak recommendation).	2019	Not reported

Focus of clinical practice guideline	Guideline producer	Jurisdictional focus	Key findings	Publication date	AGREE II score
Colorectal screening recommendations for asymptomatic and at average-risk adults	US Preventive Services Task Force (USPSTF)	U.S.	The USPSTF recommends screening for adults aged 50 to 76 who are asymptomatic and at average risk based on substantial net benefit. CRC screening for adults aged 76 to 86 should be based on clinician consultation and the person's overall health, while those who have never been screened would likely benefit more. These recommendations do not include suggestions on surveillance programs. Average-risk adults are defined as those who do not have a family history of genetic conditions or disorders that increase the risk of CRC (e.g., Lynch syndrome or familial adenomatous polyposis), and no history of inflammatory bowel disease or CRC. The USPSTF highlights possible CRC screening options for individuals who are not in surveillance programs: 1) gFOBT (every year); 2) FIT (every year); 3) FIT-DNA (every one to three years); 4) colonoscopy (every 10 years); 5) CT colonography (every five years); 6) flexible sigmoidoscopy (every five years); flexible sigmoidoscopy with FIT (every 10 years plus FIT every year). An update of these 2016 recommendations is currently in progress.	2016	Not reported
Endoscopic Management of Lynch Syndrome and of Familial Risk of Colorectal Cancer: European Society of Gastrointestinal Endoscopy (ESGE) Guideline	European Society of Gastrointestinal Endoscopy (ESGE)	Europe	ESGE guidelines focus on adults with increased risk of CRC due to Lynch syndrome and familial risk of CRC. ESGE defines Lynch syndrome as adults with a "constitutional pathogenic variant in one of the mismatch pair genes, MLH1, MSH2, MSH6, PMS2, or the deletions in the 3' region of the EpCAM gene". Based on strong recommendations and moderate quality of evidence, the authors suggest the following screening and surveillance for individuals with Lynch syndrome: 1) start colonoscopy surveillance from 25 years of age for individuals with MLH1 and MSH2 mutation, and from 35 years of age for MSH6 and PMS2 mutation carriers; and 2) high-quality colonoscopy every two years for asymptomatic individuals. ESGE defines familial risk of CRC for adults "with two or more first-degree relatives (FDR) with CRC or one FDR with CRC below the age of 50 years". Based on a strong recommendation and moderate quality evidence, ESGE recommends the following screening and surveillance for individuals with familial risk of CRC: 1) follow-up after polyp excision based on guidance for the general population; 2) start colonoscopy surveillance from the age of 40; and 3) high-quality colonoscopy every five years after baseline examination.	2019	Rigour: 65.6%
Early Detection for Colorectal Cancer: ASCO Resource-Stratified Guideline	American Society of Clinical Oncology	U.S.	The following guidelines are aimed at asymptomatic adults aged 50 to 75 who are at average risk with no family history of colorectal cancer, but are among environments or settings with high incidence of suspected or confirmed cases of CRC. The authors provide options based on resources in a setting (basic, limited, enhanced, maximal). Based on a range of low to high evidence quality with majority strong recommendations, at a maximal setting, an individual should receive a highly-sensitive gFOBT or FIT annually, flexible sigmoidoscopy every five	2019	Not reported

Focus of clinical practice guideline	Guideline producer	Jurisdictional focus	Key findings	Publication date	AGREE II score
			years, flexible sigmoidoscopy every 10 years plus FIT ever year, or a colonoscopy every 10 years. With a positive result from a non-colonoscopy CRC screening, a clinician should perform a colonoscopy. If there are abnormal screening results, an individual should be referred to an endoscopy or surgery.		
