Journal of the Canadian Association of Gastroenterology, 2026, **9**, 61–71
https://doi.org/10.1093/jcag/gwag008
Published: 07 March 2026
Original Article

2026 RD McKenna Memorial Lecture

Should we screen for colorectal cancer with biennial FIT beginning at age 45 in Canada?

Linda Rabeneck, CM, MD, MPH[1], Jill Tinmouth, MD, PhD[1,2,3], John M. Hutchinson, BHSc[4], Yibing Ruan, PhD, MPH[5], Robert J. Hilsden, MD, PhD[6,7], Matthew T. Warkentin, PhD[4], Jennifer J. Telford, MD, MPH[8], Harminder Singh, MD[9], Mark J. Dobrow, PhD[3], Alan N. Barkun, MD, CM[10], Diego Llovet, PhD[3], Jerry McGrath, MD[11], Amanda J. Sheppard, PhD[12,13], Catherine Dubé, MD, MSc[14], Henrik du Plessis, MB-ChB[15], Clarence K.W. Wong, MD[16], Sean P. Cleary, MD, MSc, MPH[17], Andrew J. Coldman, PhD[18], Steven J. Heitman, MD, MSc[6,7], Laura C. Senese, MA, BSc[2], Darren R. Brenner, PhD*[,4,7]; on Behalf of the Canadian Colorectal Cancer Screening Research Network

[1]Department of Medicine, University of Toronto, Toronto, ON M5S 3K3, Canada
[2]Department of Medicine, Sunnybrook Health Sciences Centre, Toronto, ON M4N 3M5, Canada
[3]Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, ON M5T 3M6, Canada
[4]Department of Oncology, Cumming School of Medicine, Calgary, AB T2N 2T8, Canada
[5]Department of Cancer Epidemiology and Prevention Research, Cancer Care Alberta, Alberta Health Services, Calgary, AB T2N 5G2, Canada
[6]Department of Medicine, Cumming School of Medicine, Calgary, AB T2N 2T8, Canada
[7]Department of Community Health Sciences, Cumming School of Medicine, Calgary, AB T2N 2T8, Canada
[8]Department of Medicine, University of British Columbia, Vancouver, BC V6T 1Z3, Canada
[9]Department of Internal Medicine, Max Rady College of Medicine, Rady Faculty of Health Sciences, University of Manitoba and Paul Albrechtsen Research Institute CancerCare Manitoba, Winnipeg, MB R3E 0V9, Canada
[10]Department of Medicine, McGill University, Montreal, QC H3G 2M1, Canada
[11]Department of Medicine, Memorial University of Newfoundland, St. John's, NL A1B 3X5, Canada
[12]Indigenous Health Unit, Acute & Hospital-Based Care, Ontario Health, Toronto, ON M5G 2L3, Canada
[13]Dalla Lana School of Public Health, University of Toronto, Toronto, ON M5T 3M7, Canada
[14]Division of Gastroenterology, Department of Medicine, University of Ottawa, Ottawa, ON K1H 8M5, Canada
[15]College of Medicine, University of Saskatchewan, Saskatoon, SK S7N 5E5, Canada
[16]Department of Gastroenterology, University of Alberta, Edmonton, AB T6G 2X8, Canada
[17]Department of Surgery, University Health Network, Toronto, ON M5G 2C4,Canada
[18]British Columbia Cancer Research Institute, Vancouver, BC, V5Z 0B4, Canada

*Corresponding author: Darren R. Brenner, PhD (darren.brenner@ucalgary.ca)

Abstract

Background: Increasing incidence rates of colorectal cancer (CRC) diagnosed before age 50 have been reported in Canada and other Western countries. Several organizations have lowered their recommended starting age for CRC screening. We aimed to analyze CRC rates in Canada and model the impacts of lowering the age to start faecal immunochemical test (FIT)-based screening in Canada.

Methods: We evaluated the differences in absolute and relative incidence rates between age groups over time using the Canadian Cancer Registry data. Additionally, we used the OncoSim-Colorectal microsimulation model to examine starting FIT screening at 45 years of age over a lifetime time horizon. We estimated changes in CRC cases, deaths, potential years of life gained, and costs.

Results: Absolute CRC incidence increased among groups below 50 years of age, with recent birth cohorts experiencing the greatest relative increases. Microsimulation results suggest that screening at 45 would result in fewer CRC cases (15 070) and CRC deaths (6100) in Canada between 2025 and 2071. For every additional 100 colonoscopies, 3.5 fewer CRC cases and 1.4 fewer CRC deaths are expected. Modelling suggests this may lead to an overall cost savings of $233 million CAD over the lifespan of eligible cohorts.

Conclusion: Our results indicate that as CRC incidence in younger age groups has continued to increase, lowering the age to start FIT screening to 45 would result in overall population benefit through reduced CRC incidence and mortality. However, given resource considerations, provincial decision makers must evaluate changes in their programs to ensure proper implementation.

Key words: colorectal neoplasms; early detection of cancer; computer simulation; cancer screening tests

Lay Summary

Early-onset colorectal cancers have increased in Canada. This study looked at whether screening from age 45 would be beneficial. The results show that younger people continue to have increasing rates of colorectal cancer. Screening at 45 would lead to 15 000 fewer cases and 6000 fewer deaths. Over time, starting at a lower age would also lead to expected cost savings. This study suggests that lowering the screening age would result in fewer cases and deaths. Because a change would require more resources, provinces should look to minimize any impacts from a change.

Introduction

Colorectal cancer (CRC) is the fourth most commonly diagnosed cancer and second leading cause of cancer death in Canada.[1] Beginning in 2008, most Canadian provinces and territories have implemented CRC screening of asymptomatic average-risk individuals aged 50 to 74 years. Screening is recommended using the faecal immunochemical test (FIT) every 2 years.[2] Most CRC screening programs in Canada are population-based, and publicly funded, organized, and administered through the provinces and territories. In 2017, a report drew attention to a major shift in the epidemiology of CRC, with increased incidence among younger individuals, in the United States.[3] This reported rise in CRC incidence in younger persons has now been observed in many countries, including Canada.[4] In 2018, in response to the changing epidemiology of the disease, the American Cancer Society recommended lowering the age to start CRC screening from 50 to 45 years.[5] In 2021, the US Preventive Services Task Force (USPSTF), and then in 2022, the US Multi-Society Task Force (USMSTF) lowered the recommended age to 45 to start CRC screening.[6,7] The National Health and Medical Research Council of Australia also recommended lowering the age to start screening to 45 in 2023.[8] In 2016, the Canadian Task Force on Preventive Health Care (CTFPHC) recommended CRC screening in adults aged 50 to 74 years.[9] However, these recommendations have not been updated, and the activities of the Task Force are currently on hold.

The aim of this work is to determine whether CRC screening with biennial FIT starting at age 45 years should be considered in Canada. To achieve this aim, we (1) updated the analyses of CRC incidence rates in Canada through 2022 and (2) used microsimulation to examine the difference in CRC cases detected, CRC mortality, and total health system costs for different screening strategies.

