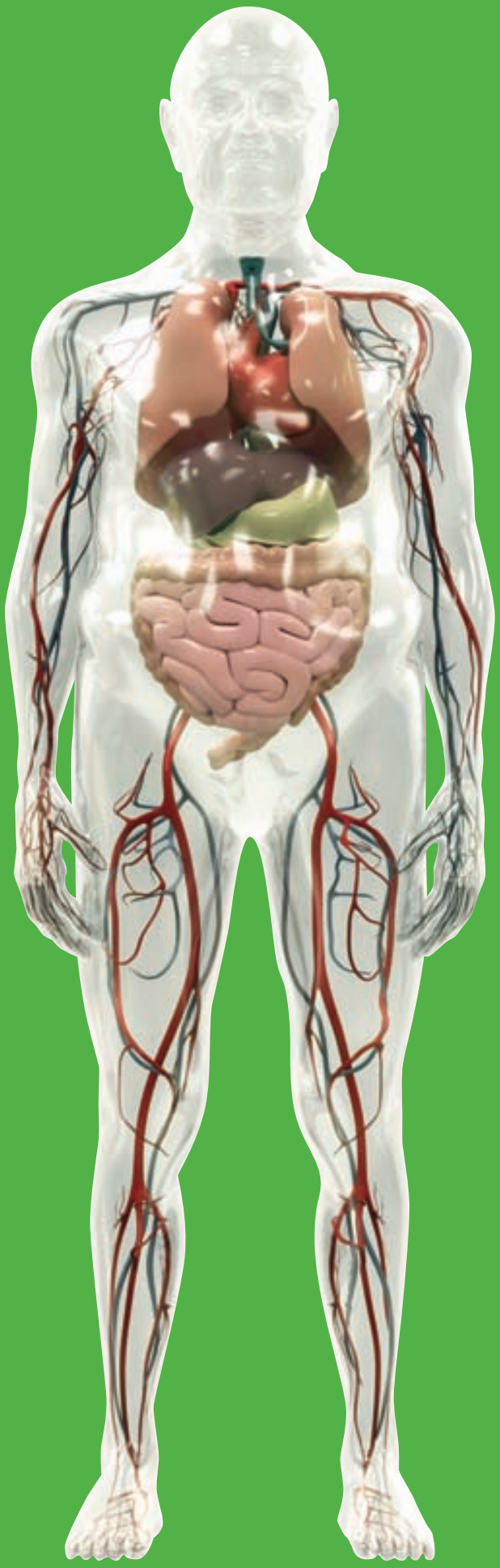

Screen *for* Life

Cancer screening sees what you can't

- Breast
- Cervical
- Colorectal

ColonCancerCheck

2010 Program Report

Ontario

Cancer Care Ontario

Action Cancer Ontario

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Acknowledgements

The *ColonCancerCheck 2010 Program Report* was prepared by the Surveillance Unit and the Policy, Planning and Knowledge Translation and Exchange Unit in the Prevention and Cancer Control Portfolio at Cancer Care Ontario. Informatics and the Prevention and Cancer Control Information Program, departments within Cancer Care Ontario's Chief Information Officer's Portfolio, as well as the Institute for Clinical and Evaluative Sciences, contributed significantly to this report.

The report also benefited from the guidance of the ColonCancerCheck Scientific Lead, **Dr. Jill Tinmouth,** who confirmed the indicators to be included in this document and directed the analyses.

Core team members from the Surveillance Unit included:
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Message from Dr. Linda Rabeneck and Dr. Jill Tinmouth

Colorectal cancer is a significant public health concern for Ontario. It is the second leading cause of Ontario cancer deaths after lung cancer and the third most common cancer diagnosed in the province.

In 2008, the Ontario Ministry of Health and Long-Term Care, in partnership with Cancer Care Ontario, launched a province-wide, population-based colorectal cancer screening program, ColonCancerCheck. The goals of the program are to reduce mortality from colorectal cancer through an organized screening program and to improve the capacity of primary care to participate in comprehensive colorectal cancer screening.

The first ColonCancerCheck report contained data from 2008, the inaugural year of the program. This 2010 report builds on and expands the analyses in the first report, and provides a more complete picture of Ontario's performance in colorectal cancer screening. This report highlights the strengths of the ColonCancerCheck Program, illustrates our progress to date and identifies areas for further improvement.

Our focus for the coming few years will be to consolidate the gains we have made and learn from the results of our program evaluation in order to build an even more effective colorectal cancer screening program for Ontario. With our partners at the Ministry of Health and Long-Term Care, we are working to reduce the burden of colorectal cancer in Ontario through this high-quality, evidence-based organized screening program.

Linda Rabeneck, MD, MPH, FRCPC
Vice President, Prevention and Cancer Control
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Scientific Lead, ColonCancerCheck Program
Cancer Care Ontario

Executive Summary

BURDEN OF DISEASE

Colorectal cancer is the second leading cause of death from cancer in Ontario and the third most common cancer diagnosed in Ontarians. Colorectal cancer incidence increases with age, especially after age 50, with 93 percent of cancers diagnosed in people 50 years of age or older.

ONTARIO'S COLORECTAL CANCER SCREENING PROGRAM

The purpose of screening is to prevent cancer by identifying and removing pre-cancerous changes so that cancer does not develop, or to reduce cancer deaths by finding cancer at an early stage when it is easier to treat. Screening is most effective when offered through an organized, population-based program that uses quality assurance to maximize screening benefits and minimize harms.

Canada's first organized, province-wide, population-based colorectal cancer screening program, ColonCancerCheck, was launched in Ontario in April 2008. The ColonCancerCheck Program was developed using the highest quality published evidence. ColonCancerCheck recommends biennial screening in average risk people aged 50 to 74 using the guaiac fecal occult blood test (gFOBT), followed by colonoscopy for those with an abnormal FOBT. For people at increased risk because of a family history of the disease (one or more first-degree relatives with colorectal cancer), ColonCancerCheck recommends colonoscopy beginning at age 50, or 10 years earlier than the age at which the relative was diagnosed, whichever occurs first. Laboratories and hospitals that participate in ColonCancerCheck are required to meet Cancer Care Ontario's evidence-based quality standards.

Primary care providers are central to ColonCancerCheck, and eligible Ontarians must see their primary care providers to access screening. Correspondence to participants is a major focus for the program, and ColonCancerCheck uses a robust data management system to send participants FOBT results letters, recalls for screening and invitations for the newly screen-eligible.

PROGRAM EVALUATION FRAMEWORK

The 2010 program report builds on the 2008 program report, updating the four indicators from 2008 and expanding to include four new indicators.

Participation

FOBT participation

The percentage of Ontario men and women of screen-eligible age (50 to 74 years) who have completed an FOBT in the prior two years.

Up-to-date with colorectal tests (NEW for 2010)

The percentage of Ontario men and women of screen-eligible age (50 to 74 years) who have had an FOBT in the last two years, a flexible sigmoidoscopy in the last five years or a colonoscopy in the last 10 years.

Screening

Abnormal FOBT result

The percentage of individuals of screen-eligible age (50 to 74 years) who have had an abnormal FOBT result.

Positive predictive value (NEW for 2010)

The percentage of individuals of screen-eligible age (50 to 74 years) with an abnormal FOBT result followed by large bowel endoscopy or surgery who were diagnosed with colorectal cancer.

Diagnostic follow-up

Follow-up colonoscopy

The percentage of individuals of screen-eligible age (50 to 74 years) with an abnormal FOBT who had a follow-up colonoscopy within six months.

Endoscopist annual colonoscopy volume (NEW for 2010)

The percentage of endoscopists performing 200 or more colonoscopies annually.

Outcomes

Colorectal cancer detection

The proportion of individuals diagnosed with colorectal cancer among those aged 50 to 74 screened with FOBT, or among those aged 20 to 74 with family history screened with colonoscopy.

Interval colorectal cancer incidence (NEW for 2010)

The percentage of individuals of screen-eligible age (50 to 74 years) who were diagnosed with colorectal cancer in the two years following a normal FOBT result.

PROGRAM RESULTS

Participation

FOBT participation

FOBT participation increased steadily, from 15 percent in 2003–2004 to 30 percent in 2007–2008, and then decreased to 27 percent in 2009–2010. This trend was seen across all age groups and in 10 out of 14 of Ontario's regional health authorities (Local Health Integration Networks or LHINs).

Up-to-date with colorectal tests

The proportion of the population up-to-date with colorectal tests climbed since 2006, reaching a plateau of 53 percent in 2009 and 2010. Older age groups were more likely than younger age groups to be up-to-date with colorectal tests. The increase in the proportion up-to-date was seen across most LHINs, with two showing a small decline in 2010. People who lived in higher income neighbourhoods were more likely to be up-to-date with colorectal tests.

Screening

Abnormal FOBT result

The abnormal FOBT rate was higher for men than for women. Abnormal FOBT rates varied by LHIN and people living in lower income neighbourhoods were more likely to have an abnormal FOBT result.

Positive predictive value

In ColonCancerCheck in 2010, 5.4 percent of people who had an abnormal FOBT followed by large bowel endoscopy or surgery were found to have colorectal cancer. Positive predictive value rose with increasing age. Positive predictive value varied across LHINs and varied modestly by income.

Diagnostic follow-up

Follow-up colonoscopy

The percentage of people who had a follow-up colonoscopy within six months after an abnormal FOBT has climbed steadily since program launch, and was 71 percent in 2010. Similar improvements were evident when data were analyzed by LHIN.

Endoscopist annual colonoscopy volume

Among endoscopists who regularly performed colonoscopies in ColonCancerCheck-participating hospitals, the percentage who met the Cancer Care Ontario standard (at least 200 colonoscopies annually) increased since program launch and reached 79 percent in the 2010/2011 fiscal year. Among endoscopists who did not regularly perform colonoscopies in participating hospitals, the percentage who met the standard also increased since 2008, but reached only 66 percent in the 2010/2011 fiscal year.

Outcomes

Colorectal cancer detection

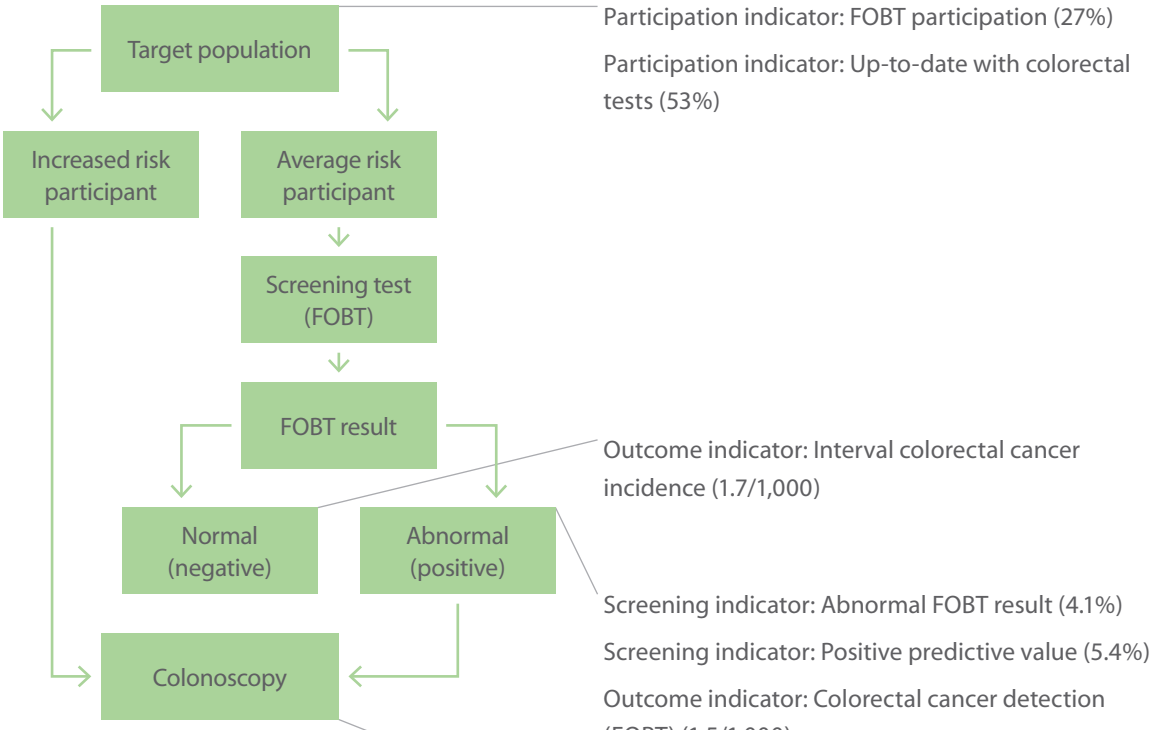
For every 1,000 people aged 50 to 74 who were screened with FOBT in 2010, 1.5 cancers were detected. More cancers were detected in older age groups. There was modest variation across LHINs for this indicator and little variation across income quintiles.

For every 1,000 people aged 20 to 74 who had a family history of colorectal cancer and were screened by colonoscopy in 2010, 4.3 cancers were detected. More cancers were detected in the older age groups. There was modest variation across LHINs. People with a family history of colorectal cancer living in lower income neighbourhoods were more likely to be diagnosed with colorectal cancer following a colonoscopy than those living in higher income neighbourhoods.

Interval colorectal cancer incidence

For every 1,000 people aged 50 to 74 who had a normal FOBT result in 2008, 1.7 cancers were diagnosed in the two years following the normal result.

FIGURE 1 Overview of program and associated indicators



SUMMARY

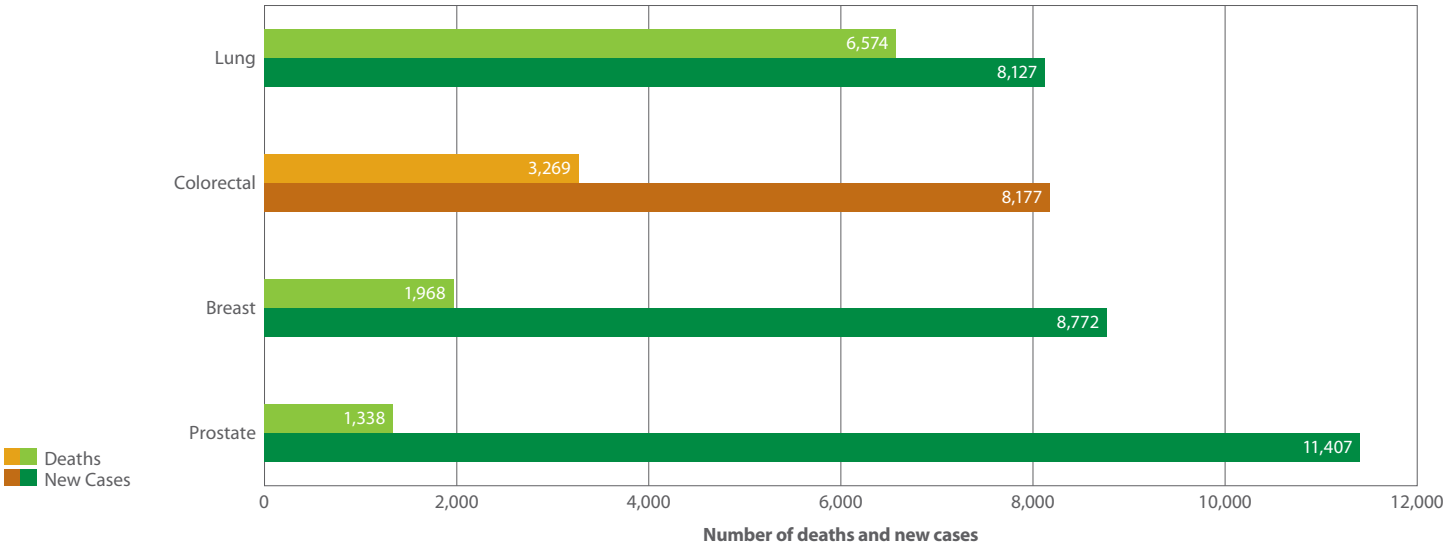
The ColonCancerCheck Program was launched in 2008 and by 2010 had made impressive progress.