Guidelines for Colonoscopy Surveillance After Screening and Polypectomy: A Consensus Update by the US Multi-Society Task Force on Colorectal Cancer	U.S. Multi-Society Task Force on Colorectal Cancer	U.S.	The authors provided updates to the following recommendations for CRC colonoscopy surveillance intervals for adults with baseline average risk: 1) 10-year interval after no adenomas or polyps, or small (<10 mm) hyperplastic polyps in rectum or sigmoid present at baseline colonoscopy; 2) five- to 10-year interval after presence of one to two (<10mm) tubular adenomas; 3) five-year interval after presence of sessile serrated polyp(s) <10 mm with no dysplasia; 4) three-year interval after presence of three to 10 adenomas, greater than 10 adenomas, one or more tubular adenomas that is greater or equal to 10 mm, one or more villous adenomas, adenoma with HGD, or sessile serrated polyp with dysplasia or greater than or equal to 10 mm; and 5) one-year interval after the presence of serrated polpysis syndrome based on the WHO definition.	2012	Not reported
Colorectal cancer surveillance after index colonoscopy: Guidance from the Canadian Association of Gastroenterology	Canadian Association of Gastroenterology (CAG)	Canada	CAG identifies an adult at average risk as an individual with a normal baseline colonoscopy examination with no increased risk due to personal or family history. CAG provides the following recommendations for CRC surveillance intervals after baseline colonoscopy: 1) 10-year interval after identifying no polyps, small (<10 mm) hyperplastic polyps in rectum or sigmoid; five- to 10-year interval after the presence of one to two small (<10 mm) tubular adenomas; 2) five-year interval after presence of sessile serrated polyp(s) <10 mm with no dysplasia; 3) three-year interval after the presence of three to 10 adenomas, one or more tubular adenomas greater or equal to 10 mm (could be shortened if polyps are large or removed piecemeal), one or more villous adenomas, adenoma with HGD, or sessile serrated polyp with dysplasia; and 4) one-year interval after the confirmation of serrated polypsis syndrome based on WHO definition. Among adults with a first-degree relative less than 60 years of age or who has two or more first-degree relatives of any age with CRC, the surveillance interval is shortened by five years with colonoscopy as the screening method (in place of findings where 10-year intervals are recommended by CAG). CAG noted that individuals with increased risk are those who have a history of adenoma and family history.	2013	Not reported
Genetic/Familial High-Risk Assessment: Colorectal, Version 3.2019	National Comprehensive Cancer Network (NCCN)	International	The NCCN's risk assessment for individuals with genetic or familial risk for CRC involves genetic counselling and patient education from clinicians with genetic expertise. Potential genetic conditions that increase the chance of CRC include polyposis syndromes and Lynch syndrome (LS). According to NCCN's stepwise assessment, an individual with personal or family history of more than 10 adenomatous polyps, two or more hamartomatous polyps, or five or more serrated polyps proximal to sigmoid colon may warrant further assessment. According to NCCN's strategy for the evaluation of LS, if an individual is negative for familial pathogenic variant, they are referred to NCCN guidelines for CRC screening. If they test positive they are referred to LS management and genetic testing for at-risk family members.	2019	Not reported

Focus of clinical practice guideline	Guideline producer	Jurisdictional focus	Key findings	Publication date	AGREE II score
Clinical Practice Guideline on Screening for Colorectal Cancer in Individuals With a Family History of Nonhereditary Colorectal Cancer or Adenoma: The Canadian Association of Gastroenterology Banff Consensus	The Canadian Association of Gastroenterology Banff Consensus	Canada	The guidelines focus on five risk categories: 1) adults with two or more first-degree relative (FDRs) with CRC; 2) one FDR with CRC; 3) one or more FDRs with advanced adenoma; 4) one or more secondary-degree relatives (SDRs) with CRC; and 5) one or more FDR with any non-advanced adenoma. Overall, the group strongly recommends screening for adults with one or more FDR with CRC. The following suggested recommendations are based on low-quality