Methods

Updated CRC incidence and mortality trends in Canada

To examine the trends in absolute age-specific cancer rates, we utilized incidence data for cancers of colon (C18.0, C18.2-C18.9 and C26.0 from the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* [ICD-10]) and rectum (C19, C20). Complete data were obtained from the National Cancer Incidence Reporting System (1971-1991) and the Canadian Cancer Registry (CCR) (1992-2022) in February of 2025. The CCR included data provided by the provincial and territorial cancer registries (PTCRs) that are legislated to collect and report cancer incidence. Each PTCR identifies tumours in its population by combining information from various clinical and administrative sources. The type of cancer or cancer death is ascertained with ICD-O-3 and ICD-10 codes.[10,11] A quality control process is implemented by the CCR to assure the accuracy and completeness of the incidence and mortality data.[12] In these analyses, we included population-based data from all provinces and territories up to 2022. We used aggregated data of cancer cases by province, age, sex, and calendar year. National counts were simple summation of provincial counts. However, in the case of Nova Scotia and Quebec, data were only available up to 2019 and 2017, respectively. Province-specific rates were also estimated, and territories were grouped due to small case counts. Colorectal cancer incidence was compared between 5-year age groups by year to determine any change in trends between age groups.

We evaluated relative incidence of CRC in Canada (excluding Nova Scotia and Quebec) over time across birth cohorts using the age-period-cohort analysis web-tool from the National Cancer Institute.[13] Cohort effects are presented as incidence rate ratios (IRRs) with 1953-1957 as the reference birth cohort.[14] In this context, IRRs represent the comparison of incidence rates between different age-cohorts (relative to a reference-cohort). The first and last birth cohorts in this analysis were from year 1928-1932 and 1993-1997, respectively. All statistical tests were 2-sided with a significance level of 0.05.

Microsimulation to evaluate lowering starting age in the Canadian population

Using the OncoSim-Colorectal model (version 3.6.9.3), we simulated a change in screening with biennial FIT across Canada from the current starting age of 50 years to a lower age of 45 years.[15] Modelling details and specific parameters are included in Table S1. We simulated FIT testing every 2 years with a starting age of 45 or 50 years and an ending age of 74 years over the period from 2025 to 2071. Four birth cohorts were used for this study (1975-1979, 1980-1984,1985-1989, and 1990-1994). The year 2025 represented the beginning of the screening change and 2071 was the year where all members of the 1990 to 1994 cohort would exit screening. Screening participation was modelled as 43% and adherence with subsequent screening was modelled at 80% based on population survey data from the Canadian Community Health Survey.[16] To model the increased rates of CRC in younger cohorts, we generated a cohort-specific adenoma-rate multiplier based on previous data (Table S2). We set up reference scenarios with the current screening starting age of 50 years and comparator scenarios with a change of the starting age to 45 years. For the purposes of the reference scenario, we assumed that screening was not occurring before 50 years of age.

The main analysis assumed an FIT threshold of 20 µg/g for a positive result. As sensitivity analyses, we also applied FIT thresholds of 10 and 35 µg/g to inform provinces with differing

FIT thresholds. Faecal immunochemical test positivity rates for cancer or polyps of various sizes for each threshold previously calculated for use in OncoSim are shown in Table S3. Methodology similar to Coldman (2017) was used to derive these values.[17] In the model, participants with a positive FIT return to their primary care provider for an office visit and are referred for colonoscopy. Within OncoSim, there is an 85% compliance rate for FIT-positive patients to undergo colonoscopy. Based on the colonoscopy results, participants are classified into 4 groups: adenoma-free, low risk, high risk, and cancer. Adenoma-free participants return to FIT screening with the same interval as previous (generally 2 years). Low-risk participants, defined as having fewer than 3 small (<10 mm) nonvillous adenomas, undergo another colonoscopy in 5 years, and if no adenomas are found, they return to FIT screening. High-risk participants, defined as having 3 or more small nonvillous adenomas, 1 or more large adenomas (≥10 mm) or an adenoma with a villous or tubulovillous component, undergo colonoscopies at 3 and 5 years before returning to FIT screening. Participants with cancer are referred for treatment and undergo colonoscopy the next year and every 3 years thereafter.

The primary outcomes were the difference in the number of CRCs detected, in CRC deaths and potential years of life gained, between the age 45 and 50 scenarios. Potential years of life gained (PYLG) were calculated as the difference in the number of potential years of life lost (PYLL) before 75 years in the age 45 scenario, compared to the age 50 scenario. For example, a CRC death at age 60 would contribute 15 PYLL; a CRC death at age greater than 75 contributes 0 PYLL. Age 75 was used as the cut-off because it was considered a benchmark for premature death in Canada.[18] To evaluate relative differences between the age 50 and 45 scenarios, in terms of additional FITs and colonoscopies done for those with a positive FIT, we estimated the reduction in cases and deaths per 100 additional colonoscopies or 1000 additional FITs. Total health system costs from the perspective of a provincial payer were examined including screening costs and cancer diagnosis and treatment costs. These costs were obtained primarily from Ontario sources. Detailed cost tables and sources are included in Tables S4 and S5. To simplify the data presentation, we included only the most common FIT threshold of 20 µg/g for our main results.

Results

CRC incidence and mortality trends in Canada

As previously reported, absolute CRC incidence rates in Canada among individuals younger than 50 years have been increasing (while still generally remaining lower than the rates of individuals older than 50 years), with the most dramatic increase occurring after 1996.[4] New data from 2022 reported here suggest these trends continued after the disruptions from the COVID-19 pandemic. The absolute CRC incidence rates by 5-year age group for all of Canada are shown in Figure 1. Figure 2 presents CRC incidence rates among the 45 to 49 and 50 to 54 age groups for all 10 provinces and the 3 territories (grouped together) over time. To account for the annual variability, 5-year average smoothing has been used. The CRC rates vary considerably across Canada generally in an east to west gradient. For example, 5-year smoothed CRC incidence in 2022 is highest in Newfoundland and Labrador, the eastern-most province, and lowest in British Columbia, the western-most province. Without smoothing, in 2022, British Columbia had 33.8 cases per 100 000 in the 45 to 49 years of age group, compared to 43.6 in Newfoundland and Labrador. Within the 50 to 54 years group, British Columbia had 58.6 cases per 100 000 compared to 64.4 in Newfoundland and Labrador.