A legal and regulatory framework was established to allow identification and follow-up of the target population. An information management system was developed to allow eligible Ontarians to be invited into the program, informed of their FOBT results and recalled for screening when due. Quality standards were established for processing of FOBT kits and for colonoscopy, and funding was provided to incent performance according to these standards. Promotional efforts targeting the public and providers raised awareness of the program and encouraged participation. An inaugural program report was released highlighting key aspects of program performance.

This report expands considerably on the 2008 ColonCancerCheck Program report, and gives a fuller and more nuanced picture of the ColonCancerCheck Program and its impact on the more than 3 million Ontarians aged 50 to 74 who were in the target age group for colorectal cancer screening in 2010. In the future, ColonCancerCheck will focus on increasing screening participation, improving follow-up colonoscopy rates for those with abnormal screening test results and continuing to improve the quality of screening.

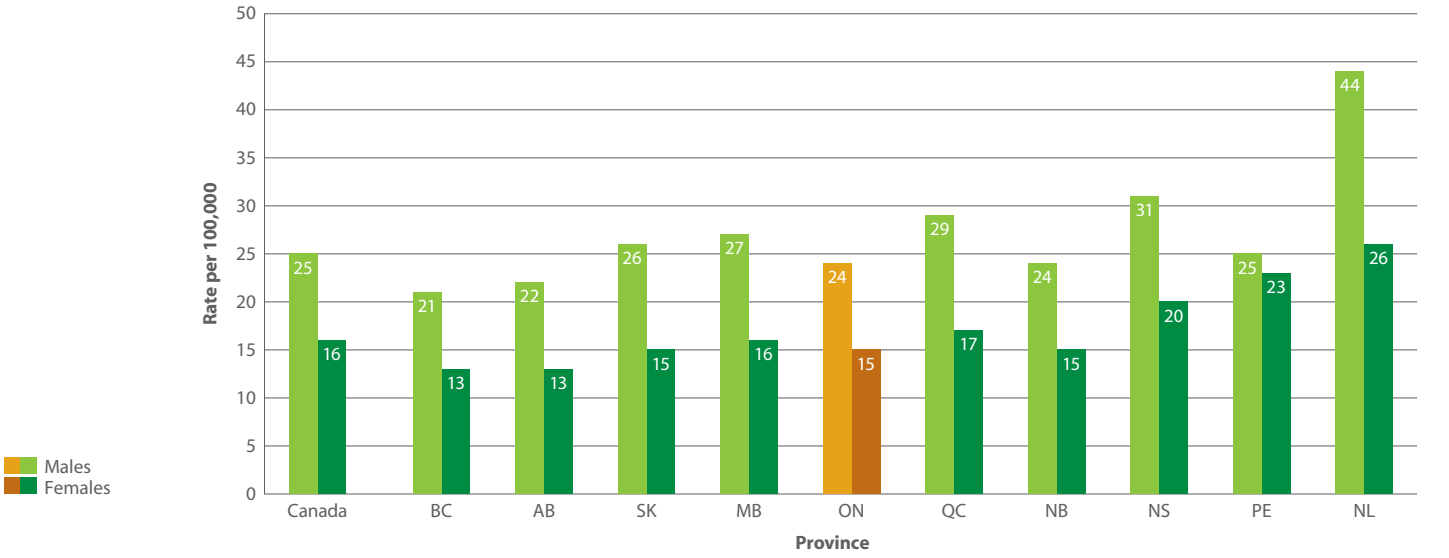
Burden of Disease

FIGURE 2 Estimated numbers of deaths and new cases for the most common cancers in Ontario, 2010



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 2.

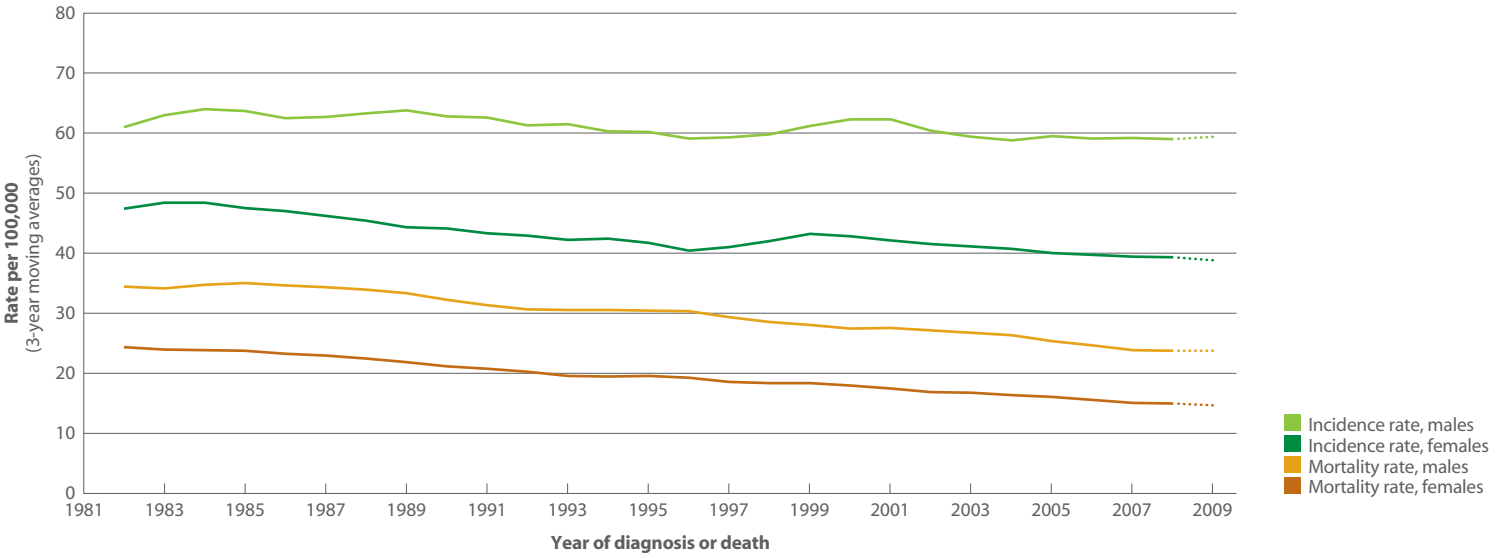
FIGURE 3 Estimated age-standardized colorectal cancer mortality rates across Canada, by province and sex, 2010



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 2.

Colorectal cancer is the second leading cause of death from cancer in Ontario, with an estimated 3,269 deaths in 2010 (*Figure 2*). It is one of the most common cancers diagnosed in Ontario, with an estimated 8,177 new cases in 2010. Internationally, Ontario's colorectal cancer incidence is similar to other developed countries[1] and incidence in Canada is among the highest in the world.[2] Ontario had lower colorectal cancer mortality rates than most provinces in 2010, but higher rates than Alberta and British Columbia, and similar rates to Saskatchewan and New Brunswick (*Figure 3*).

FIGURE 4 Age-standardized incidence and mortality rates of colorectal cancer, by sex, Ontario, 1981–2010

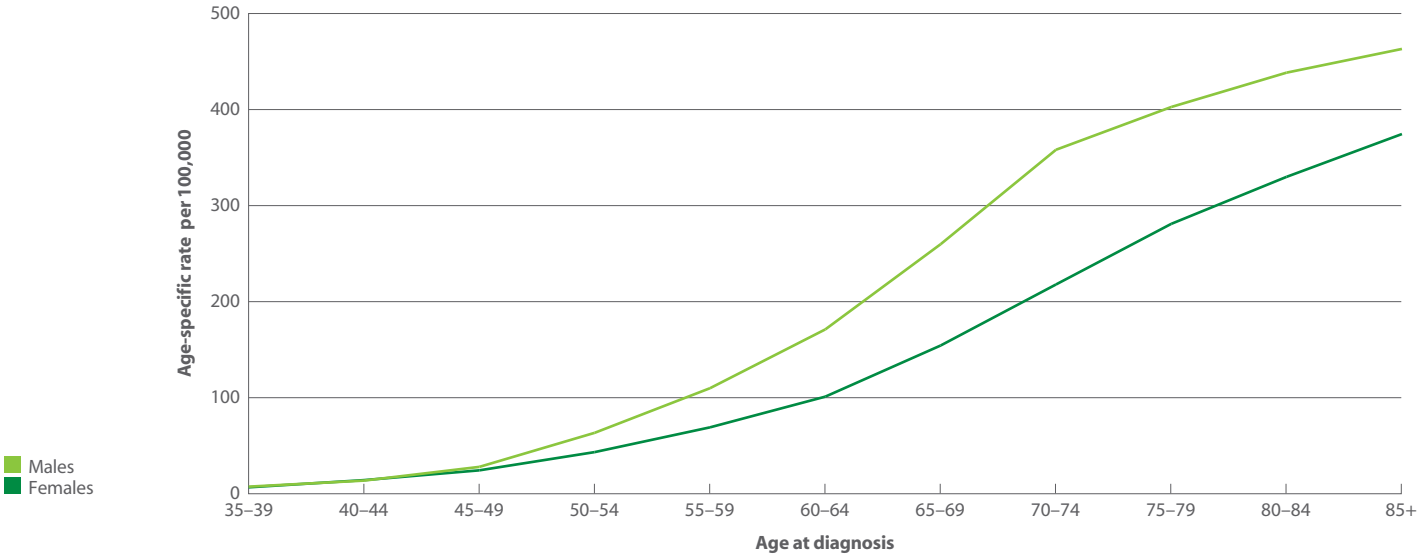


Note ····· represents estimated rates.
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 2.

Mortality from colorectal cancer has been on the decline since the late 1980s in males and since the early 1980s in females in Ontario (*Figure 4*). Mortality rates in males fell at 1.7 percent per year from 1986 to 2008, and at 1.9 percent per year from 1981 to 2008 in females. These long-term declines likely reflect a combination of changes in risk and protective factors, earlier diagnosis due to more screening and improvements in treatment.[3] The estimated mortality rate was 23.5 per 100,000 in males and 14.4 per 100,000 in females in 2010.

Colorectal cancer incidence has been declining since the 1980s in both sexes (by 0.3 percent per year in males between 1984 and 2008, and by approximately 1 percent per year in females between 1986 and 1996 and between 1999 and 2008). The slight rise in colorectal cancer incidence that is apparent during the late 1990s may reflect the increased use of large bowel evaluation in Ontario at the time.[4] The estimated incidence rate was 59.4 per 100,000 in males and 38.2 per 100,000 in females in 2010.

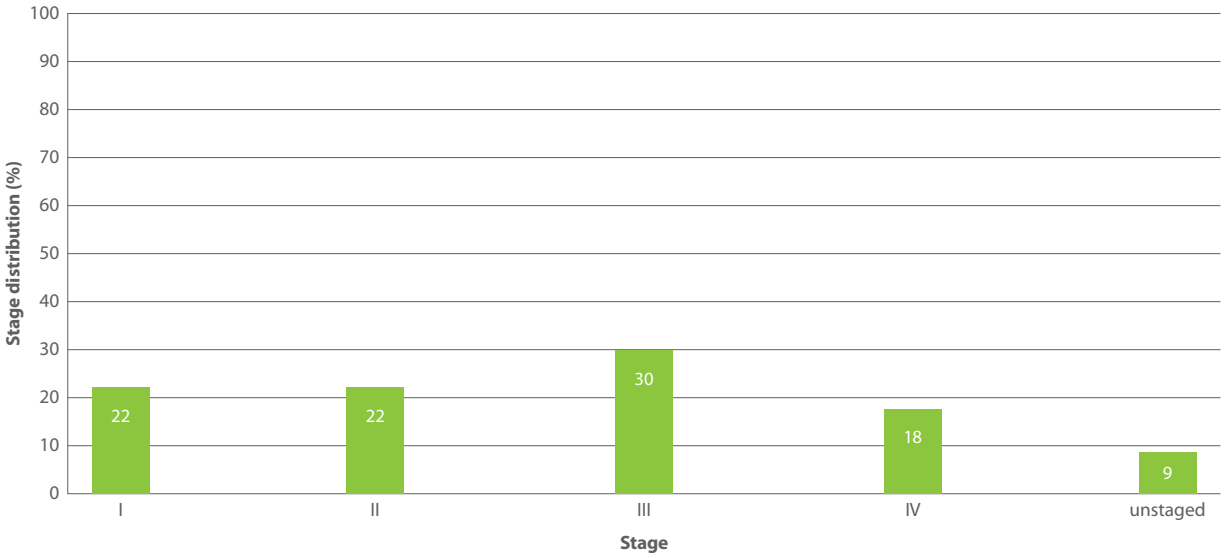
FIGURE 5 Colorectal cancer incidence rates, by age, Ontario, 2004–2008



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 2.

Colorectal cancer incidence increases with age, especially after age 50 in both sexes (*Figure 5*). Approximately 93 percent of colorectal cancers from 2004 to 2008 were diagnosed in people 50 years or older.

FIGURE 6 Stage at diagnosis for colorectal cancer, aged 50–74, Ontario, 2010



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 2.

In Ontario, 44 percent of colorectal cancers were diagnosed at stages I and II in 2010 (*Figure 6*). Stage I and II cancers have good prognoses, with estimated five-year relative survival of 96 percent and 87 percent, respectively.[5] Forty-eight percent of colorectal cancers were diagnosed at a late stage (stages III and IV) when survival is worse.[6] Population-based screening can detect cancer at an early stage, when treatment is more effective. Removal of pre-cancerous lesions detected through screening will result in a reduction in incidence rates.

The results in *Figure 6* are based on the Collaborative Stage Data Collection System that Cancer Care Ontario has used to assign cancer stage to all colorectal cancer cases diagnosed from 2010 onwards. For more information about this system, see http://www.cancerstaging.org/cstage.

Ontario's Colorectal Cancer Screening Program

A screening test identifies those in an asymptomatic population who may be at risk for disease. A screening test is not a diagnostic test. The purpose of screening is to prevent cancer by identifying and removing pre-cancerous changes so cancer does not develop, or to reduce cancer death by finding cancer at an early stage when it is easier to treat. Regular screening can reduce colorectal cancer deaths.

Screening is most effective when offered through an organized program that uses quality assurance to maximize screening benefits and minimize harms. The International Agency for Research on Cancer has defined fundamental aspects that organized screening programs must consider[7]:

- a legal framework to allow the target population to be identified and followed
- available and accurate epidemiological data to form the basis for a decision to begin screening
- available and accessible demographic data to identify individuals in the target population and to set up an invitation system
- available and accessible quality-assured services for diagnosis and treatment of colorectal cancer and its precursors
- promotional efforts to encourage participation in the screening program
- access to population, screening and cancer registries

Enabled by legislation, Canada's first organized, province-wide, population-based colorectal cancer screening program, ColonCancerCheck, was officially launched in April 2008.