evidence with overall agreement from the group. For adults with history of one FDR with CRC, the group suggests: 1) colonoscopy as the screening test with FIT as a second-line option; 2) start CRC screening between ages 40 to 50, or 10 years younger than the diagnosis of FDR; and 3) five- to 10-year screening intervals for colonoscopy or one- to two-year screening intervals with FIT. For adults with two or more FDRs with CRC, the group suggests: 1) colonoscopy as the preferred screening test; 2) start CRC screening at age 40 or 10 years younger than the earliest diagnosis of an FDR; and 3) five-year screening intervals For adults with history of one or more SDRs with CRC, the group suggests: 1) screening (with no mention of preferred screening test); 2) start CRC screening at age 50; and 3) follow screening intervals according to average-risk guidelines. For adults with one or more FDR with advanced adenoma, the group recommends: 1) screening with either colonoscopy or FIT (no preferred screening test); 2) start CRC screening at age 40 to 50 or 10 years younger than the earliest diagnosis of an FDR; 3) five- to 10-year screening interval with colonoscopy or one- to two-year interval with FIT. For adults with one or more FDR with non-advanced adenoma, the group recommends following average-risk guidelines. The group could not make recommendations on age cut-offs for screening, optimal time to initiate screening and screening intervals, and excludes individuals with hereditary syndromes.	2018	Rigour: 82.3%
Referral of Patients With Suspected Colorectal Cancer by Family Physicians and Other Primary Care Providers	Cancer Care Ontario	Canada	The guidelines are aimed at family physicians and other primary-care providers in the management of patients showcasing symptoms of CRC. A history and physical examination should be conducted when patients present the following symptoms: 1) palpable rectal mass; 2) palpable abdominal mass; 3) anemia; 4) rectal bleeding; 5) change in bowel habits; 6) weight loss; 7) abdominal discomfort; and/or 8) perianal symptoms. A focused history should include: 1) age and gender; 2) rectal bleeding; 3) change in bowel habit; 4) abdominal discomfort; 5) perianal symptoms; 6) symptoms of anemia; 7) personal or family history of polyps, IBD, CRC (and age of onset).	2017	Not reported

Focus of clinical practice guideline	Guideline producer	Jurisdictional focus	Key findings	Publication date	AGREE II score
			The referral times are consistent with the recommendations by the Canadian Association of Gastroenterology, including: 1) urgent referral (send referral to specialist within 24 hours, a consultation within two weeks, and diagnostic examination within four weeks) if a patient has at least a palpable rectal mass for CRC or abnormal abdominal imaging; 2) semi-urgent referral (send referral within 24 hours, a consultation within four weeks, and diagnostic examination within eight weeks) if a patient has unexplained rectal bleeding or iron-deficiency anemia; or 3) unexplained symptoms that do not meet the criteria (refer after symptoms do not resolve in four to six weeks). The working group recommended early referral to specialists for those with personal history of polyps or IBD and are part of the surveillance program.		
Colorectal Cancer Screening: Recommendations for Physicians and Patients from the U.S. Multi-Society Task Force on Colorectal Cancer	The US Multi-Society Task Force on Colorectal Cancer	U.S.	Average-risk adults who are age 50 should begin CRC screening, with exceptions for African-Americans who are recommended to start screening at age 45. The US Multi-Society Task Force on Colorectal Cancer recommended the following screening approaches for adults with average-risk of CRC: 1) colonoscopy every 10 years or annual FIT (strong recommendation with moderate-quality evidence) for colorectal neoplasia; 2) CT colonography every five years, FIT-fecal DNA every three years, or flexible sigmoidoscopy every five to 10 years for patients who refuse colonoscopy and FIT (strong recommendation with high-quality evidence); and 3) capsule colonoscopy if the previous screening tests are declined by the patient. Screening recommendations for adults with a first-degree relative (FDR) who was diagnosed less than aged 60 or has two FDRs with CRC or documented advanced adenoma, involves colonoscopy every five years, starting at 10 years younger than the age of the youngest FDR diagnosis or age 40 (whichever is earlier). Screening should start at the age of 40 for adults with a FDR who was diagnosed with CRC, documented advanced adenoma at aged 60 or older, or advanced serrated lesions (≥10 mm in size or an SSP with cytologic dysplasia). Screening options and intervals are recommended akin to average-risk adults. If colonoscopy is declined, adults should be recommended annual FIT (based on strong recommendation and moderate-quality evidence).	2017	Rigour: 60.4%