The relative CRC incidence rates for all of Canada also continue to increase, as shown in Figure 3, which provides CRC

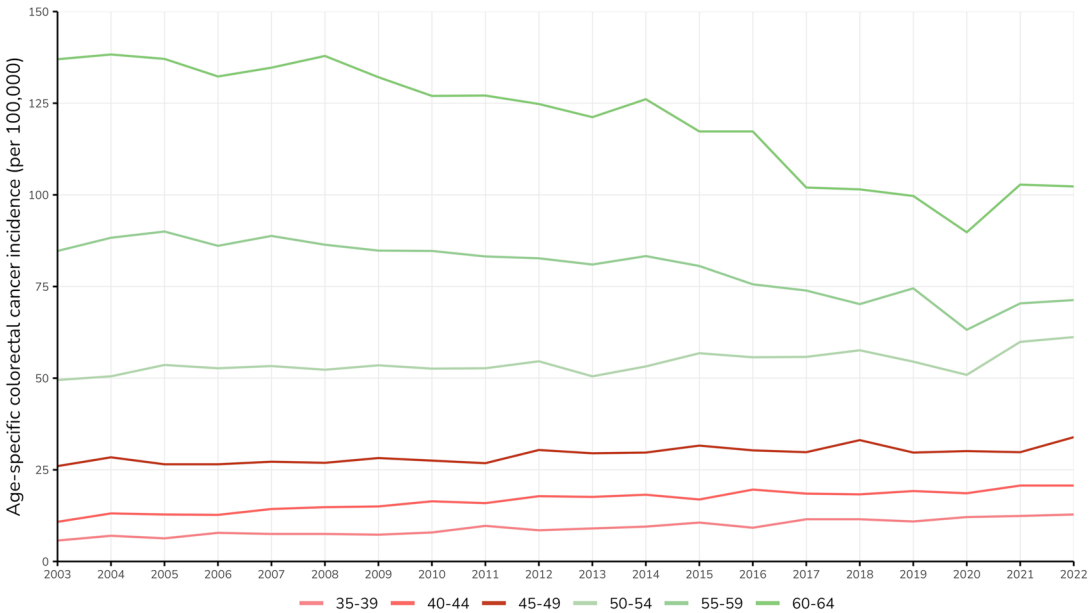

Figure 1 Age-specific colorectal cancer incidence rate (per 100 000) between 2003 and 2022 for all of Canada (excluding Nova Scotia and Quebec) by 5-year age group from age 35 to 64. The data were obtained from Statistics Canada.

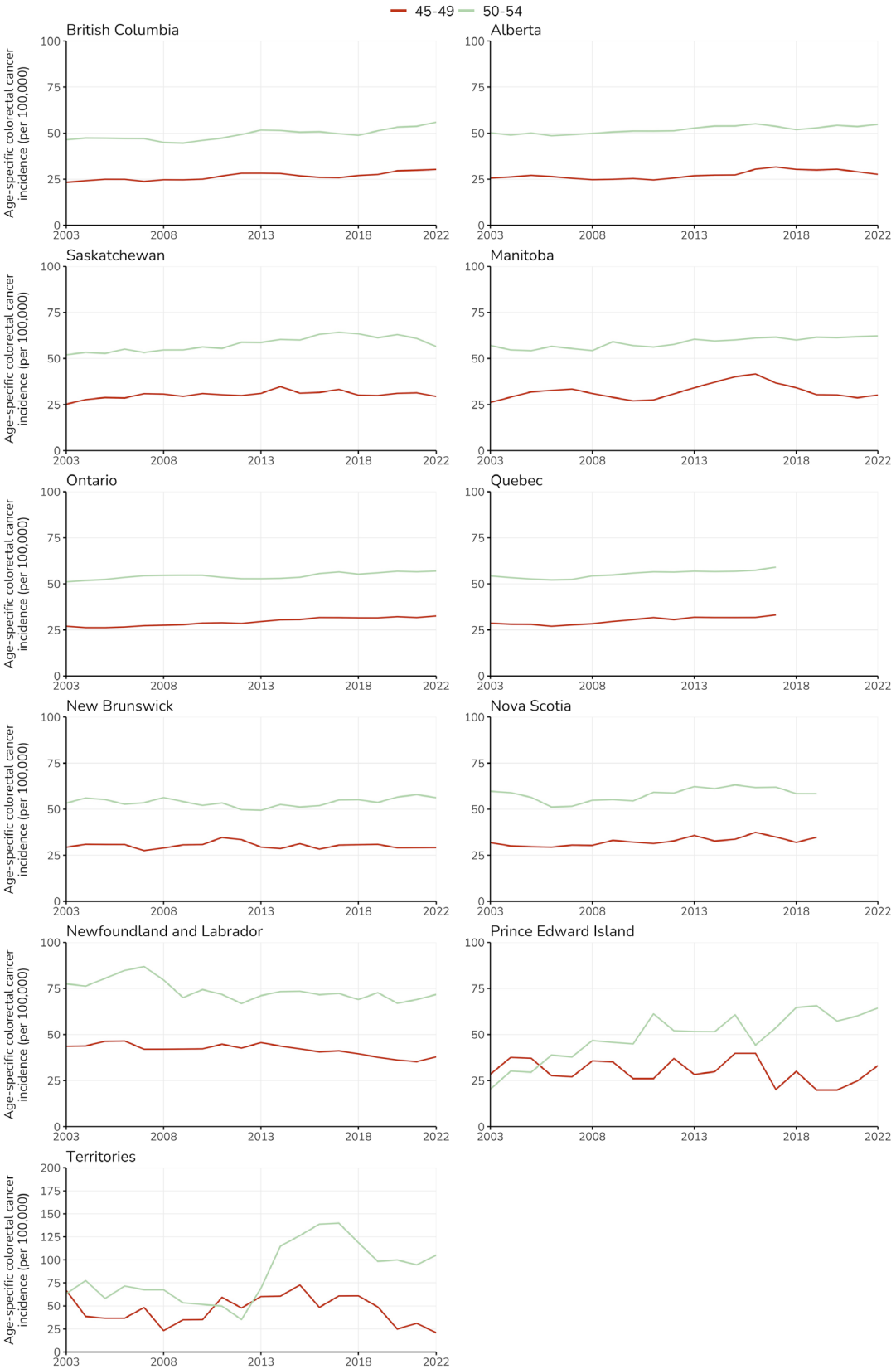

Figure 2 Age-specific colorectal cancer incidence rate (per 100 000) by province, obtained from Statistics Canada. Each plot is shown between 2003 and the latest date available for each province. The 45 to 49 and 50 to 54 age groups are displayed.