ColonCancerCheck recommends biennial screening in average risk people aged 50 to 74 using the guaiac fecal occult blood test (gFOBT), followed up by colonoscopy for those with an abnormal (positive) FOBT. This strategy is well-supported by evidence: a meta-analysis of colorectal cancer mortality results from three landmark trials—Minnesota, Nottingham and Funen—showed that this screening regimen is associated with a 15 percent reduction in colorectal cancer mortality.[8]

ColonCancerCheck recommends colonoscopy for people at increased risk because of a family history of the disease (one or more first-degree relatives—parent, sibling or child—with colorectal cancer). Colonoscopy should begin at age 50, or 10 years earlier than the age at which the relative was diagnosed, whichever occurs first. Approximately 30 percent of Ontarians who have been diagnosed with colorectal cancer have a family history of the disease.[9]

In order for people to have a risk assessment prior to screening (i.e., to determine if they are at average or increased risk), and based on evidence that a physician's recommendation is a powerful motivator to be screened,[10] eligible Ontarians must see their primary care provider to access colorectal cancer screening. Providers dispense FOBT kits or refer for colonoscopy as appropriate. Providers receive results for all FOBTs they dispense directly from processing labs and are responsible for following up on the results of these tests, including referring people who have had abnormal FOBT results for follow-up colonoscopy. People who do not

have a primary care provider can get a risk assessment and an FOBT kit, if appropriate, through community pharmacies or by calling Telehealth Ontario. A comprehensive website, http://www.ontario.ca/coloncancercheck, provides information about the screening program for providers and the public.

Participant correspondence is a major focus for the program, supported by a comprehensive suite of data management tools. Initially, using data submitted to the program by the laboratories that process program-branded FOBT kits, letters were sent to participants informing them of their normal and inadequate (indeterminate results or kits rejected for processing) FOBT results.

In 2010, in order to improve colonoscopy follow-up after abnormal FOBT results, the program began to send letters to participants with abnormal results. Once the program had the required data, it expanded correspondence to include recalls for repeat FOBT screening and invitations to the newly screen-eligible. Other correspondence being piloted and evaluated includes invitations sent on behalf of the participant's physician, and invitations and recalls containing an FOBT kit. Invitations for the under- and never-screened are planned for the near future.

Quality assurance has been guided by evidence-based standards that were developed prior to program launch by expert panels supported by Cancer Care Ontario's Program in Evidence-Based Care. Seven community laboratories are funded to process program-branded FOBT kits and are required to meet *Cancer Care Ontario's Guaiac Fecal Occult Blood Test (FOBT) Laboratory Standards*.[11] Laboratories report FOBT results for all program-branded kits to Cancer Care Ontario. Participating laboratories formed a Quality of Care Committee to oversee the performance of FOBT processing.

Between 60 and 70 hospitals receive funding each year to provide extra colonoscopies for people who have a family history of colorectal cancer or who have had an abnormal FOBT result. These participating hospitals are required to meet *Cancer Care Ontario's Colonoscopy Standards*[12] and to provide data to Cancer Care Ontario on all colonoscopies performed in their institutions. ColonCancerCheck captures data on approximately 85 percent of all hospital-based colonoscopies performed in Ontario. Under the leadership of the Provincial Colonoscopy Lead, Dr. Michael Gould, the program is currently exploring how to incorporate non-hospital facilities (which perform approximately 20 percent of colonoscopies in the province) into ColonCancerCheck, and is developing a more robust quality assurance program for colonoscopies performed in hospital and non-hospital settings.

Program Evaluation Framework

For reporting on the colorectal cancer screening program, ColonCancerCheck adapted the Canadian Partnership Against Cancer's quality determinants framework for colorectal cancer screening and reports on as many of the indicators contained in that framework as possible.[13] To the extent feasible, the indicators included in this report are defined to align with indicators established by the Canadian Partnership Against Cancer[13] and the European Union.[14] Aligning indicator definitions facilitates comparison of Ontario's results with those in other jurisdictions in Canada and internationally.

The 2010 program report builds on the 2008 program report, updating the indicators previously reported on and expanding to include four new indicators.

I. Participation
- Fecal occult blood test (FOBT) participation
- Up-to-date with colorectal tests (NEW for 2010)

II. Screening
- Abnormal FOBT result
- Positive predictive value (NEW for 2010)

III. Diagnostic follow-up
- Follow-up colonoscopy
- Endoscopist annual colonoscopy volume (NEW for 2010)

IV. Outcomes
- Colorectal cancer detection
- Interval colorectal cancer incidence (NEW for 2010)

Program Indicators

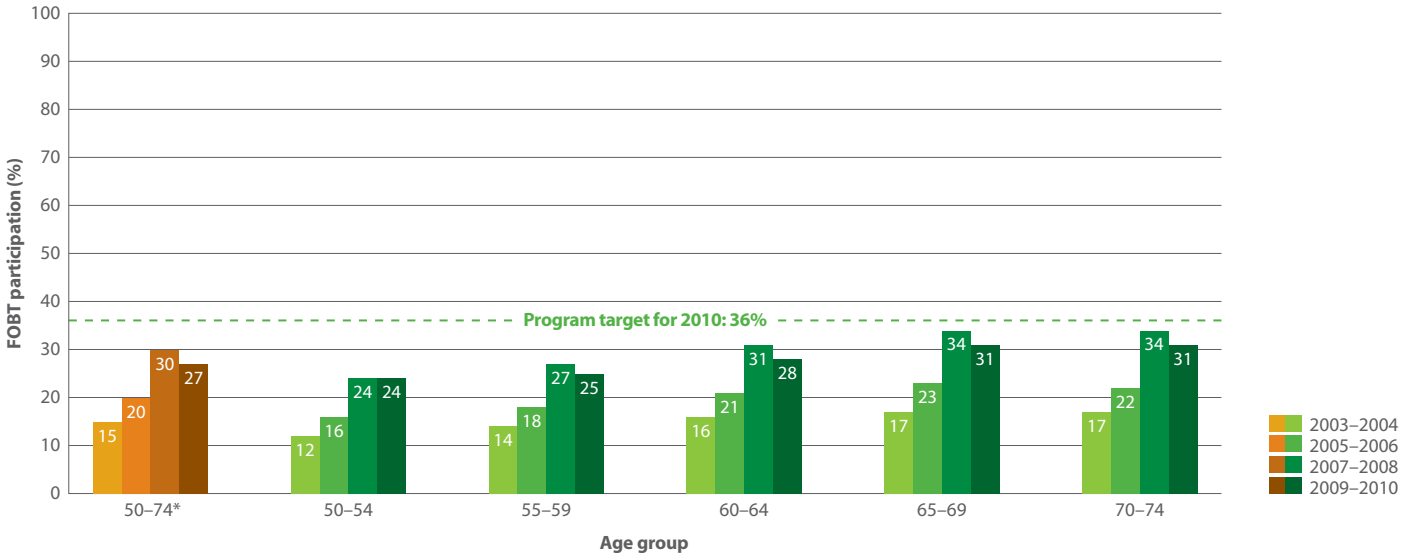
I. Participation

FOBT participation

ColonCancerCheck recommends biennial (once every two years) screening using the fecal occult blood test (FOBT) for people aged 50 to 74 at average risk. In 2009–2010, there were 3,491,067 Ontarians aged 50 to 74, and 27 percent of these people completed an FOBT in the prior two years (*Figure 7*). There was regional variation in the proportion of Ontarians completing an FOBT (*Figure 8*). Regional variation is analyzed by Local Health Integration Network (LHIN). LHINs are Ontario's regional health authorities and are responsible for planning, funding and managing health services in their communities. For a map of Ontario's LHINs, see http://www.lhins.on.ca/FindYourLHIN.aspx.

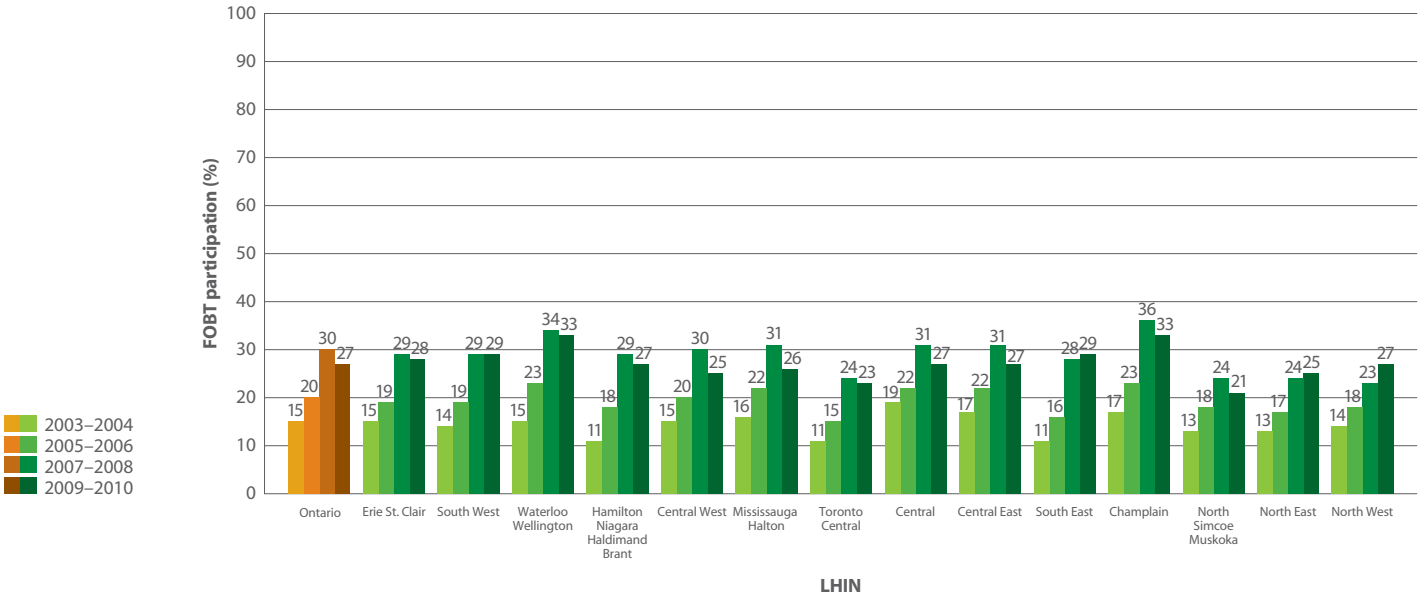
Overall, FOBT participation for the population aged 50 to 74 increased steadily between 2003–2004 and 2007–2008, but decreased slightly in 2009–2010 for all age groups and in 10 out of 14 LHINs. Only the South East, North East and North West LHINs had higher FOBT participation in 2009–2010 than for the other periods reported; the South West had the same rate as the previous period.

FIGURE 7 Percentage of population aged 50–74 who had at least one FOBT in a two-year period, by age group, Ontario, 2003–2004 to 2009–2010



Note *Age-standardized to the 1991 Canadian population.
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 3.

FIGURE 8 Percentage of population aged 50–74 who had at least one FOBT in a two-year period (age-standardized), by LHIN, 2003–2004 to 2009–2010



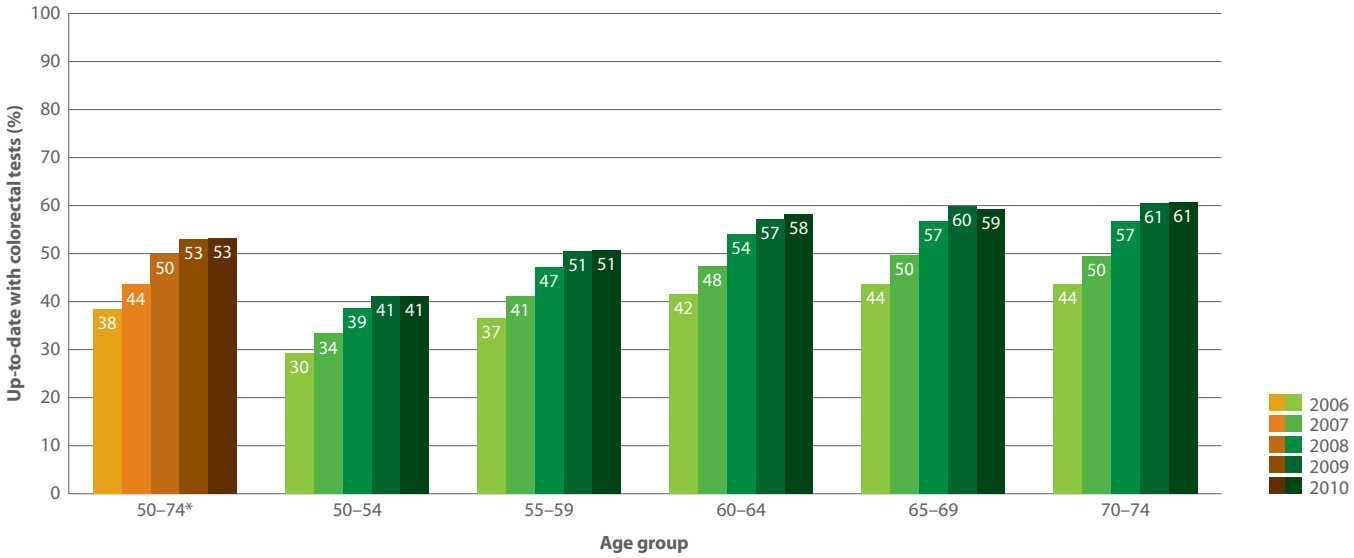
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 3.

Up-to-date with colorectal tests

In order to better understand what percentage of the age-eligible population remains truly unscreened, ColonCancerCheck is reporting here, for the first time, the percentage of people aged 50 to 74 who have had an FOBT in the last two years, a flexible sigmoidoscopy in the last five years or a colonoscopy in the last 10 years. All these people can be considered up-to-date with colorectal tests. The program does not send screening invitations to people who are up-to-date with colorectal tests.

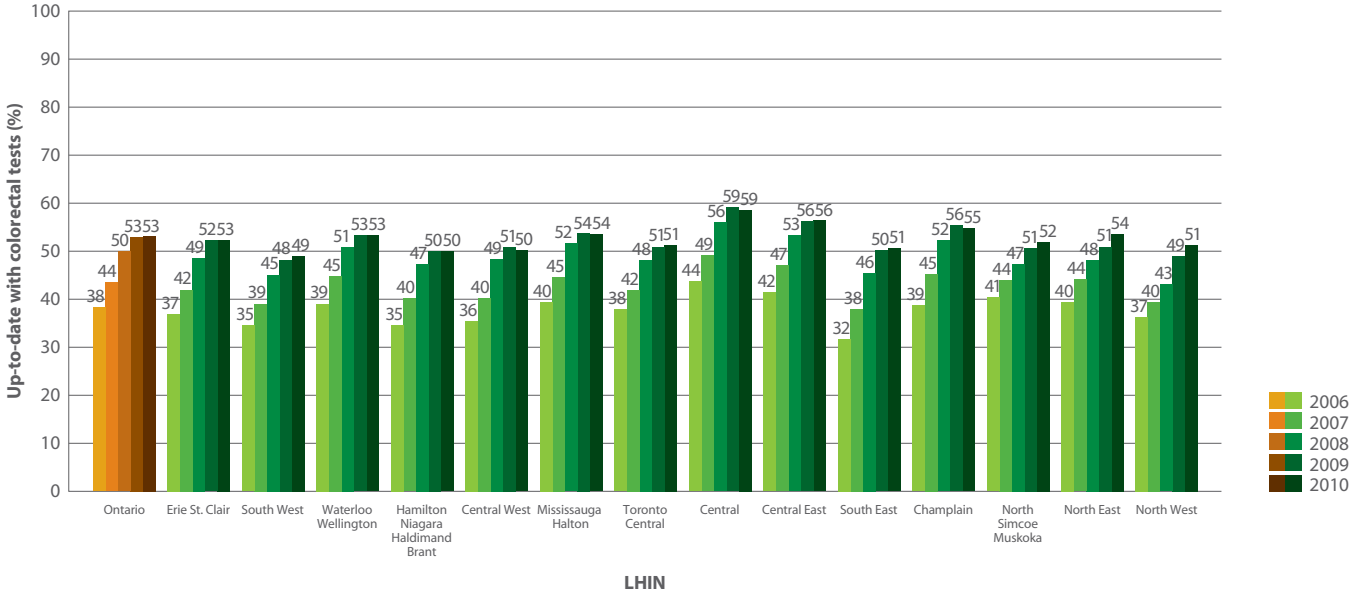
The percentage of the population aged 50 to 74 who were up-to-date with colorectal tests climbed since 2006, and reached a plateau of 53 percent in 2009 and 2010 (*Figure 9*); this finding was consistent across 12 LHINs, with two showing a small decline (*Figure 10*). Older age groups were more likely than younger age groups to be up-to-date with colorectal tests. People who lived in higher income neighbourhoods were more likely to be up-to-date with colorectal tests (*Figure 11*).