Recommendations on Screening for Colorectal Cancer in Primary Care	Canadian Task Force on Preventive Health Care	Canada	Recommendations were developed in collaboration with the Public Health Agency of Canada and the National Colorectal Cancer Screening Network. The following recommendations are aimed at adults who are not at high risk for CRC. The working group screening recommendations included: 1) FOBT (gFOBT or FIT) every two years or flexible sigmoidoscopy every 10 years for adults aged 50 to 59 (weak recommendation with moderate-quality evidence); 2) FOBT (gFOBT or FIT) every two years or flexible sigmoidoscopy every 10 years (strong recommendation, moderate-quality evidence); 3) no screening for adults aged 75 and older (weak recommendation with low-quality evidence); and 4) not to use colonoscopy as the primary screening test for CRC (weak recommendation with low-quality evidence).	2016	Rigour: 85.4%

Focus of clinical practice guideline	Guideline producer	Jurisdictional focus	Key findings	Publication date	AGREE II score
			High or increased risk is defined as adults withprevious CRC or polyps, inflammatory bowel disease, signs or symptoms of CRC, history of CRC in one or more first-degree relatives, or adults with hereditary syndromes (e.g., familial adenomatous polyposis, Lynch syndrome).		
Evidence-Based Guideline for Colorectal Cancer	German Guideline Program in Oncology	Germany	The guidelines define asymptomatic population as individuals who do not belong to a CRC risk group and recommend screening to begin at the age of 50. Colonoscopy is recommended as the standard CRC screening test, with 10-year intervals. Sigmoidoscopy or an annual FOBT can be used as screening approaches if a patient refuses a colonoscopy. The authors of the guidelines highlighted increased risk groups for CRC, and that adults with FDR or SDR who had CRC before age 50 have an increased chance of developing CRC. Additionally, adults with multiple (≥ 3) or large (> 1 cm) adenomas have an increased chance for CRC. The use of standardized questionnaires may be helpful to identify familial colon cancer risk. Adults with increased risk should complete a colonoscopy 10 years before the age of a diagnosed FDR with CRC or at the age of 40-45 (based on which comes first), with 10-year intervals if the initial screening was free of polyps. Adults with FDRs with detected adenoma should undergo a colonoscopy 10 years before the age of the initial diagnosis of the FDR. Colonoscopy should be repeated every 10 years if the initial screening was clear. Adults with hereditary syndromes that elevate the risk of CRC should receive genetic counselling before the age of 25. Especially among adults with hereditary colorectal cancer without polyposis, they should undergo annual colonoscopies from the age of 25.	2019	Rigour: 65.6%
ACR Appropriateness Criteria Colorectal Cancer Screening	American College of Radiology	U.S.	The ACR recommended CT colonography for CRC screening among adults with average risk from the ages of 50 or older. If the initial screening test is negative, the recommended interval is every five years. Adults with moderate risk are defined as those with FDRs with history of cancer or adenoma, and are recommended to undergo CT colonography as the appropriate CRC screening. If the initial screening test is negative, the recommended interval is every five years. Adults with increased or high risk are defined as those with hereditary nonpolyposis colorectal cancer, ulcerative colitis, or Crohn colitis), and are recommended for colonoscopy given its ability to obtain biopsies.	2018	Rigour: 67.7%

Appendix 2: Summary of findings from systematic reviews about criteria for defining individuals at average and increased risk of CRC, and optimal approaches for managing CRC screening for individuals at average and increased risk

Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
Colorectal cancer screening in average risk populations: Evidence summary	This review included 30 randomized controlled trials and 29 observational studies for a total of 59 studies. The objective of this review was to critically evaluate the evidence surrounding colorectal cancer screening for average-risk adults, which includes the benefits and harms, the optimal primary screening tests, the appropriate age of initiation/cessation for screening, and the intervals for successive screening in the average-risk adult. The reported outcomes screening tests vary by test, however, all-cause mortality, the incidence of colorectal cancer, participation rate, and diagnostic outcomes were considered important outcomes of interest. The evidence to support the use of fecal tests for occult blood to screen people at average risk of colorectal cancer was deemed to be strong. The evidence to support the use of flexible sigmoidoscopy to screen people at average risk of colorectal cancer was also deemed to be strong, however the evidence to support the use of colonoscopy screening for this same population was of low certainty. To have a more complete understanding of the benefits and harms of colonoscopy, the results of current ongoing randomized controlled trials must be evaluated once they are available. There was insufficient evidence to support the use of radiological tests, DNA tests and metabolomic tests to screen people at average risk of colorectal cancer. Both annual and biennial screening using fecal tests for occult blood reduced mortality associated with colorectal cancer, however there was insufficient data to support changing the age of initiation and cessation for this screening method. The authors state that the information from this review alongside other criteria such as cost-effectiveness, public acceptability and feasibility are critical in the ongoing development of Ontario's colorectal cancer screening program.	2014	7/10 (AMSTAR rating from McMaster Health Forum)	Not reported
Screening for colorectal cancer: A systematic review and meta-analysis	This review included 87 studies and aimed to evaluate the effectiveness of various colorectal cancer screening tests to reduce mortality related to this disease, as well as all-cause mortality and the incidence of late-stage colorectal cancer. Within this objective, the authors examined the optimal age to begin and end screening and the optimal screening time interval. The systematic review found that guaiac fecal occult blood testing resulted in a relative reduction of 18% in mortality related to colorectal cancer, over a median follow-up period of 18.25 years. This type of screening was also associated with a small reduction of incidence of late-stage colorectal cancer, but had no effects on all-cause mortality. Similarly, flexible sigmoidoscopy screening was associated with a 26% reduction in colorectal-cancer mortality over a medium follow-up period of 11.3 years. This type of screening resulted in a significant reduction of incidence of late-stage cancer, however did not have any effect on all-cause mortality. Colonoscopy screening every 10 years yielded the greatest net health benefit when compared to annual screening by fecal occult blood test or low-sensitivity guaiac tests. It is important to note that no randomized controlled trials were found to support the benefits of colonoscopy screening for colorectal	2015	8/10 (AMSTAR rating from McMaster Health Forum)	0/87

	cancer. All-cause mortality was not significantly higher for screening groups receiving either guaiac fecal occult blood testing or flexible sigmoidoscopy compared to control groups. No significant trend for colorectal mortality based on age groups was found, and the metaregression did not show any significant interaction with age when assessing colorectal mortality for guaiac fecal occult blood testing or flexible sigmoidoscopy screening. The authors state that there was insufficient evidence to answer all sub-questions of the review, and to interpret the results of fecal occult blood testing with caution as this is a relatively new test making it hard to determine long-term outcomes. There were also insufficient studies that reported the outcome of interest to assess publication bias.			