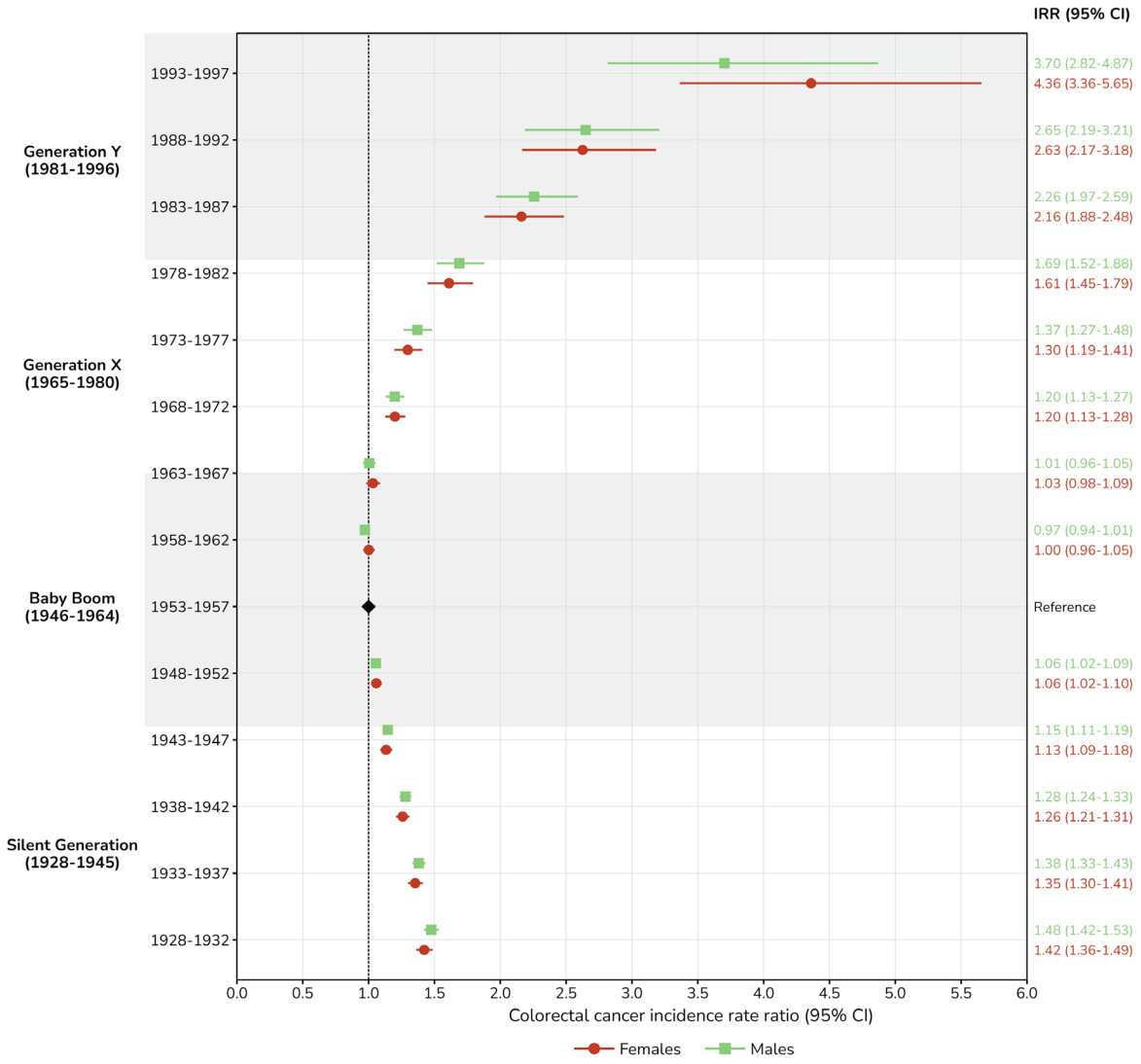

Figure 3 Colorectal cancer incidence rate ratio by birth cohort, estimated using age-period-cohort models with incidence data aged 25 years and over obtained from Statistics Canada. The years 1953-1957 have been designated as the reference group. Abbreviations: CI, confidence interval; IRR, incidence rate ratio.

incidence rate ratio plots by 5-year birth cohort. In contrast to the reference group of Canadians born between 1953 and 1957, each successive group and generation has observed a significantly increased risk of CRC in Canada. This indicates that the incidence rates of younger individuals may continue to rise, necessitating additional preventive efforts.

Microsimulation modelling

The differences in CRC cases and CRC deaths between starting ages generated by microsimulation are presented in Figure 4. When compared to starting FIT screening at age 50, starting at age 45 is estimated to result in considerably lower numbers of CRCs diagnosed (15 070) and CRC deaths (6100) over the OncoSim simulation period (2025-2071) (Figure 4). This change is most prominent in the 50 to 54 years age group but extends across the screening age range into the 75 to 79 years age group. On a per screen basis, the model suggests that lowering the age to initiate screening would result in 3.5 fewer incident CRCs per 100 additional colonoscopies performed (for those with a positive FIT), and 2.2 fewer CRCs per 1000 additional FITs, from 2025 to 2071. Similarly, for CRC deaths over the same time period, the model suggests 1.4 fewer CRC deaths per 100 additional colonoscopies performed, and 0.9 fewer CRC deaths per 1000 additional FITs. The notable reductions in cases and deaths at younger ages result in a substantial number of potential years of life gained before 75 years of age, which is presented by age groups and overall in Figure 5. The models suggest that lowering the screening age would lead to an overall cost savings as shown in Figure 5, as the increase in costs required to screen the younger age group would be offset by anticipated reductions in cancer diagnosis and treatment costs. Results including the 10 and 35 µg/g FIT thresholds are available in Figures S2 and S3. The values used to estimate the differences between