FIGURE 9 Percentage of population aged 50–74 who were up-to-date with colorectal tests in a one-year period, by age group, Ontario, 2006–2010



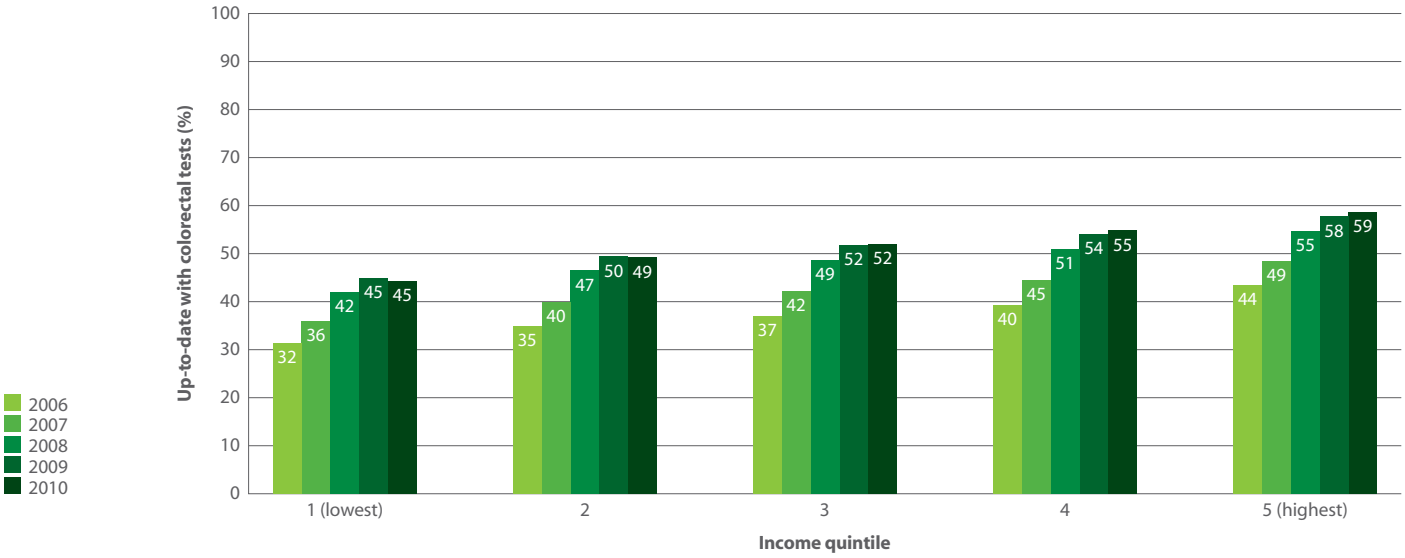
Note *Age-standardized to the 1991 Canadian population.
Colorectal tests include FOBT, colonoscopy and flexible sigmoidoscopy.
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 4.

FIGURE 10 Percentage of population aged 50–74 who were up-to-date with colorectal tests in a one-year period (age-standardized), by LHIN, 2006–2010



Note Colorectal tests include FOBT, colonoscopy and flexible sigmoidoscopy.
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 4.

FIGURE 11 Percentage of population aged 50–74 who were up-to-date with colorectal tests in a one-year period, by income quintile, Ontario, 2006–2010



Note Colorectal tests include FOBT, colonoscopy and flexible sigmoidoscopy.
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 4.

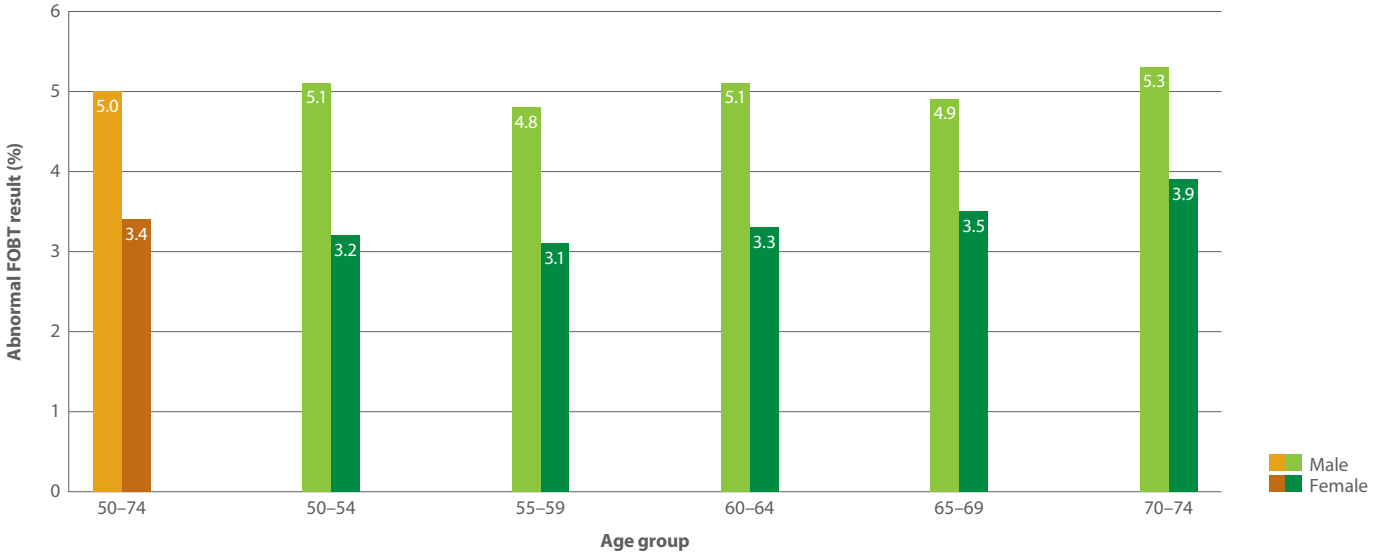
II. Screening

Abnormal FOBT result

The program-branded gFOBT currently used by ColonCancerCheck has three flaps. Participants smear a sample of stool from a bowel movement onto one flap per day for three days. As recommended by Cancer Care Ontario's Guaiac FOBT Laboratory Standards Expert Panel, ColonCancerCheck considers an FOBT abnormal if any one flap gives an abnormal result.[11] After an abnormal FOBT, ColonCancerCheck recommends a colonoscopy to assess whether or not colorectal cancer is present.

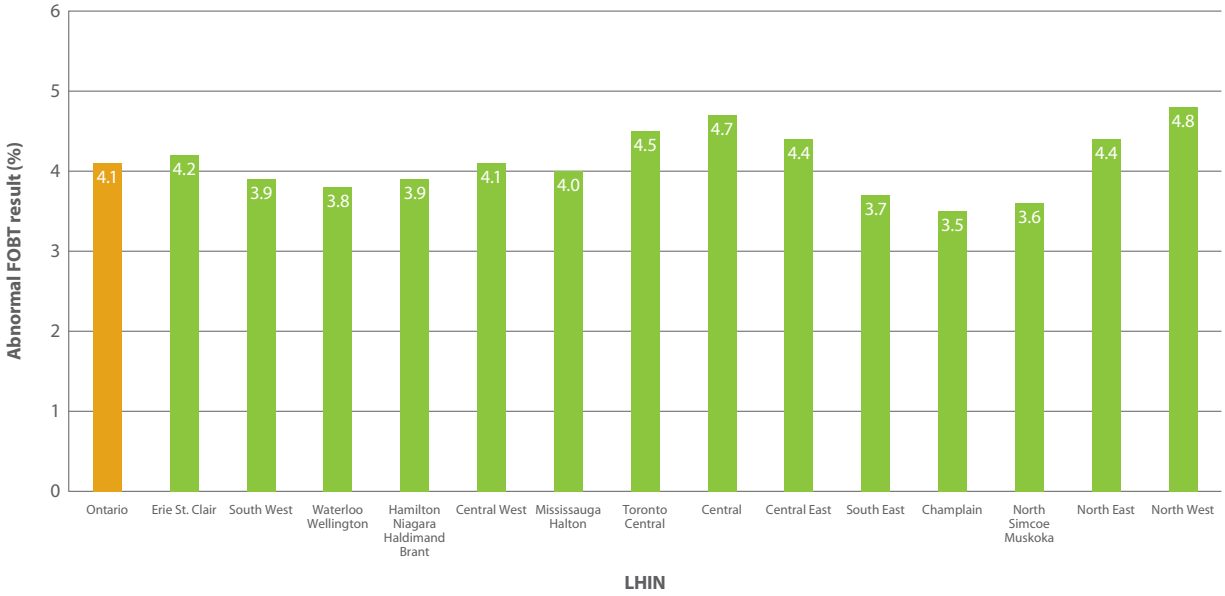
The percentage of abnormal results for people aged 50 to 74 did not vary widely across age groups in 2010 (*Figure 12*). The abnormal rate was higher for men than for women, which was expected because the incidence of colorectal cancer is higher among men than women (*Figure 4*). Abnormal rates varied by LHIN (*Figure 13*). In addition, abnormal rates varied by neighbourhood income (*Figure 14*), perhaps reflecting differences in health status and/or risk behaviours across income quintiles.[15]

FIGURE 12 Percentage of ColonCancerCheck participants aged 50–74 who had an abnormal FOBT result, by age group and sex, Ontario, 2010



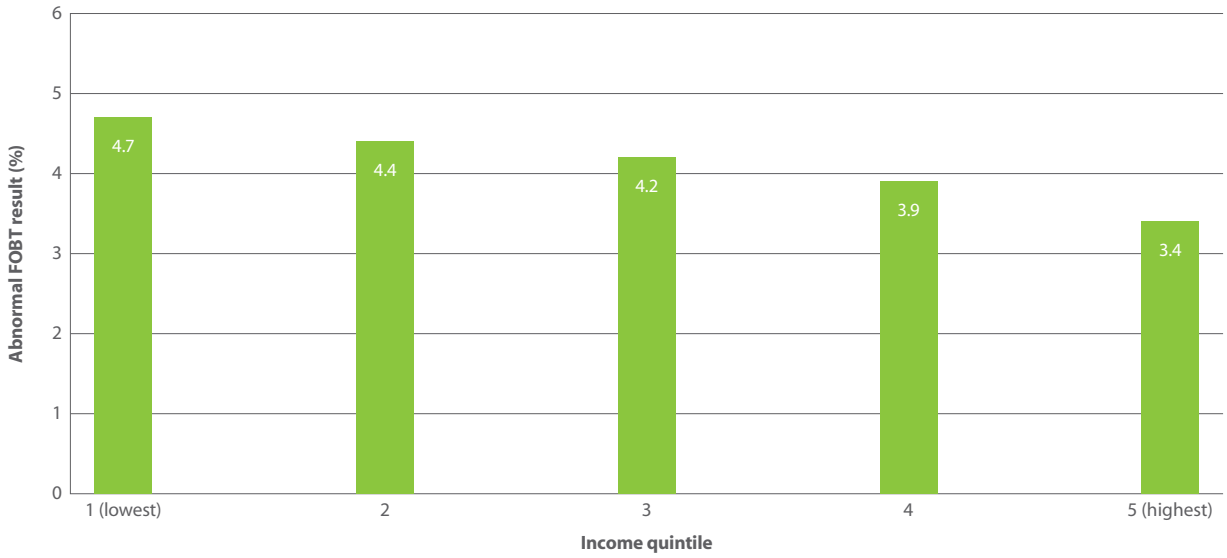
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 5.

FIGURE 13 Percentage of ColonCancerCheck participants aged 50–74 who had an abnormal FOBT result, by LHIN, 2010



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 5.

FIGURE 14 Percentage of ColonCancerCheck participants aged 50–74 who had an abnormal FOBT result, by income quintile, Ontario, 2010



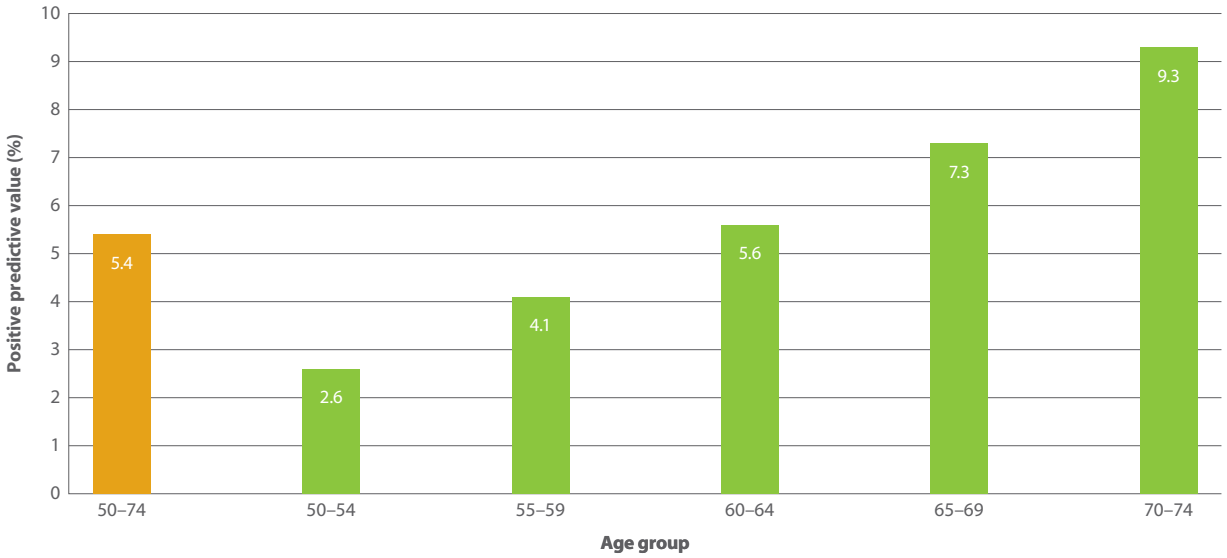
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 5.

Positive predictive value

The positive predictive value of FOBT is the percentage of people found to have invasive colorectal cancer after appropriate diagnostic work-up in those who have an abnormal FOBT.