Screening for Colorectal Cancer: Updated Evidence Report and Systematic Review for the US Preventive Services Task Force	This review was conducted to update the 2008 screening guidelines for colorectal cancer set by the United State Preventive Services Task Force. The aim of the review was to evaluate the effectiveness, diagnostic accuracy and harms of screening for colorectal cancer with a total of 156 studies included. The authors state that to date, no colorectal screening test has been shown to reduce all-cause mortality. Although both hemoccult II and flexible sigmoidoscopy have been shown to reduce colorectal mortality, neither of these tests are widely used in the United States. Colonoscopies are slightly more invasive than other available screening tests, but are currently the criterion standard for assessing test performance of other colorectal screening tests. Computed tomographic colonography has been shown to detect colorectal cancer and large potential precursor lesions, and the risk of immediate harms is very low. However, it is unclear whether the cumulative exposure to low-dose radiation causes any long-term harms. The authors claim that it still remains unclear whether detection of extracolonic findings represents a net benefit or harm to patients. This review was not able to address several important topics such as screening in high-risk adults, risk assessment to tailor screening, test acceptability and availability, methods to improve adherence and the overuse and misuse of screening for colorectal cancer. Large-scale trials and well-designed cohort studies with average-risk populations are needed to evaluate colonoscopies and stool tests and to better understand the effects of colorectal cancer on cancer mortality.	2016	9/11 (AMSTAR rating from McMaster Health Forum)	0/156
Impact of colorectal cancer screening on cancer-specific mortality in Europe: A systematic review	This review compared the mortality effects of colorectal cancer screening across European regions with a total of 18 studies included. Eleven studies were related to guaiac fecal occult blood testing, four were related to flexible sigmoidoscopy, two were related to fecal immunochemical testing and one was related to colonoscopy. For patients undergoing guaiac fecal occult blood test screening, cancer-specific mortality reduction was 8-16% across Europe. It's important to note that this type of screening varied greatly between regions, with a higher willingness to accept guaiac fecal occult blood tests in the northern region rather than western Europe. Only one flexible sigmoidoscopy per patient was associated with a reduction in colorectal cancer mortality ranging from 21% to 30%. The authors state that there was very limited evidence on the effectiveness of fecal immunochemical testing and colonoscopy screening since almost all screening programs were implemented recently, making it impossible to observe mortality rates. The authors conclude that screening strategies such as guaiac fecal occult blood testing and flexible sigmoidoscopy have consistent effects on colorectal cancer mortality across Europe. They also state one limitation of their review being the fact that no studies in the review pertained to eastern European	2018	7/10 (AMSTAR rating from McMaster Health Forum)	0/18

	countries. This may be problematic since colorectal cancer mortality is higher in central and eastern Europe, making screening programs even more crucial in this region.			
Effectiveness of screening modalities in colorectal cancer: A network meta-analysis	This review included 44 studies with the objective of evaluating the effectiveness of screening modalities to prevent colorectal cancer incidence and mortality. A network meta-analysis was used to estimate the relative risk between different screening methods. No studies were found on the effectiveness of colorectal cancer screening using computed tomography colonography, fecal DNA or barium enema. Colonoscopy seemed to have the highest possibility of being the screening method for reducing colorectal cancer-related mortality, while guaiac fecal occult blood tests showed less of a reduction in mortality rates. The use of flexible sigmoidoscopy as a screening test showed a significant decrease in mortality related to colorectal cancer, however there was no effect of screening on the mortality of proximal colon cancers. The authors explain this by stating that there is less protection against cancer in the proximal colon than in the distal colon. The review concludes that overall, screening methods such as guaiac fecal occult blood tests, fecal immunohistochemical testing, flexible sigmoidoscopy and colonoscopy reduce the incidence of colorectal cancer by 13% in the average-risk population.	2016	5/11 (AMSTAR rating from McMaster Health Forum)	5/44