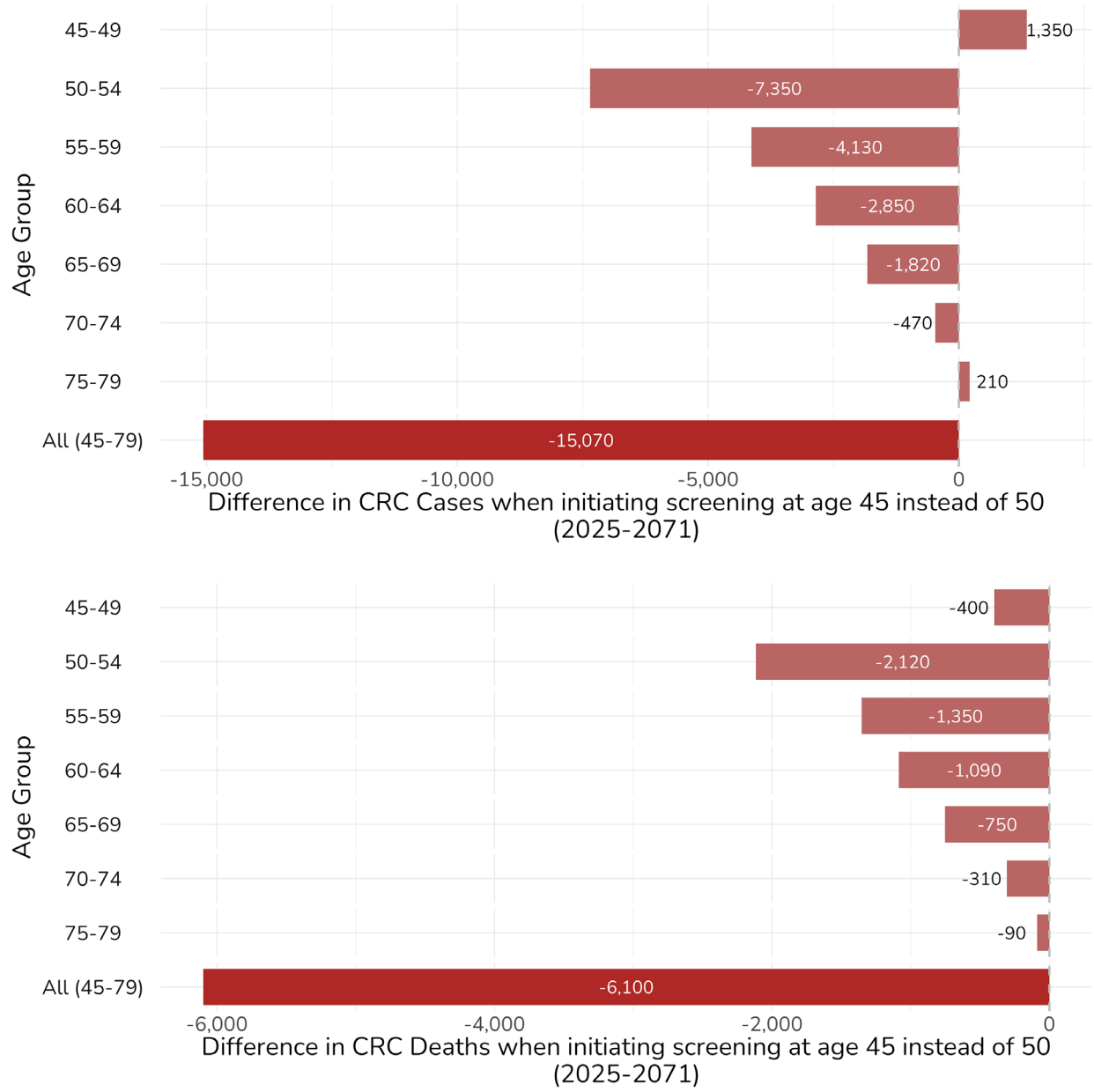

Figure 4 Difference in the estimated numbers of CRC diagnoses and deaths resulting from lowering the start age of FIT screening to 45 from 50 years old. Results are grouped by age. Results shown are for 20 µg/g FIT threshold scenarios. Abbreviations: CRC, colorectal cancer; FIT, faecal immunochemical test.

scenarios are available within Figures S4 to S6 for each FIT threshold. Within these analyses, both the 45-year and 50-year starting age use the same FIT threshold, meaning these results can be used to estimate the change in using different FIT thresholds. These results show similar results to the 20 µg/g FIT threshold, where there is an overall cost savings with a reduction in deaths.

Discussion

Results from these analyses of incidence trends and microsimulation modelling indicate that lowering the age to start CRC screening with biennial FIT to age 45 years would result in a notable reduction in the number of CRC diagnoses, CRC deaths, and person-years of life lost in Canada. Lowering the age to 45 years also would result in a lower CRC incidence both among 50-year-olds to 54-year-olds and older age groups, highlighting the further population benefit of early screening. The modelling also suggests that lowering the age to 45 years would lead to an overall net cost-saving over the long term, resulting from considerably reduced cancer diagnosis and treatment costs that would offset increased costs related to screening.

Results included in this analysis show that CRC incidence rates in younger Canadian adults are similar to the United States and Australia where individuals are eligible to screen starting from

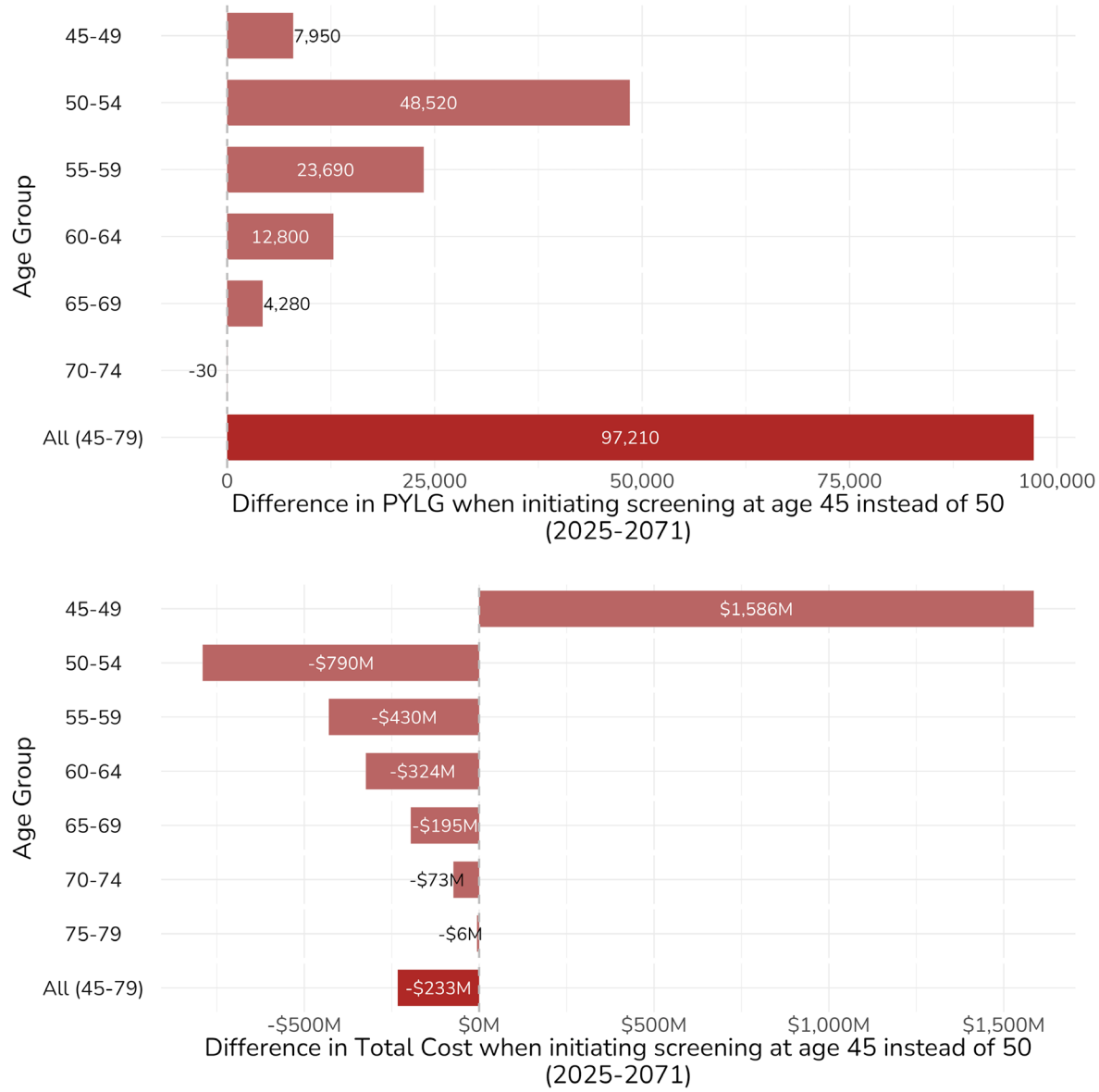

Figure 5 Difference in PYLG (before the age of 75) and total costs (screening, cancer diagnoses, and treatment) resulting from lowering the starting age of faecal immunochemical test screening to 45 from 50 years old. Results are grouped by age. Results shown for 20 µg/g FIT threshold scenarios. Abbreviation: PYLG, potential years of life gained.