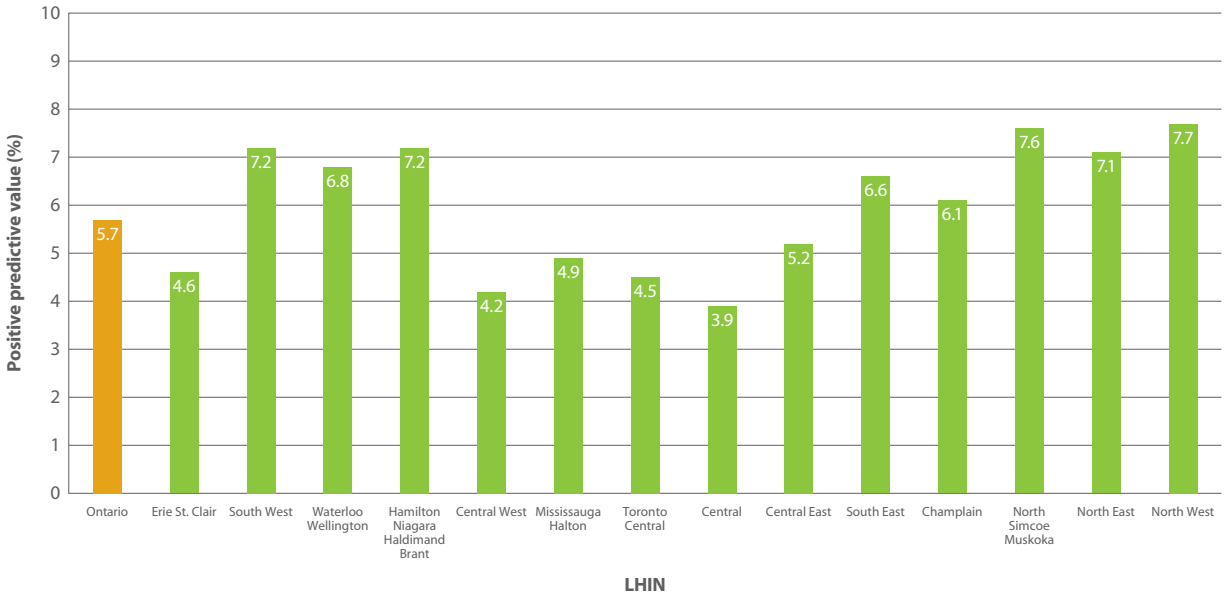
In the ColonCancerCheck Program in 2010, 5.4 percent of people aged 50 to 74 who had an abnormal FOBT followed by large bowel endoscopy or surgery were found to have colorectal cancer (*Figure 15*). The percentage was higher in the older age group, which is expected because the incidence of colorectal cancer increases with age (*Figure 5*). Positive predictive value varied across LHINs (*Figure 16*) and across income quintiles, with a higher positive predictive value for those in the highest income quintile (*Figure 17*). (*Figure 15* and *Figure 16* show different provincial totals because the time frame reported varies.)

FIGURE 15 Percentage of ColonCancerCheck participants aged 50–74 with an abnormal FOBT result who were diagnosed with colorectal cancer, by age group, Ontario, 2010



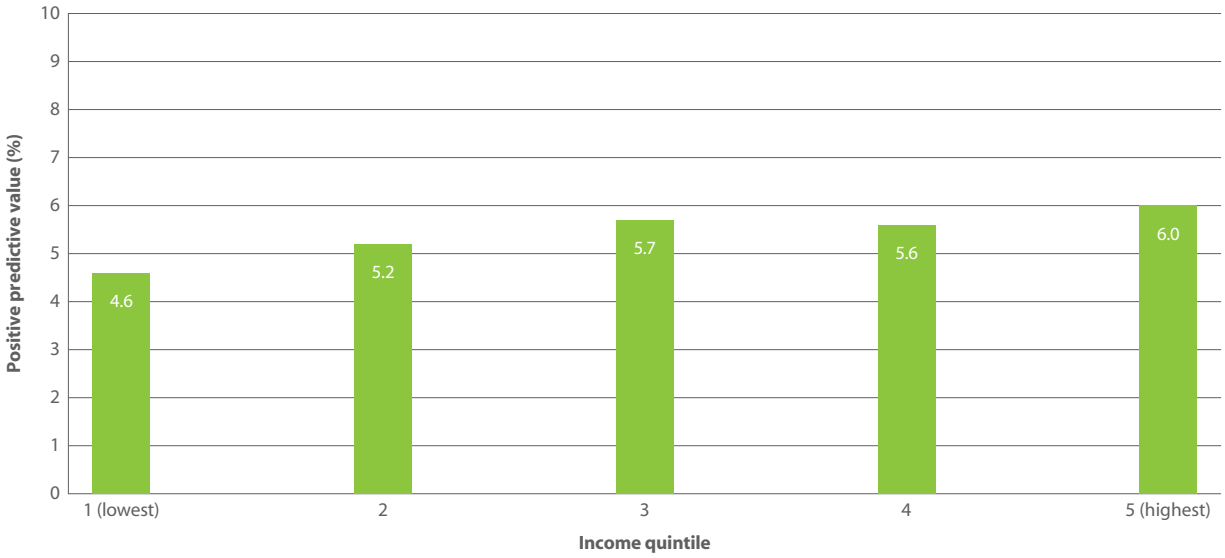
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 6.

FIGURE 16 Percentage of ColonCancerCheck participants aged 50–74 with an abnormal FOBT result who were diagnosed with colorectal cancer, by LHIN, 2008–2010



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 6.

FIGURE 17 Percentage of ColonCancerCheck participants aged 50–74 with an abnormal FOBT result who were diagnosed with colorectal cancer, by income quintile, Ontario, 2010



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 6.

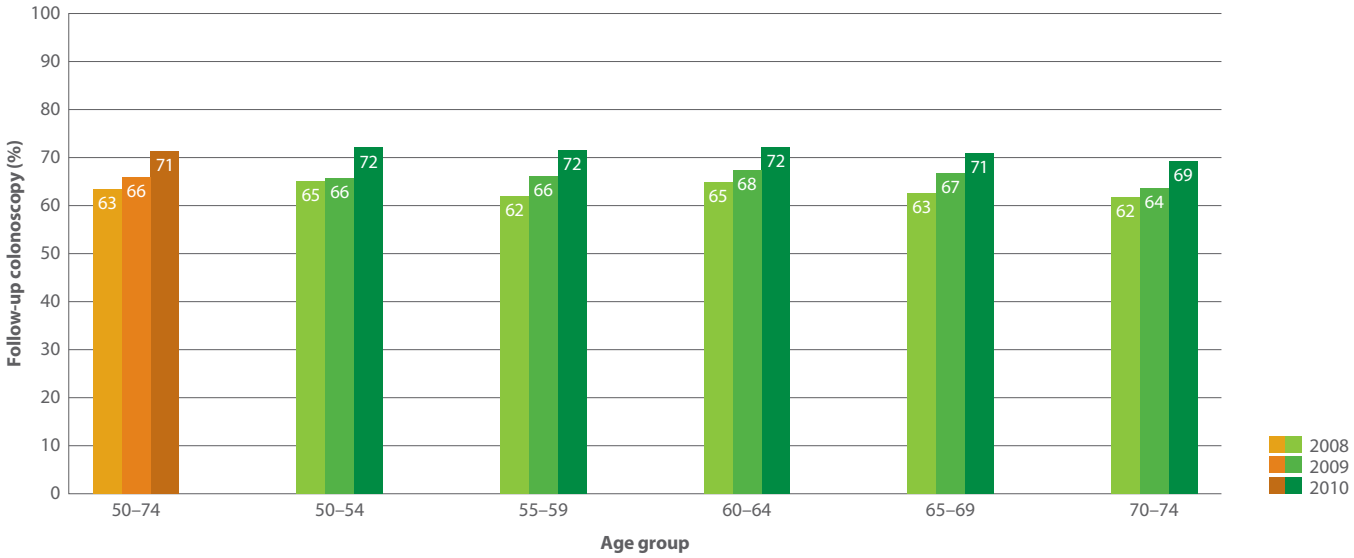
III. Diagnostic follow-up

Follow-up colonoscopy

In order to realize the mortality reduction expected from cancer screening, participants with abnormal screening test results must receive timely and appropriate follow-up. ColonCancerCheck strongly recommends a timely colonoscopy after an abnormal FOBT to assess whether or not cancer is present. During colonoscopy, any pre-cancerous polyps can be identified and removed.

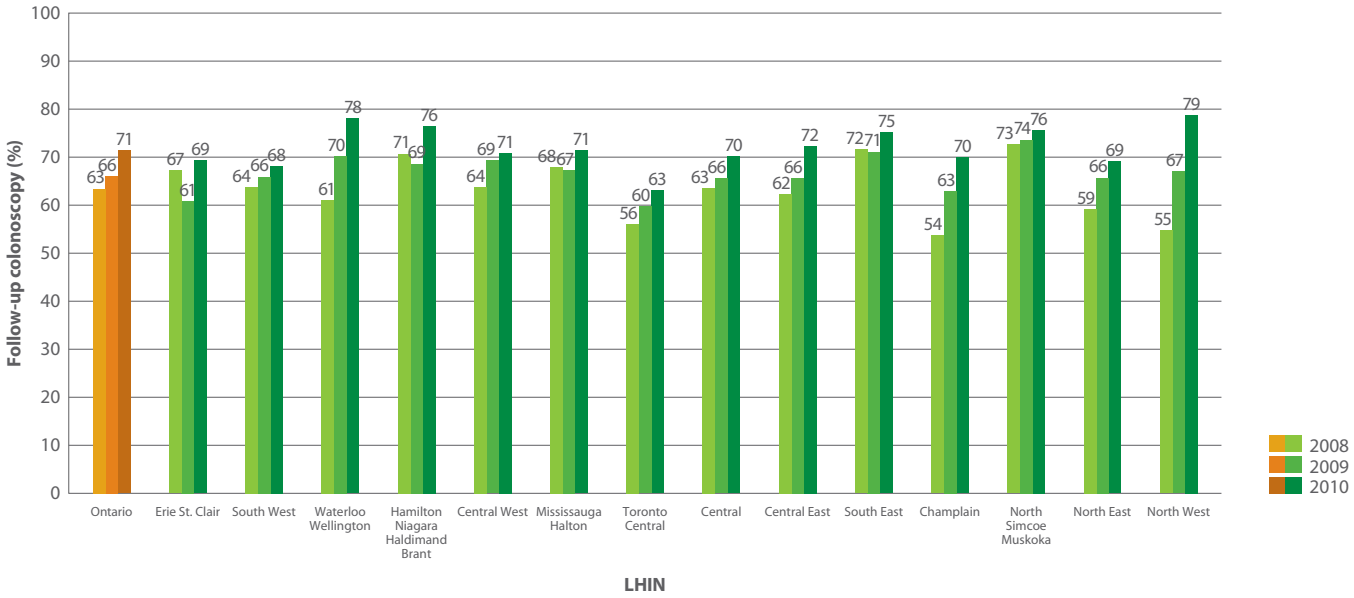
The percentage of people aged 50 to 74 who had a follow-up colonoscopy after an abnormal FOBT climbed steadily since program launch, and was 71 percent for those in 2010 (*Figure 18*). Similar improvements were evident when data were analyzed by LHIN (*Figure 19*).

FIGURE 18 Percentage of ColonCancerCheck participants aged 50–74 with an abnormal FOBT result who had a follow-up colonoscopy within six months, by age group, Ontario, 2008–2010



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 7.

FIGURE 19 Percentage of ColonCancerCheck participants aged 50–74 with an abnormal FOBT result who had a follow-up colonoscopy within six months, by LHIN, Ontario, 2008–2010



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 7.

Endoscopist annual colonoscopy volume

Cancer Care Ontario's Colonoscopy Standards make recommendations for endoscopist performance standards, including colonoscopy volumes. The expert panel recommended that endoscopists perform at least 200 colonoscopies annually in order to achieve or maintain competency.[12]

Among endoscopists who performed five or more colonoscopies in ColonCancerCheck-participating hospitals, the percentage who met or exceeded this standard increased since program launch and reached 79 percent in the 2010/2011 fiscal year (*Table 1*). Among endoscopists who performed five or more colonoscopies in other settings (non-participating hospitals, clinics), the percentage who met or exceeded the standard also increased since 2008, but reached only 66 percent in the 2010/2011 fiscal year.

TABLE 1 Percentage of endoscopists performing 200 or more colonoscopies annually, by ColonCancerCheck Program status, Ontario, fiscal years 2008/2009 to 2010/2011

	ENDOSCOPISTS IN CCC PROGRAM		ENDOSCOPISTS OUTSIDE OF CCC PROGRAM	
FISCAL YEAR	Total N	Annual volume ≥ 200 colonoscopies N (%)	Total N	Annual volume ≥ 200 colonoscopies N (%)
2008/2009	691	520 (75%)	192	112 (58%)
2009/2010	639	499 (78%)	217	138 (64%)
2010/2011	618	488 (79%)	270	179 (66%)

Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 8.

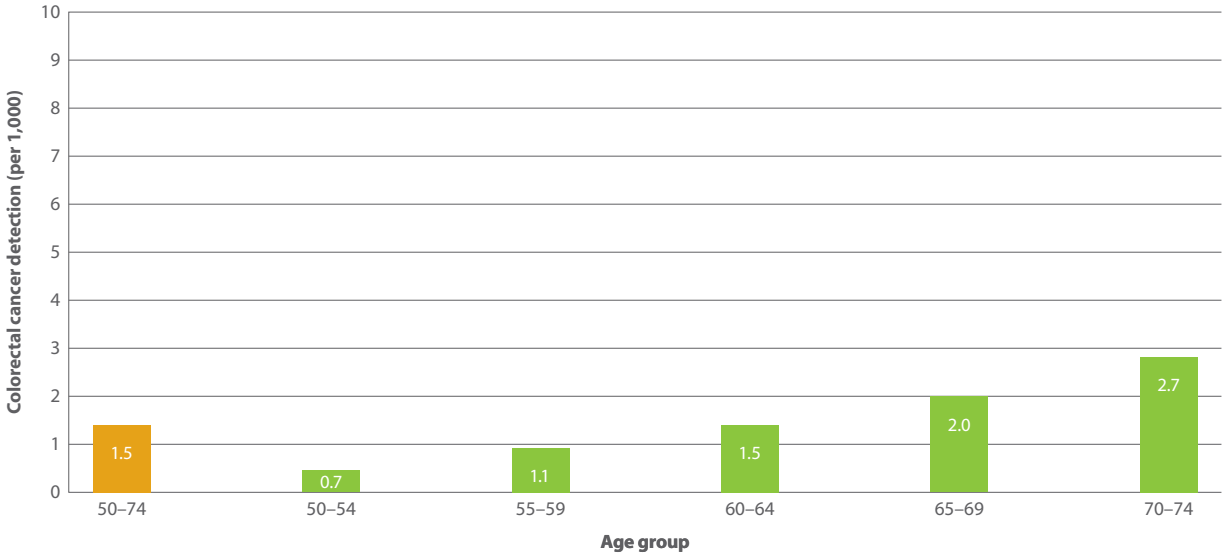
IV. Outcomes

Colorectal cancer detection

Colorectal cancer detection is the number of people who have a cancer detected as a result of screening. For people screened with FOBT, colorectal cancer detection is the proportion of people among those screened with FOBT who had an abnormal FOBT followed by a large bowel endoscopy or surgery and were diagnosed with colorectal cancer. For people with a family history of colorectal cancer who are screened with colonoscopy, colorectal cancer detection is the proportion of people who had a colonoscopy because of family history and were diagnosed with colorectal cancer.