Efficacy and cost-effectiveness of fecal immunochemical test versus colonoscopy in colorectal cancer screening: A systematic review and meta-analysis	The objective of this review was to compare the efficacy and cost effectiveness of fecal immunochemical tests and colonoscopies in an average-risk population for the purpose of screening for colorectal cancer. Twenty-three studies were included in the review and the outcomes were the detection of any adenoma, advanced adenoma, colorectal cancer or advanced neoplasia as well as quality-adjusted life-years. The results of this review revealed that the detection of colorectal cancer using fecal immunochemical tests is similar to a one-time colonoscopy. When considering adenomas or advanced adenomas, fecal immunochemical tests were inferior to a one-time colonoscopy. Cost-effectiveness analyses found most annual and biennial fecal immunochemical blood tests to be very cost-effective or even cost-saving compared to a 10-yearly colonoscopy. The authors state that their findings on the efficacy of fecal immunochemical blood tests versus colonoscopy were based only on the first round of fecal blood tests. Fecal immunochemical blood tests are to be repeated every one to two years for optimal colorectal cancer screening, therefore these results may not be applicable for the programmatic performance of such screening tests. Their meta-analysis was also suspected to be underpowered and therefore should be treated with caution when reporting the difference in detection rate between fecal immunochemical blood tests and colonoscopy groups.	2018	8/10 (AMSTAR rating from McMaster Health Forum)	1/23

Appendix 3: Examples of specific tools used as part of CRC screening programs

Jurisdiction	Pre-colonoscopy medical assessments	Colonoscopy consent documents and consent documents used at time of initial participation in screening programs	Colonoscopy and pathology reports and attempts to use IT to import needed data (e.g., polyp size and pathology) into screening-program databases to aid in making recommendations for future surveillance	Colonoscopy follow-up recommendation reports (post screening)
Canada				
British Columbia	• Complete Colon Screening Program Colonoscopy Referral Form	• No specific tools identified	• No specific tools identified	• No specific tools identified
Alberta	• For patients identified as higher risk, primary-care providers fill out the ACRCSP Standardized Referral Form to inform the triage process	• No specific tools identified	• No specific tools identified	• No specific tools identified
Saskatchewan	• No specific tools identified	• No specific tools identified	• Procedure Room Screening Colonoscopy Indicator Sheet	• Re-screening and surveillance guidelines
Manitoba	• No specific tools identified	• No specific tools identified	• No specific tools identified	• Formal program partnerships with endoscopists ensure timely follow-up and standardized reporting
Ontario	Mobile screening coaches travel between communities in Ontario providing cancer-screening services • Primary-care providers in a Patient Enrollment Model receive a Screening Activity Report detailing the screening status of patients in their practice • Online risk assessment	• No specific tools identified	• No specific tools identified	• No specific tools identified
Quebec	• Management algorithm for people at risk of colorectal cancer (French)	• No specific tools identified	• No specific tools identified	• No specific tools identified

Jurisdiction	Pre-colonoscopy medical assessments	Colonoscopy consent documents and consent documents used at time of initial participation in screening programs	Colonoscopy and pathology reports and attempts to use IT to import needed data (e.g., polyp size and pathology) into screening-program databases to aid in making recommendations for future surveillance	Colonoscopy follow-up recommendation reports (post screening)
New Brunswick	• New Brunswick Colon Cancer Screening Clinical Practice Guidelines	• No specific tools identified	• No specific tools identified	• No specific tools identified
Nova Scotia	• No specific tools identified	• Colon Cancer Prevention Program Participation Form	• No specific tools identified	• Colon Cancer Treatment Overview
Prince Edward Island	• No specific tools identified	• No specific tools identified	• No specific tools identified	• No specific tools identified
Newfoundland and Labrador	• No specific tools identified	• No specific tools identified	• No specific tools identified	• No specific tools identified
Yukon	• No specific tools identified	• No specific tools identified	• No specific tools identified	• No specific tools identified
Northwest Territories	• NWT Colorectal Screening Guidelines	• No specific tools identified	• No specific tools identified	• No specific tools identified
Nunavut	• No specific tools identified	• No specific tools identified	• No specific tools identified	• No specific tools identified
International				
Australia	• No specific tools identified	• No specific tools identified	• No specific tools identified	• No specific tools identified
New Zealand	• No specific tools identified	• No specific tools identified	• No specific tools identified	• No specific tools identified
United Kingdom (NHS England)	• No specific tools identified	• No specific tools identified	• No specific tools identified	• No specific tools identified
United Kingdom (NHS Scotland)	• Bowel Screening Standards	• No specific tools identified	• No specific tools identified	• No specific tools identified
United States (Kaiser Permanente)	• Colorectal Cancer Screening National Guideline Summary • Colorectal Cancer Screening Guideline, Washington	• No specific tools identified	• No specific tools identified	• No specific tools identified
United States (New Hampshire Screening Program)	• NHCRCSP enrollment form • Primary Care Provider Colonoscopy Referral Form	• No specific tools identified	• No specific tools identified	• No specific tools identified
United States (John Hopkins)	• No specific tools identified	• No specific tools identified	• No specific tools identified	• No specific tools identified