45 years of age.[19–21] Sung et al compared trends in CRC incidence rates among 25-year-olds to 49-year-olds in 50 countries using data from GLOBOCAN. Including data up to 2017, Australia had the highest incidence rate at 16.5/100 000 (16.1-16.9), followed by the United States at 14.8/100 000 (14.7-14.9); Canada ranked seventh highest with an incidence rate of 13.5/100 000 (13.1-13.8).[19] The data included in our analyses show that between 2017 and 2022, the incidence rates in Canada have continued to increase in all groups below age 50 and have surpassed the incidence rates which informed the decision to start CRC screening in the United States and Australia.

Furthermore, while the mechanisms driving the increased rates are not known, the prevalence of the most widely reported risk factors (eg, excess body weight, ultra processed foods) continues to increase in younger cohorts in Canada, which suggests that the rates are not likely to decrease without intervention.[22–24] The recent discovery that a mutational signature indicating early-life exposure to colibactin-producing Pks+ bacteria is enriched in the tumours of early-onset CRC also provides new insights into the causes of this rising trend.[25]

As organized CRC screening in Canada is FIT-based,[2] we focused on FIT exclusively as the initial screening test in our modelling. Recent results from the pivotal COLONPREV trial support this strategy, as FIT-based screening offered to the population was demonstrated to be noninferior to a colonoscopy-based CRC screening offer.[26] The COLONPREV trial was a large 10-year randomized trial comparing invitation to an FIT-based program versus a colonoscopy-based program that showed FIT-based screening was equally effective with

higher participation and no differences in long-term CRC mortality compared to screening colonoscopy.[26] Additionally, a randomized clinical trial including 20 508 45 to 49-year-old participants in the UCLA Health system evaluated patient participation in different screening strategies (FIT only, colonoscopy only, FIT or colonoscopy and a default outreach with mailed FIT) and found that the mailed FIT test achieved higher participation (26.2%) than any active-choice intervention (between 14.5% and 17.4%).[27] This highlights the potential positive reception of organized FIT screening among 45-year-old to 49-year-old patients.

An independent Health Technology Review performed by the Canadian Agency for Drugs and Technology in Health (CADTH) (now Canada's Drug Agency, CDA) was completed in December 2023 to examine evidence on screening in populations below age 50.[28] At the time of publication, data on FIT uptake and performance in populations below 50 years of age were lacking. Since the release of the CADTH report, evidence has emerged showing the effects of FIT screening among individuals 45 to 49 years old.[29] A recent study from Taiwan analyzed population-based FIT screening in 39 315 participants who received early screening (40-49 years old) and 223 810 who commenced screening after age 50.[30] The results suggest that early screening (40-49 years of age) was associated with significant and notable reductions in CRC incidence and mortality compared to starting screening at age 50.[30]

A few key messages from early data on expanded FIT screening for 45-year-olds to 49-year-olds with FIT have emerged. First, participation among the younger age groups is low. In a large study from healthcare institutions in the Kaiser Permanente Health System in Southern California, Washington and Colorado in the United States during 2022, participation in FIT-based screening was 38.9% in the 45 to 49 group.[31] The American Cancer Society reports that the lowest screening (20% prevalence FIT or colonoscopy) is seen in individuals between 45 and 49 years old as of 2021.[32] While Australia is not yet reporting participation for people between 45 and 49 years of age, the lowest participation is seen in the youngest reported age group of 50 to 54 with a value of 31.2%, as shown by 2021 Census data.[33] While further evidence is required, this may indicate that younger populations tend to have lower screening rates, indicating that lowering the age to start may not markedly increase demand for screening services. However, as younger age FIT-based screening is fully implemented, this trend may change. Second, FIT positivity rates are low among 45-year-old to 49-year-old cohorts. The US data from Kaiser Permanente reported that in a cohort of 45-year-olds to 49-year-olds who underwent FIT screening, there was a 3.6% positivity rate within the 45 to 49 group, compared to 4.0% in the 50-year-olds.[31] While these rates are similar, they do suggest that fewer follow-up colonoscopies would be required when screening those between 45 and 49 years of age. In the United States, the conventional FIT threshold is 20 µg/g, which closely matches our simulations.[34] Lastly, colonoscopy yields in those with a positive FIT in the younger age group are similar to those 50 years of age. Data from Kaiser Permanente show that detection rates of colorectal neoplasia in those aged 45 to 49 were similar to those aged 50.[31] These recent findings all support the use of FIT in younger populations.

Expanding eligibility with a focus on FIT-based screening

An important consideration in decreasing the age to start organized FIT-based CRC screening is the increased resources required, particularly colonoscopy capacity for follow-up of persons with a positive FIT. Interventions to strengthen appropriate use of colonoscopy among those 50 to 74 years are essential, such as ensuring colonoscopy surveillance intervals are supported by evidence.[6] Furthermore, in Canada, reducing the use of colonoscopy as a primary screening test for average risk adults, screened outside the organized FIT-based programs, remains a key priority. The FIT-based screening remains more accessible than colonoscopy screening across Canada, and this access can be enhanced through expanded models of FIT kit distribution. Most provinces are not reaching the modest target of 60% uptake of FIT-based CRC screening.[2] Increasing participation in the current target age group should remain a goal of all programs. A recent study examined CRC incidence in 45-year-olds to 49-year-olds in the United States, following the reduction in screening starting age to 45 years old and found a steady upward trend between 2004 and 2019, followed a 12% annual increase in CRC between 2019 and 2022, driven mainly by early-stage cases.[35] Canada may expect to experience a similar increase, which should be considered as individuals between 45 and 50 begin to enter screening programs.

Ensuring sustainability for existing programs

It is essential that any expansion of eligibility not adversely impact the progress made so far in screening uptake among those currently eligible. To evaluate the potential negative consequences of expanding eligibility, we also performed a sensitivity analysis of FIT screening beginning at 45 years old where the screening interval was increased from 24 to 30 months. This model represents an extreme example where expanded eligibility leads to system-wide delays in screening intervals and completion. The results emphasize the importance of ensuring sufficient resources, as an extension of the screening interval from 24 to 30 months results in meaningfully reduced benefits associated with lowering the screening age to 45 Figures S7 and S8.