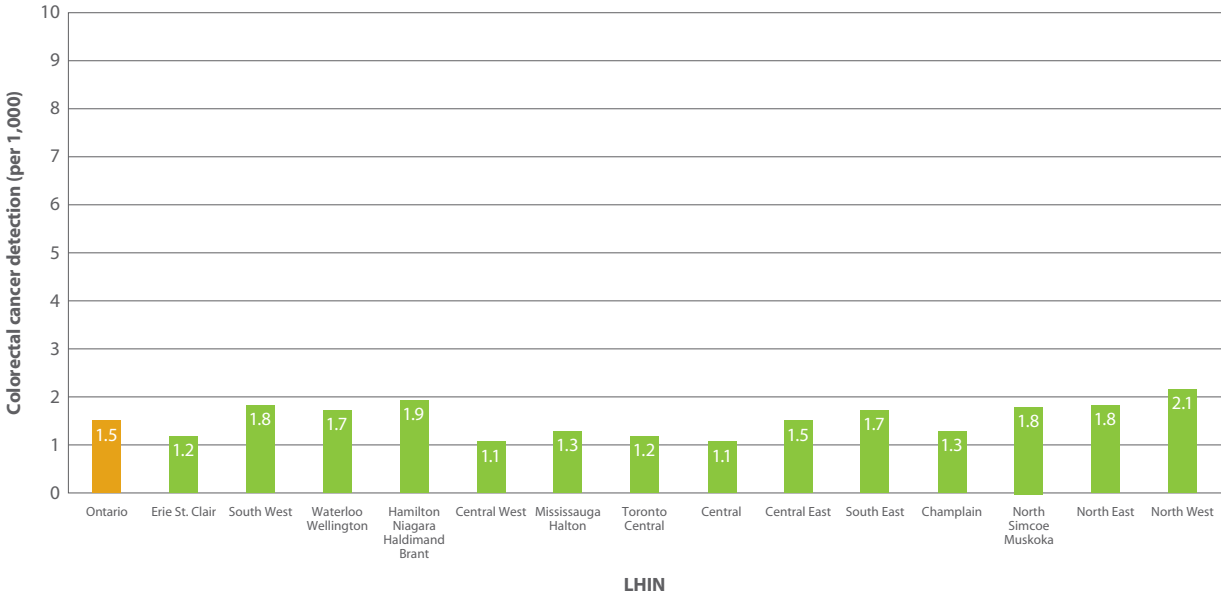
In 2010, 1.5 cancers were detected per 1,000 people aged 50 to 74 who were screened with FOBT (*Figure 20*). As expected, more cancers were detected in older age groups because the incidence of colorectal cancer rises with increasing age (*Figure 5*). There was modest variation in cancers detected across LHINs (*Figure 21*) and little variation across income quintiles (*Figure 22*).

FIGURE 20 ColonCancerCheck participants aged 50–74 screened with FOBT, who were diagnosed with colorectal cancer, by age group, Ontario, 2010



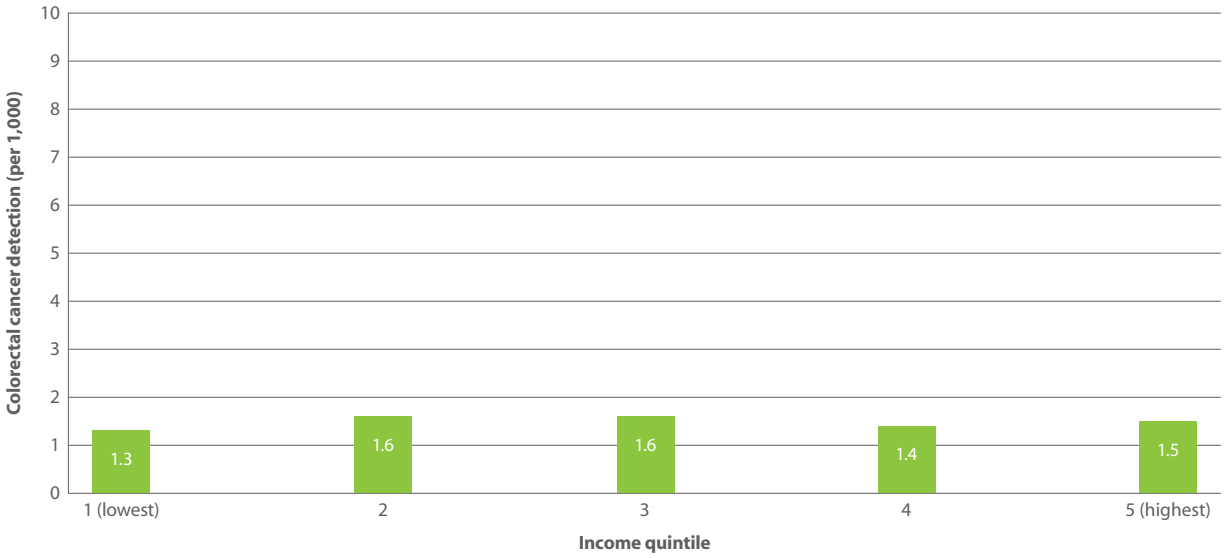
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 9.

FIGURE 21 ColonCancerCheck participants aged 50–74 screened with FOBT, who were diagnosed with colorectal cancer, by LHIN, 2008–2010



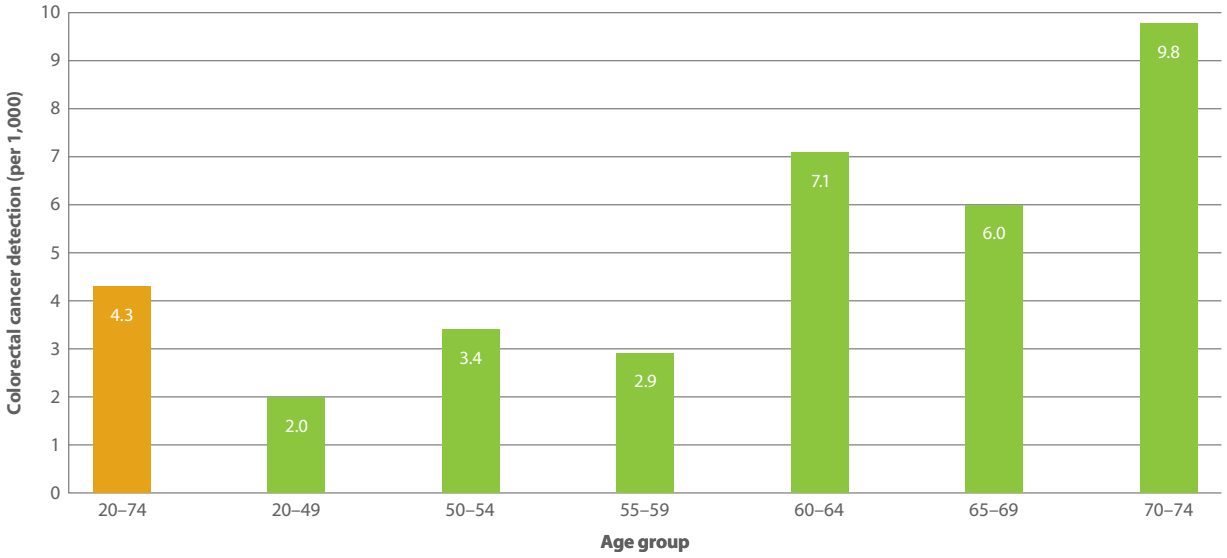
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 9.

FIGURE 22 ColonCancerCheck participants aged 50–74 screened with FOBT, who were diagnosed with colorectal cancer, by income quintile, Ontario, 2010



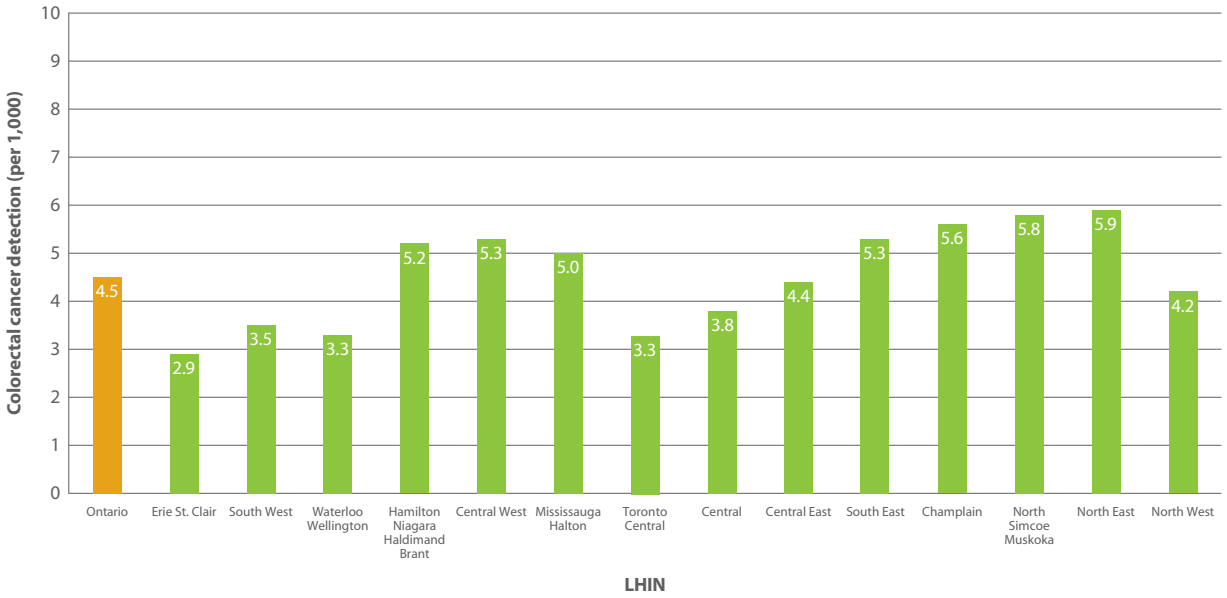
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 9.

FIGURE 23 ColonCancerCheck participants aged 20–74 with family history screened with colonoscopy, who were diagnosed with colorectal cancer, by age group, Ontario, 2010



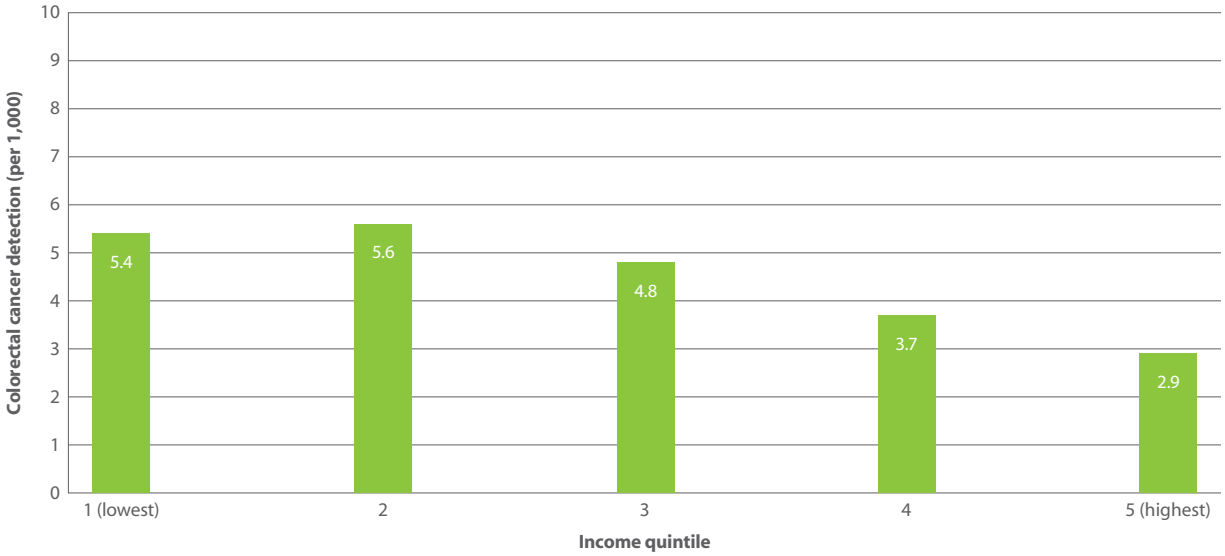
Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 9.

FIGURE 24 ColonCancerCheck participants aged 20–74 with family history screened with colonoscopy, who were diagnosed with colorectal cancer, by LHIN, 2008–2010



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 9.

FIGURE 25 ColonCancerCheck participants aged 20–74 with family history screened with colonoscopy, who were diagnosed with colorectal cancer, by income quintile, Ontario, 2010



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 9.

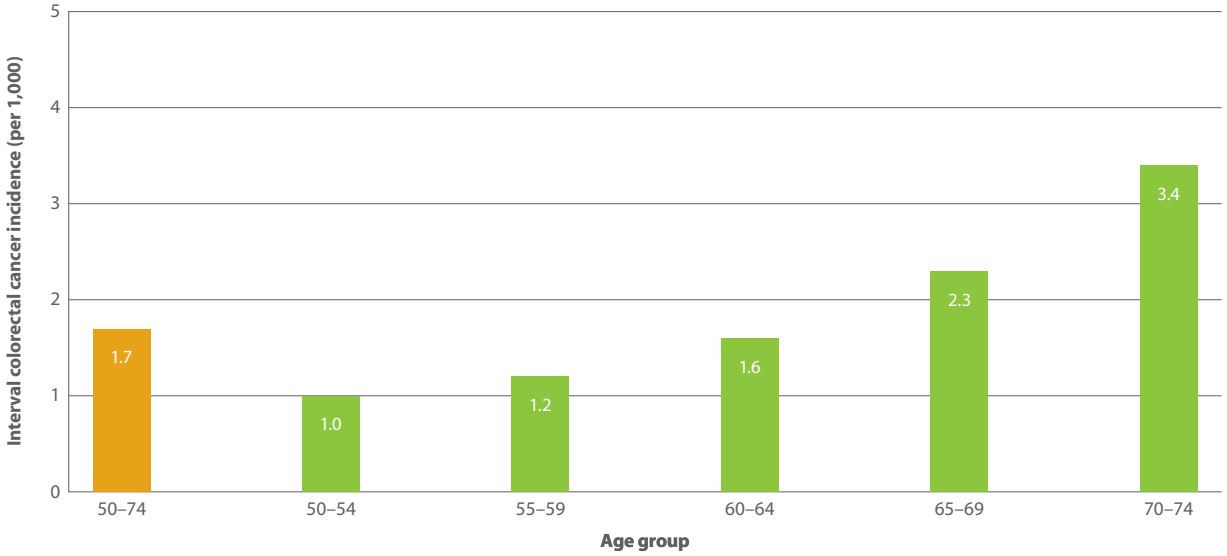
In 2010, 4.3 cancers were detected per 1,000 people aged 20 to 74 who had a family history of colorectal cancer and were screened by colonoscopy (*Figure 23*). As expected, more cancers were detected in the older age groups because the incidence of colorectal cancer rises with increasing age (*Figure 5*). There was modest variation across LHINs (*Figure 24*) and across income quintiles, with more cancers detected among those in the lowest quintiles (*Figure 25*). (*Figure 23* and *Figure 24* show different provincial totals because the time frame reported varies.)

Interval colorectal cancer incidence

Screening tests are intended to identify people at higher risk for cancer so that they can have a more definitive test to see if they actually have cancer. Sometimes a screening test gives a normal (negative) result, but cancer is diagnosed soon after; when these cancers are detected, they are called interval cancers. Interval cancers may have been missed by the screening test or may have developed in the period after the test was completed.

For every 1,000 people aged 50 to 74 who had a normal FOBT result in 2008, 1.7 cancers were diagnosed in the two years following the normal result (*Figure 26*). As expected, more interval cancers occurred in older age groups because the incidence of colorectal cancer is higher with increasing age (*Figure 5*).

FIGURE 26 ColonCancerCheck participants aged 50–74 who were diagnosed with colorectal cancer in the two years following a normal FOBT result, by age group, Ontario, 2008



Data sources and methodology ColonCancerCheck 2010 Program Report, Appendix B, Table 10.

Summary

The ColonCancerCheck Program was launched in 2008 and by 2010 had made impressive progress.