Any expansion should include a focus on equity in access to health services, where inequities may arise due to inadequate recruitment of newly eligible individuals, or reduced resources available for existing populations. However, a recent cross-sectional study performed using the National Health Interview Survey in the United States reported that while CRC screening among 45-year-olds to 49-year-olds increased from 20.8% in 2019 to 33.7% in 2023, screening among 50-year-olds to 75-year-olds did not markedly change.[36] This suggests that CRC screening programs may be able to expand to include younger populations without displacing existing participants.[36]

Possible strategies to make change feasible while improving population outcomes

Expanding FIT-based CRC screening to include those 45 to 49 years is worthy of consideration to maximize the population

health impacts of existing programs. Managing the available resources is key. Provinces could lower the age eligibility to 45 in their current programs without beginning to send letters of invitation until age 50. This could result in a slower adoption of FIT screening in individuals between 45 and 50 (reducing immediate resource demand), as many individuals would not initially engage without an invitation. This change in screening eligibility (without the additional step of sending invitations) would mirror the approach of the Australian Bowel Screening Program.[20] With this approach, Australians aged 50 to 74 continue to receive an FIT in the mail every 2 years. In addition, all eligible people aged 45 to 49 can now request an FIT through their primary care provider, which is then mailed out by the program.[20] Through this change, some proportion of 45-year-olds to 49-year-olds would undergo screening. Then, after a period of 3 to 5 years, implementing letters of invitation to the younger age group could be implemented. Alternatively, screening younger groups could be phased in using a staggered approach, such as a rolling 1-year expansion in eligibility beginning with those age 49 years, and then each year adding the next cohort of younger persons until 45-year-olds are included. This approach was used in the United Kingdom when the age to start screening was lowered from 55 years to 50, with those 50 and 52 receiving invitations followed by those 52 and 53 to stagger program intake.[37] Should provinces and territories decide to lower the age to start FIT-based CRC screening, there should be a clear plan in place beforehand to monitor and to evaluate the implementation so that the impacts are fully understood. These implementation options can provide important opportunities to minimize adverse impacts of lowering the age to start CRC screening.

It is important to consider the findings reported here in the context of the study's strengths and limitations. The model is inherently limited as it is unable to consider every aspect of cancer progression, resource limitations, and provincial screening differences. Our simulations were intended to model conservative surveillance intervals and reflect a high colonoscopy demand, meaning that outcomes could be improved by assuming greater resource availability. The simulation models assume that there are no additional changes to the screening tests and programs currently in place. They also assume continued elevated CRC risk in the future cohort being modelled. Additionally, the OncoSim model assumes that screening participation and screening efficacy are at a uniform rate across all age groups, which may not represent actual trends. We used cancer diagnosis and treatment and cost data derived largely from Ontario. Consultation with the other provinces reveals that these Ontario costs are a reasonable estimation of costs in those provinces. These costs are modelled to increase with inflation over time; however, trends in CRC treatment costs have been rising faster than inflation with increasing use of targeted and immunotherapies over the past 5 to 10 years.[38] These costs are expected to rise and are not accounted for, which would in turn lead to even greater cost savings over time. Alongside reductions in health system costs, there could be less out-of-pocket, indirect, and time costs for cancer patients and their caregivers, which accounts for 25% of direct health system costs and are paid by individuals.[39] The estimated cost reductions shown here do not include indirect lost productivity costs to the Canadian economy. Therefore, the overall cost-benefit of lowering screening age for FIT screening could be higher. In the analyses, the follow-up colonoscopy surveillance of low-risk adenomas modelled is not reflective of practices in all provinces or territories. Finally, randomized controlled trial data for FIT performance are not available for the 45 to 49 age group. It is unlikely that these studies will be completed as jurisdictions have moved directly to implementation while industry-sponsored screening trials are evaluating new biomarkers such as cell-free DNA from stool or blood.[40,41]

In conclusion, the data presented here support an expansion of eligibility to include individuals from 45 to 49 years in organized FIT-based CRC screening programs in Canada based on improved overall population health outcomes and cost-savings. Should provinces and territories elect to lower the age to start screening, several approaches could be used to mitigate the anticipated increase in resource requirements. Ongoing monitoring and evaluation are key to understand the impacts of lowering the screening age and to make evidence-informed adjustments as necessary.

For additional details on CanSCCRN and a complete membership list, please visit https://www.cansccrn.ca/

Acknowledgments

We would like to thank Paijani C. Sheth for her contribution to the graphical abstract for this publication.

Author contributions

L.R., J.T., and D.R.B. were responsible for conceptualization and project administration. L.R., J.T., J.M.H., Y.R., M.T.W., and D.R.B. were responsible for formal analysis and investigation. J.M.H., Y.R., and M.T.W. were responsible for visualization, writing software, and validation of the results. L.R., J.T., J.M.H., Y.R., and D.R.B. were responsible for the original draft of the manuscript. All authors contributed to editing and refinement.

Supplementary material

Supplementary material is available at *Journal of the Canadian Association of Gastroenterology* online.

Funding

D.R.B. is supported by the Armstrong Investigatorship in Molecular Epidemiology at the University of Calgary.

Conflicts of interest

Conflict of interest disclosure forms (ICMJE) have been collected for all co-authors and can be accessed as Supplementary material.

Ethical approval

This study did not include the participation of human/animal subjects or individual-level patient data. The study involved only population-level and simulation data; therefore, ethics approval was not required.

Data availability

The data generated have been reported throughout the article.