A legal and regulatory framework was established to allow identification and follow-up of the target population. A robust information management system was developed to allow eligible Ontarians to be invited into the program, informed of their fecal occult blood test (FOBT) results and recalled for screening when due. Quality standards were established for processing of FOBT kits and for colonoscopy, and funding was provided to incent performance according to standards. Promotional efforts targeting the public and providers raised awareness of the program and encouraged participation. An inaugural program report was also released highlighting key aspects of program performance.

This report expands considerably on the inaugural ColonCancerCheck Program report, and gives a fuller and more nuanced picture of the ColonCancerCheck Program and its impact on the more than 3 million Ontarians aged 50 to 74 who are in the target age group for colorectal cancer screening.

FOBT participation among the population aged 50 to 74 increased steadily until the most recent period reported, 2009–2010, when participation showed a slight decline. ColonCancerCheck has set targets for FOBT participation that increase each year. In 2009–2010, ColonCancerCheck did not reach the 2010 program target of 36 percent FOBT participation.

The percentage of the population aged 50 to 74 who were up-to-date with colorectal tests (FOBT in the previous two years, flexible sigmoidoscopy in the previous five years or colonoscopy in the previous 10 years) increased and reached 53 percent in 2010. The increase in the percentage of people up-to-date with colorectal tests is good news, but these data also show that almost half of Ontarians remain unscreened. Mortality benefits can only be achieved with increased screening participation.

Overall, 5 percent of men and 3.4 percent of women aged 50 to 74 had an abnormal FOBT result in 2010. The percentage of abnormal results was higher in the ColonCancerCheck Program than for some other screening programs; for example, the English arm of the United Kingdom bowel cancer screening pilot

had abnormal rates of 1.6 and 1.8 percent in two rounds of screening.[16] The difference in the abnormal rates between the ColonCancerCheck Program and the United Kingdom pilot may be attributable to the more stringent definition of abnormal FOBT used by the pilot compared to that used by ColonCancerCheck.

ColonCancerCheck strongly recommends a timely colonoscopy after an abnormal FOBT to assess whether or not cancer is present. In 2010, 5.4 percent of people aged 50 to 74 with an abnormal FOBT followed by large bowel endoscopy or surgery were found to have colorectal cancer. The percentage of those with an abnormal FOBT who went on to colonoscopy increased from 63 percent in 2008 to 71 percent in 2010. The United Kingdom's National Health Service has set a standard that 85 percent of people with an abnormal FOBT result should have a colonoscopy.[17] ColonCancerCheck has not set a program target for this indicator.

In order to achieve or maintain competency, *Cancer Care Ontario's Colonoscopy Standards* recommend that endoscopists perform at least 200 colonoscopies per year. In the 2010/2011 fiscal year, 79 percent of endoscopists who performed procedures in participating hospitals achieved or exceeded this target, compared to 66 percent of endoscopists who did not routinely perform procedures in participating hospitals.

In 2010, 1.5 cancers were detected per 1,000 people aged 50 to 74 who were screened with FOBT. In 2010, 4.3 cancers were detected per 1,000 people aged 20 to 74 who had a family history and were screened with colonoscopy.

For every 1,000 people who had a normal FOBT result in 2008, 1.7 cancers were diagnosed in the two years following the normal result.

Future Directions

In the future, ColonCancerCheck will focus on increasing screening participation, improving follow-up colonoscopy rates for those with abnormal screening test results, and continuing to improve the quality of screening.

INCREASING SCREENING PARTICIPATION

A key to increasing screening participation is an invitation system. ColonCancerCheck began sending invitation correspondence in 2010, starting with recall letters to those who were due for repeat screening two years after a normal fecal occult blood test (FOBT). In the same year, ColonCancerCheck began sending invitations to the newly screen-eligible (people turning 50 and, for the first year only, people turning 51 and 52). ColonCancerCheck is planning to expand invitations to reach all eligible Ontarians who are under- or never-screened. Invitations are also being strengthened by referencing the person's physician, if known, based on evidence that a physician's recommendation is a strong motivator to participate in colorectal screening.[10]

The International Agency for Research on Cancer notes that promotional efforts to encourage participation are a vital consideration when launching a new screening program.[7] Program launch was supported by an intensive and innovative campaign to raise public awareness about the importance of colorectal cancer screening. ColonCancerCheck will continue to support public and provider education on the importance of colorectal cancer screening for Ontarians aged 50 to 74.

In the coming years, the ColonCancerCheck Program is evaluating a more sensitive type of FOBT, the fecal immunochemical test or FIT. There was insufficient evidence for FIT at the time of program launch, but FIT is increasingly recognized as a superior test, in part because it is associated with higher screening participation rates.[18]

Switching to FIT is a lengthy process that includes a review of the evidence, field testing to optimize kit performance in the Ontario setting, policy and regulatory changes to allow the kit to be used and funded, and program planning for eventual implementation. An expert panel has reviewed the evidence and concluded that FIT has important advantages over gFOBT, including higher screening participation rates, greater sensitivity for colorectal cancer and advanced adenomas, potential for automation in the laboratory and potential to select the hemoglobin cut-off level to define a positive test. However, FIT also has disadvantages, such as greater specimen instability and potentially higher abnormal rates. Therefore, the panel recommended that a pilot be undertaken to determine how to optimally implement FIT in Ontario.[19]

As recommended by the expert panel, a FIT pilot is currently underway and results are expected by spring 2013. Over the next year, Cancer Care Ontario and the Ministry of Health and Long-Term Care will work to prepare for an eventual change to FIT as the primary mode of average risk colorectal cancer screening in Ontario based on the results from this pilot.

IMPROVING FOLLOW-UP COLONOSCOPY RATES AFTER ABNORMAL FOBT

European colorectal screening quality assurance guidelines recommend that programs actively follow up with people who have had screening abnormalities in order to ensure timely and appropriate assessment, using reminders and computerized systems for tracking and monitoring management of these people.[7]

ColonCancerCheck has begun tracking and monitoring management of those with abnormal results and includes this information in regular reports to physicians about their eligible patient population. The program has also used its data holdings to explore why some people do not have a colonoscopy after an abnormal FOBT. Some reasons for not going on to have a colonoscopy, such as personal preference, cannot be measured. Two of the most significant factors associated with failure to have a colonoscopy after an abnormal FOBT were having a repeat FOBT instead of a colonoscopy and having a recent colonoscopy prior to the FOBT (i.e., FOBT dispensed despite recent colonoscopy). These findings point to the importance of continuing to educate providers and the public about the appropriate use of FOBT and colonoscopy for colorectal screening and follow-up.

IMPROVING THE QUALITY OF SCREENING

Led by Dr. Michael Gould, Provincial Colonoscopy Lead, the program is undertaking initiatives to improve the quality of screening through an enhanced focus on colonoscopy performance management. An expert panel is currently updating *Cancer Care Ontario's Colonoscopy Standards*. In the future, ColonCancerCheck will take a more active role in colonoscopy performance management using these updated standards, developing provider-level reports on performance and building a quality improvement support program. Endoscopists' colonoscopy volumes are expected to be one among a number of performance measures that will be tracked and reported on for the purposes of quality improvement.

Finally, through ongoing performance monitoring and evaluation, ColonCancerCheck will ensure that the highest quality colorectal cancer services are delivered to Ontarians. Program reporting will continue to improve, with future program reports that include more indicators measuring the quality and impact of colorectal cancer screening in Ontario.

Appendices

APPENDIX A: ColonCancerCheck Goals and Objectives Framework

APPENDIX B: Methodology for Program Indicators

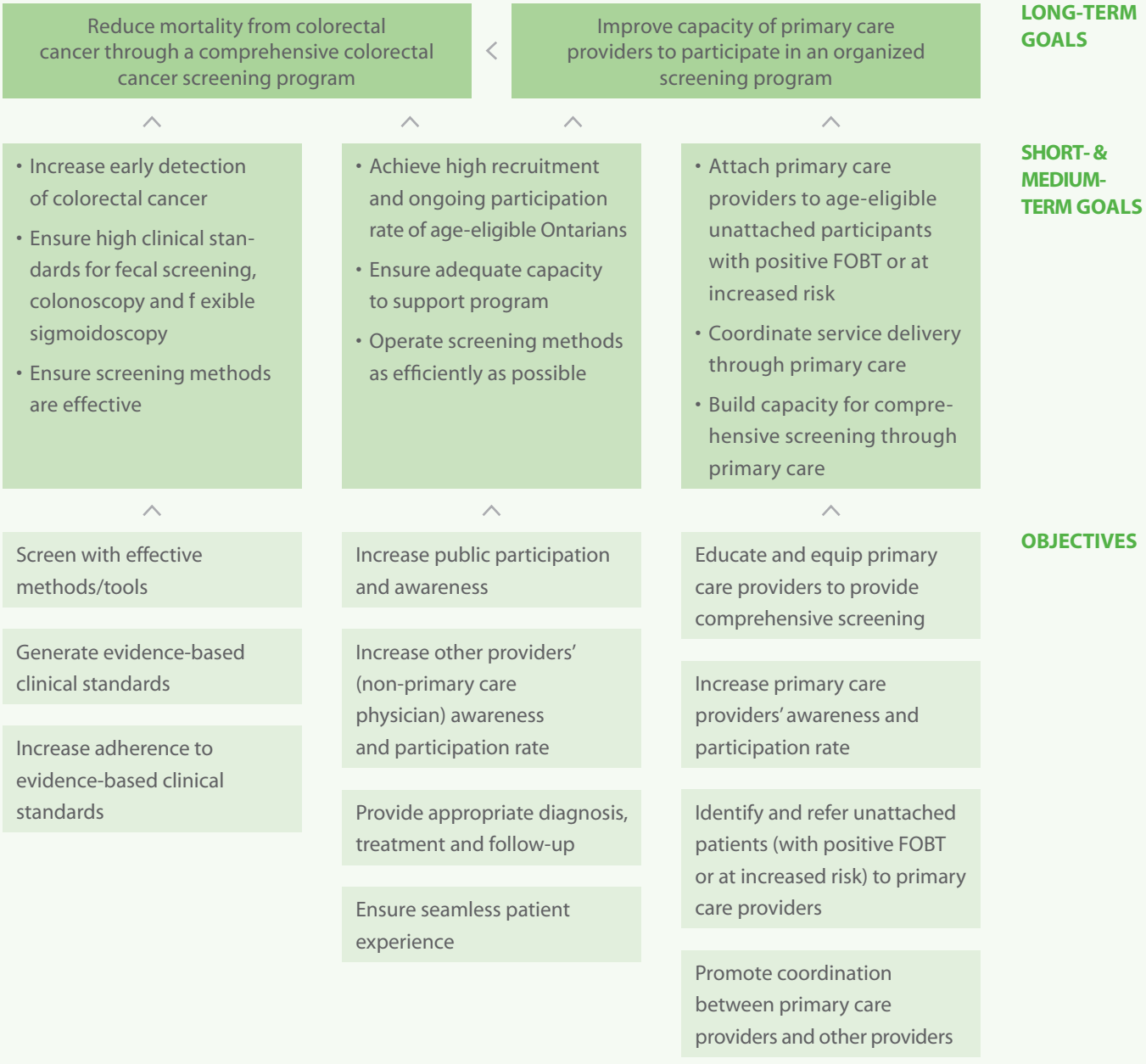
APPENDIX C: List of Abbreviations

APPENDIX D: List of Figures

APPENDIX E: List of Tables

Appendix A

FIGURE 27 ColonCancerCheck goals and objectives framework



Appendix B: Methodology for Program Indicators

TABLE 2 Burden of disease methodology

INDICATORS	Numbers of cancer deaths and new cases for the most common cancers in Ontario; colorectal mortality rates Canada; colorectal incidence and mortality rate trends Ontario; colorectal incidence rates by age Ontario; colorectal cancer stage at diagnosis Ontario
Definitions	• Numbers of deaths / new cases for the most common cancers in Ontario: the estimated number of deaths attributed to lung, colorectal, breast or prostate cancer / the estimated number of new cases of lung, colorectal, breast or prostate cancer, diagnosed during 2010 (Colorectal cancer definition: see Definition for Numerators (rates), below; ICD-10 and ICD-O-3 codes lung cancer C34; breast cancer C50 (females only); prostate cancer C61.) • Colorectal cancer incidence / mortality rates: the number of new cases of colorectal cancer diagnosed, or the number of deaths attributed to colorectal cancer, during a defined period of time, per 100,000 people • Colorectal cancer stage at diagnosis: the proportion of colorectal cancer diagnosed at Stages I through IV or unstaged, during a defined period of time, in a specified population
Calculations (rates)	• Age-standardized incidence / mortality rates: weighted average of the age-specific (crude) rates, where the weights are the proportions of people in the corresponding age groups of a standard population. The current standard population in Canada for calculating age-standardized rates is the 1991 Canadian census population structure. • Age-specific incidence rates (incidence rates by age): the number of new cases of a cancer diagnosed in a five-year age group (0–4, 5–9,…85+) during a year or range of years, divided by the number of people in that age group during that year or range of years, multiplied by 100,000 and then expressed as a rate per 100,000 persons in that time period.
Numerators (rates)	**Definition:** • Total number of individuals diagnosed with, or with death attributed to, colorectal cancer (diagnoses: ICD-O-3 codes C18, C19, C20, C26.0; deaths: ICD-10 codes C18, C19, C20, C26.0) (Note: mortality rates for Canada and provinces, from *Canadian Cancer Statistics 2010*, also included deaths with ICD-10 codes C21 (anus, anal canal and anorectum)) **Inclusions:** • Individuals all ages (except for age-specific incidence rates, Ontario, calculated for ages 35 and older) **Exclusions:** • For age-specific incidence rates, Ontario, individuals diagnosed at ages <35 **Data Sources:** • Ontario Cancer Registry, 2011 (Ontario incidence rates) • Death, Ontario Ministry of Health and Long-Term Care, intelliHEALTH ONTARIO Date Data Last Refreshed Oct, 2011 (Ontario mortality rates) (original source: Registrar General Ontario) • *Canadian Cancer Statistics 2010* (Canadian Vital Statistics Death database at Statistics Canada) (Canadian and provincial mortality rates)
Denominators (rates)	**Definition:** • Total number of Ontario residents (Ontario rates): total number of Canadian residents and residents of each province (Canadian and provincial rates) **Inclusions:** • Individuals all ages (except for age-specific incidence rates, Ontario, calculated for ages 35 and older) **Exclusions:** • For age-specific incidence rates, Ontario, individuals aged <35 **Data Sources:** • Statistics Canada – Canadian Demographic Estimates

Data availability & limitations	• Numbers of new cases and deaths for Ontario 2010 are estimates, as are Canadian and provincial mortality rates for 2010 • Ontario mortality and incidence rates are based on actual data through 2008, and on estimated data for 2009–2010
Similar indicators in other jurisdictions	• *Canadian Cancer Statistics*, various years (incidence and mortality rates, Canada and provinces) • International cancer incidence (reported): International Agency for Research on Cancer, *Cancer Incidence in Five Continents*, http://ci5.iarc.fr/ • International cancer mortality (reported): International Agency for Research on Cancer, World Health Organisation (WHO) Cancer Mortality Database, http://www-dep.iarc.fr/WHOdb/WHOdb.htm • International cancer mortality and incidence (estimated): GLOBOCAN 2008, http://globocan.iarc.fr/ • Eheman C, Henley SJ, Ballard-Barbash R, et al. Annual report to the nation on the status of cancer, 1975–2008, featuring cancers associated with excess weight and lack of sufficient physical activity. *Cancer* 2012;118:2338–66.
Analyses	• Numbers of deaths and new cases 2010: Cancer Care Ontario estimates based on Ontario Cancer Registry data extracted in 2011; all age groups, breast includes females only • Estimated age-standardized colorectal cancer mortality rates, Canada, by province and sex, from *Canadian Cancer Statistics 2010* • Age-standardized incidence and mortality rates, annual, all ages, by sex, three-year moving averages, 1981 through 2010 (actual data 1981 through 2008) • Age-specific incidence rates, by five-year age group, 35–39 through 85+, by sex, for the period 2004–2008 • Stage at diagnosis for ages 50–74, 2010, percent Stages I through IV and unstaged: stage data linked with Ontario Cancer Registry cohort, with Collaborative Stage available for colorectal cancer **Data Sources:** • 1991 Canadian population as the standard population for calculating age-standardized rates • Ontario Cancer Registry, 2011 • *Canadian Cancer Statistics 2010* • Statistics Canada – Canadian Demographic Estimates (2003–2010) • Interim Stage Table, Cancer Care Ontario Informatics • Death, Ontario Ministry of Health and Long-Term Care, intelliHEALTH ONTARIO Date Data Last Refreshed Oct, 2011 (Ontario mortality rates) (original source: Registrar General Ontario)