References

1. Brenner DR, Gillis J, Demers AA, et al. Projected estimates of cancer in Canada in 2024. *CMAJ*. 2024;196:E615-E623. https://doi.org/10.1503/cmaj.240095
2. *Monitoring and Evaluation of Colorectal Cancer Screening Quality Indicators*. Canadian Partnership Against Cancer; 2021. https://www.partnershipagainstcancer.ca/topics/colorectal-indicators-2017-2018/
3. Siegel RL, Fedewa SA, Anderson WF, , et al. Colorectal cancer incidence patterns in the united states, 1974-2013. *J Natl Cancer Inst*. 2017;109:djw322 https://doi.org/10.1093/jnci/djw322.
4. Brenner DR, Ruan Y, Shaw E, De P, Heitman SJ, Hilsden RJ. Increasing colorectal cancer incidence trends among younger adults in Canada. *Prev Med*. 2017;105:345-349. https://doi.org/10.1016/j.ypmed.2017.10.007
5. Wolf AMD, Fontham ETH, Church TR, et al. Colorectal cancer screening for average-risk adults: 2018 guideline update from the American Cancer Society. *CA Cancer J Clin*. 2018;68:250-281. https://doi.org/10.3322/caac.21457
6. Davidson KW, Barry MJ, Mangione CM, et al. Screening for colorectal cancer: US Preventive Services Task Force recommendation statement. *JAMA*. 2021;325:1965-1977. https://doi.org/10.1001/jama.2021.6238
7. Patel SG, May FP, Anderson JC, et al. Updates on age to start and stop colorectal cancer screening: recommendations from the U.S. Multi-Society Task Force on Colorectal Cancer. *Gastroenterology*. 2022;162:285-299. https://doi.org/10.1053/j.gastro.2021.10.007
8. *Clinical Practice Guidelines for the Prevention, Early Detection and Management of Colorectal Cancer: Population Screening. Summary of Recommendations*. Sydney: Cancer Council Australia: Cancer Council Australia Colorectal Cancer Screening Working Party; 2023. https://www.cancer.org.au/assets/pdf/colorectal-cancer-population-screening-recommendations
9. Canadian Task Force on Preventive Health Care. *Recommendations on Screening for Colorectal Cancer in Primary Care*. 2016. Contract No. 5.
10. *International Classification of Diseases for Oncology*. 3rd ed. World Health Organization; 2010.
11. *International Statistical Classification of Diseases and Related Health Problems*. 10th ed. World Health Organization; 2016.
12. Canadian Cancer Registry (CCR). Statistics Canada; 2022.
13. Rosenberg PS, Check DP, Anderson WF. A web tool for age-period-cohort analysis of cancer incidence and mortality rates. *Cancer Epidemiol Biomarkers Prev*. 2014;23:2296-2302. https://doi.org/10.1158/1055-9965.Epi-14-0300
14. Statistical Methodology and Applications Branch SRP, National Cancer Institute. *Joinpoint Regression Program*, Version 5.3.0.0. November 2024.
15. Gauvreau CL, Fitzgerald NR, Memon S, et al. The OncoSim model: development and use for better decision-making in Canadian cancer control. *Curr Oncol*. 2017;24:401-406. https://doi.org/10.3747/co.24.3850
16. *Canadian Community Health Survey - Annual Component (CCHS)*. In: Canada S, editor. 2024.
17. Coldman A, Flanagan W, Nadeau C, et al. Projected effect of fecal immunochemical test threshold for colorectal cancer screening on outcomes and costs for Canada using the OncoSim microsimulation model. *J Cancer Policy*. 2017;13:38-46. https://doi.org/10.1016/j.jcpo.2017.07.004
18. Potential Years of Life Lost of Population. *Statistics Canada*; 2010.
19. Sung H, Siegel RL, Laversanne M, et al. Colorectal cancer incidence trends in younger versus older adults: an analysis of population-based cancer registry data. *Lancet Oncol*. 2025;26:51-63. https://doi.org/10.1016/S1470-2045(24)00600-4
20. *Lowered Eligible Age for Bowel Screening*. Australian Government, Department of Health and Aged Care; 2024. https://www.health.gov.au/our-work/national-bowel-cancer-screening-program/about-the-national-bowel-cancer-screening-program/lowered-eligible-age.
21. *Screening for Colorectal Cancer*. Centers for Disease Control and Prevention; 2024. https://www.cdc.gov/colorectal-cancer/screening/index.html.
22. Hua H, Jiang Q, Sun P, Xu X. Risk factors for early-onset colorectal cancer: systematic review and meta-analysis. *Front Oncol*. 2023;13:1132306. https://doi.org/10.3389/fonc.2023.1132306
23. O'Sullivan DE, Ruan Y, Farah E, Hutchinson JM, Hilsden RJ, Brenner DR. Risk factors for early-onset colorectal cancer: a Canadian prospective cohort study. *Cancer Epidemiol*. 2024;91:102578. https://doi.org/10.1016/j.canep.2024.102578
24. Friedenreich CM, Pader J, Barberio AM, et al.; ComPARe Study Team. Estimates of the current and future burden of cancer attributable to sedentary behavior in Canada. *Prev Med*. 2019;122:73-80. https://doi.org/10.1016/j.ypmed.2019.03.009
25. Díaz-Gay M, Dos Santos W, Moody S, et al. Geographic and age variations in mutational processes in colorectal cancer. *Nature*. 2025;643:230-240. https://doi.org/10.1038/s41586-025-09025-8
26. Castells A, Quintero E, Bujanda L, et al. Effect of invitation to colonoscopy versus faecal immunochemical test screening on colorectal cancer mortality (COLONPREV): a pragmatic, randomised, controlled, non-inferiority trial. *Lancet*. 2025;405:1231-1239. https://doi.org/10.1016/S0140-6736(25)00145-X
27. Galoosian A, Dai H, Croymans D, et al. Population health colorectal cancer screening strategies in adults aged 45 to 49 years: a randomized clinical trial. *JAMA*. 2025;334:778. https://doi.org/10.1001/jama.2025.12049
28. Khangura SD, Spry C. *Screening for Colorectal Cancer in Individuals Younger Than 50 Years*. CADTH Health Technology Review; 2023. https://www.cadth.ca/screening-colorectal-cancer-individuals-younger-50-years.
29. Chia BJ, Ruan Y, Brown CJ, et al. Modeling the economic and health impact of lowering the recommended colorectal cancer screening age in Canada using fecal immunochemical test versus colonoscopy. *Cancer Epidemiol Biomarkers Prev*. 2025;34:990-997. https://doi.org/10.1158/1055-9965.EPI-24-1488
30. Chiu H-M, Chen SL-S, Su C-W, et al. Long-term effectiveness associated with fecal immunochemical testing for early-age screening. *JAMA Oncol*. 2025;11:846-854. https://doi.org/10.1001/jamaoncol.2025.1433
31. Levin TR, Jensen CD, Udaltsova N, et al. Colorectal cancer screening completion and yield in patients aged 45 to 50 years. *Ann Intern Med*. 2024;177:1621-1629. https://doi.org/10.7326/M24-0743
32. Colorectal *Cancer Facts & Figures* 2023-2025. In: Society AC, ed. Atlanta: American Cancer Society; 2023.
33. National *Bowel Cancer Screening Program Monitoring Report* 2024. In: Welfare AIoHa, ed. Canberra: Australian Institute of Health and Welfare; 2024.
34. Selby K, Jensen CD, Lee JK, et al. Influence of varying quantitative fecal immunochemical test positivity thresholds on colorectal cancer detection: a community-based cohort study. *Ann Intern Med*. 2018;169:439-447. https://doi.org/10.7326/m18-0244
35. Schafer EJ, Sung H, Star J, et al. Colorectal cancer incidence in US adults after recommendations for earlier screening. *JAMA*. 2025;334:824-826. https://doi.org/10.1001/jama.2025.9147
36. Star J, Siegel RL, Smith RA, et al. Trends in colorectal cancer screening in US adults aged 45 to 49 years. *JAMA*. 2025;334:827-829. https://doi.org/10.1001/jama.2025.10618
37. *The Bowel Cancer Screening Age Has Been Lowered to 50 in England*. Bowel Cancer UK; 2025. https://www.bowelcanceruk.org.uk/news-and-blogs/news/bowel-cancer-screening-age-lowered-in-england/.

38. Bhimani N, Wong GYM, Molloy C, et al. Cost of treating metastatic colorectal cancer: a systematic review. *Public Health*. 2022;211:97-104. https://doi.org/10.1016/j.puhe.2022.06.022
39. *Canadian Cancer Statistics: A 2024 Special Report on the Economic Impact of Cancer in Canada*. In: Canadian Cancer Statistics Advisory Committee in collaboration with the Canadian Cancer Society SCat-PHAoC, ed. 2024.
40. Raymond V, Foster G, Hong Y, et al. S295 implementation of blood-based colorectal cancer screening: real-world clinical experience. *Am J Gastroenterol*. 2023;118:S218.
41. Hutchinson JM, Ruan Y, Chia BJ, et al. Modeling population-level impacts of cell-free DNA screening for colorectal cancer in Canada. *JAMA Oncol*. 2025;11:694-699. https://doi.org/10.1001/jamaoncol.2025.0908

 Journal of the Canadian Association of Gastroenterology 2026 9(2) 61–71
https://doi.org/10.1093/jcag/gwag008
Original Article 2026 RD McKenna Memorial Lecture