TABLE 3 Participation: FOBT participation rate methodology

INDICATOR	PARTICIPATION: FOBT PARTICIPATION RATE
Definition	The percentage of Ontario residents, aged 50–74, who completed at least one FOBT in a two-year period
Calculation	$\frac{\text{Number of individuals who completed at least one FOBT in a two-year period}}{\text{Number of eligible Ontario residents in a two-year period}} \times 100 = \text{FOBT Participation Rate (\%)}$ • Rates are age-standardized to the 1991 Canadian population using the direct method

Numerator	**Definition:**
	• Total number of individuals, aged 50–74, who completed and returned an FOBT kit in a two-year period
	
	Inclusions:
	• Individuals aged 50–74
	• Each individual was counted once regardless of the number of FOBTs performed in a two-year period
	• FOBTs were identified in CHDB by OHIP fee codes:
	  • G004 Lab.med.in office – Occult Blood
	  • L179 ColonCancerCheck Fecal Occult Blood Testing
	  • L181 Lab Med – Biochem – Occult Blood
	• Index date was used to determine age and time period. Index date was defined as:
	  • Service date in CHDB
	  • If a person had multiple tests in a two-year period, the service date of the first test was selected as index date
	
	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Duplicate records:
	  • Multiple records with the same HIN, procedure date and type of procedure were assumed to be a single record
	
	Data Sources:
	• CHDB – FOBT claims
	• RPDB – Demographics

Denominator	**Definition:** • Total number of Ontario residents, aged 50–74, averaged over a two-year period **Inclusions:** • Individuals aged 50–74 **Exclusions:** • None **Data Sources:** • Statistics Canada – Canadian Demographic Estimates
Data availability & limitations	• Small proportion of FOBTs performed as a diagnostic test could not be excluded from the analysis • FOBTs analyzed in hospital labs could not be captured • CHDB data may have included (CCC program) rejected kits • Only FOBT as a primary screening test could be assessed. FOBT is recommended for those at average risk of colorectal cancer. Those at increased risk (first-degree relative with colorectal cancer) were not assessed as they could not be accurately identified • LRT data was not used, thus a small number of FOBTs may not have been captured

Similar indicator in other jurisdictions	• CPAC: Participation rate = Percentage of target population that engaged in FOBT screening test in an organized screening program (%) (Quality Determinants for Colorectal Cancer Screening in Canada, September 30, 2009) • EU: Participation rate = Number of people who have used and returned an FOBT kit irrespective of result by total number of people eligible for screening according to the program policy (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010)
Analysis	• For calendar years 2003–2010, by two-year period (2003–2004, 2005–2006, 2007–2008, 2009–2010) • Crude rate, overall; by five-year age groups • Age-standardized rate, overall; by LHIN • LHIN assignment was based on PCCF+, version 5h. The provider's postal code was used to identify the participant's LHIN, if the participant's postal code was missing **Data Sources:** • 1991 Canadian population as the standard population for calculating age-standardized rates • CHDB – FOBT claims (January 2003 – December 2010) • RPDB – Demographics (January 2003 – December 2010) • Statistics Canada – Canadian Demographic Estimates (2003–2010)

TABLE 4 Participation: Up-to-date with colorectal tests methodology

INDICATOR	PARTICIPATION: UP-TO-DATE WITH COLORECTAL TESTS
Definition	The percentage of Ontario residents, aged 50–74, who were up-to-date with colorectal tests in each time period
Calculation	$\frac{\text{Number of eligible individuals who were up-to-date with one or more colorectal tests}}{\text{Number of eligible Ontario residents}} \times 100 = \text{Up-to-date with colorectal tests rate (\%)}$ • Rates are age-standardized to the 1991 Canadian population using the direct method

Numerator	**Definition:**
	• Total number of eligible individuals, aged 50–74, who were up-to-date with one or more colorectal tests in each time period
	
	Inclusions:
	• Individuals, aged 50–74 years old, who were up-to-date with one or more colorectal tests in each time period
	• Each individual was counted once regardless of the number of tests performed
	• Up-to-date was defined as at least one of the following tests:
	  • FOBT in the last 24 months (January 1st of previous year to December 31st of calendar year of interest – see light green box)
	  • Flexible sigmoidoscopy in the last 60 months (January 1st of four years prior to calendar year of interest until December 31st of calendar year of interest – see medium green + light green boxes)
	  • Colonoscopy in the last 120 months (January 1st of nine years prior to calendar year of interest until December 31st of calendar year of interest – see heavy green + medium green + light green boxes)
	• Up-to-date was defined relative to the end of each calendar year
	• FOBT tests were identified in CHDB by OHIP fee codes:
	  • G004 Lab.med.in office – Occult Blood
	  • L179 CCC Fecal Occult Blood Testing
	  • L181 Lab Med – Biochem – Occult Blood
	• Colonoscopy was identified in CHDB by OHIP fee code Z555 ± other related codes
	• Flexible sigmoidoscopy was identified in CHDB by OHIP fee code Z580
	• December 31st of calendar year of interest was used to determine age and time period
	• Example of timelines used to calculate indicator for 2008:
	 
	January 1, 1999 – December 31, 2003 / January 1, 2004 – December 31, 2006 / January 1, 2007 – December 31, 2008
	
	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Individuals with a prior diagnosis of colorectal cancer in OCR defined as:
	  • ICD-9 153 (excluding 153.5), 154.0–154.1
	• Individuals who had a total colectomy prior to January 1st of each period identified in CHDB by OHIP fee codes S169, S170, S172
	• Individuals who had OHIP fee code Q142A in the last two years in CHDB (from December 31st of calendar year of interest to January 1st of previous year – see light green box)
	• Duplicate records:
	  • Multiple records with the same HIN, procedure date and type of procedure were assumed to be a single record
	
	Data Sources:
	• CHDB – FOBT, colonoscopy, flexible sigmoidoscopy, and total colectomy claims
	• OCR – Malignant cancer cases
	• RPDB – Demographics

Denominator	**Definition:**
	• Total number of eligible Ontario residents, aged 50–74, in each time period
	
	Inclusions:
	• Individuals, aged 50–74, identified in RPDB
	
	Exclusions:
	• Individuals with a missing or invalid HIN, date of birth, sex or postal code
	• Individuals with a prior diagnosis of colorectal cancer in OCR defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0
	• Individuals who had a total colectomy prior to January 1st of each period identified in CHDB by OHIP fee codes S169, S170, S172
	• Individuals who had OHIP fee code Q142A in the last two years in CHDB (from December 31st of calendar year of interest to January 1st of previous year – see light green box)
	• Duplicate records:
	  • Multiple records with the same HIN, procedure date and type of procedure were assumed to be a single record
	
	Data Sources:
	• CHDB – FOBT, colonoscopy, flexible sigmoidoscopy, and total colectomy claims
	• OCR – Malignant cancer cases
	• RPDB – Demographics and population count

Data availability & limitations	• Small proportion of FOBTs performed as diagnostic tests could not be excluded from these analyses • FOBTs analyzed in hospital laboratories could not be captured • CHDB data may have included (CCC program) rejected kits • Only FOBTs as primary screening tests were assessed; FOBT is recommended for individuals at average risk of colorectal cancer. Those at increased risk (first-degree relative with colorectal cancer) were not assessed as they could not be accurately identified • CIRT and LRT data were not used, thus a small number of FOBTs and colonoscopies may not be captured
Similar indicator in other jurisdictions	• CPAC: Utilization = Percentage of target population considered up-to-date for CRC screening, including those who do not participate in an organized program and who have been screened using other acceptable screening modalities (Quality Determinants for Colorectal Cancer Screening in Canada, September 30, 2009) • EU: Coverage by examination = Number screened/tested during the time frame / Number of eligible people in the target population during the time frame (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010)
Analysis	• For calendar years 2006–2010, by year • Crude rate, overall; by five-year age groups; by SES (income quintile) • Age-standardized rate, overall; by LHIN • SES information was based on income quintiles developed by Statistics Canada based on 2006 Census summary; it was obtained through the PCCF+, version 5h. Income quintiles ranged from 1–5 (lowest to highest) • LHIN assignment was based on PCCF+, version 5h **Data Sources:** • 1991 Canadian population as the standard population for calculating age-standardized rates • CHDB – FOBT, colonoscopy, flexible sigmoidoscopy, and total colectomy claims (January 1992 – December 2010) • OCR – Malignant cancer cases (1964 – December 2010) • RPDB – Demographics and population count (January 2006 – December 2010)

TABLE 5 Screening: Abnormal FOBT result methodology

INDICATOR	SCREENING: ABNORMAL FOBT RESULT
Definition	The percentage of Ontario residents, aged 50–74, who had an abnormal FOBT result during each time period
Calculation	$\frac{\text{The number of individuals who had an abnormal FOBT result}}{\text{The number of individuals who had an FOBT}} \times 100 = \text{Abnormal FOBT result rate (\%)}$

Numerator	**Definition:**
	• Total number of eligible individuals, aged 50–74, who had an abnormal FOBT result in each time period
	
	Inclusions:
	• Individuals, aged 50–74, who had an abnormal FOBT result in LRT
	• Each individual was counted once regardless of the number of tests performed
	• Abnormal FOBT results were defined as at least one abnormal flap out of three flaps
	• Index date was defined as:
	  • Kit receipt date of abnormal FOBT result in LRT
	  • If a person had multiple tests in a given time period, the kit receipt date of the first test was selected as index date
	• Index date was used to determine age and time period
	
	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Individuals with a diagnosis of colorectal cancer in OCR prior to the index date defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0
	
	Data Sources:
	• LRT – CCC program FOBT records
	• OCR – Malignant cancer cases
	• RPDB - Demographics

Denominator	**Definition:**
	• Total number of eligible individuals, aged 50–74, who completed and returned a CCC program kit in each time period
	
	Inclusions:
	• Individuals aged 50–74
	• Each individual was counted once regardless of the number of tests performed
	• Index date was defined as:
	  • FOBT date in LRT
	  • If a person had multiple tests in a given period, the index date was selected according to the following hierarchy:
	  1 kit receipt date of the first abnormal FOBT result
	  2 kit receipt date of the first FOBT
	• Index date was used to determine age and time period
	
	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Individuals who returned kits that were rejected
	• Individuals with a diagnosis of colorectal cancer in OCR prior to the index date defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0
	
	Data Sources:
	• LRT – CCC program FOBT records
	• OCR – Malignant cancer cases
	• RPDB – Demographics

Data availability & limitations	• Number of persons who had completed a CCC program FOBT kit is available through LRT as of April 1, 2008 • This indicator does not include Ontario residents who were screened outside of the CCC organized program
Similar indicator in other jurisdictions	• CPAC: Positivity rate = (Number with abnormal FOBT/Number with an adequate test returned and processed) (Quality Determinants for Colorectal Cancer Screening in Canada, September 30, 2009) • EU: Positivity rate = (Number with abnormal FOBT/Number with an adequate test) (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010) • Definition of an abnormal FOBT result for an FOBT kit varies across jurisdictions and will vary by type of FOBT used [guaiac FOBT (gFOBT) vs. fecal immunologic test]: Ontario defines abnormality as one or more abnormal f aps on gFOBT, regardless of the number of f aps containing a stool sample
Analysis	• For calendar years 2008–2010, by year (year 2008 includes April – December only) • Crude rate, overall; by sex, five-year age groups; by LHIN; by SES (income quintile) • SES information was based on income quintiles developed by Statistics Canada based on 2006 Census summary; it was obtained through the PCCF+, version 5h. Income quintiles ranged from 1–5 (lowest to highest) • LHIN assignment was based on PCCF+, version 5h. The provider's postal code was used to identify the participant's LHIN, if the participant's postal code was missing **Data Sources:** • LRT – CCC program FOBT records (April 2008 – December 2010) • OCR – Malignant cancer cases (1964 – December 2010) • RPDB – Demographics (April 2008 – December 2010)

TABLE 6 Screening: Positive predictive value methodology

INDICATOR	SCREENING: POSITIVE PREDICTIVE VALUE
Definition	The percentage of Ontario residents, aged 50–74, with a detected colorectal cancer among those who had an abnormal FOBT result followed by large bowel endoscopy or surgical resection in each time period
Calculation	$\frac{\text{Number of individuals with a detected colorectal cancer}}{\text{Number of individuals who had an abnormal FOBT result followed by bowel endoscopy or surgical resection}} \times 100 = \text{Positive predictive value (\%)}$

Numerator	**Definition:**
	• Total number of eligible individuals, aged 50–74, with a detected colorectal cancer among those with an abnormal FOBT result followed by large bowel endoscopy or surgical resection in each time period
	
	Inclusions:
	• Individuals, aged 50–74, who had an abnormal FOBT result in each time period
	  • If an individual had multiple abnormal FOBT results in a given period, the date of the first abnormal result was selected
	• Only colorectal cancers detected as a result of an abnormal FOBT results were counted:
	  • Abnormal FOBT result was followed by large bowel endoscopy or colonic surgical resection within 183 days, and
	  • Date of colorectal cancer in OCR occurred between seven days before and up to 91 days after large bowel endoscopy or within ± seven days of surgery, and
	  • Date of colorectal cancer in OCR occurred up to 190 days after the abnormal FOBT result, and
	  • Colorectal cancer was identified in OCR as ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0, excluding histologic codes 9590–9989 (lymphomas)
	• Large bowel endoscopy was defined as a record in CIRT or in CHDB by OHIP fee codes Z555 ± other related codes, or Z580
	• Colonic surgical resections were defined as resection with or without stoma, bypass or local excisions of colon and rectum, using the relevant Canadian Classification of Health Interventions (CCI) codes developed by the Canadian Institute for Health Information (CIHI). The codes used are listed in the *Technical Appendix* to Urbach DR, Simunovic M, Schultz SE, editors. *Cancer Surgery in Ontario: ICES Atlas*. Toronto: Institute for Clinical Evaluative Sciences, 2008. The Technical Appendix is located at http://www.ices.on.ca/file/Technical%20appendix%20full%20FINAL.pdf
	• Admission date was used as proxy of surgical date if surgical date was missing in CIHI database
	• FOBT date was used to determine age and time period
	
	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Individuals with a diagnosis of colorectal cancer in OCR prior to the FOBT date defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0
	
	Data Sources:
	• CHDB – Large bowel endoscopy claims
	• CIHI DAD and NACRS – Colorectal related surgery records
	• CIRT – CCC program colonoscopy records
	• LRT – CCC program FOBT records
	• OCR – Malignant cancer cases
	• RPDB – Demographics

Denominator	**Definition:** • Total number of eligible individuals, aged 50–74, who had an abnormal FOBT result followed by large bowel endoscopy or colonic surgical resection within 183 days of the FOBT date in each time period

	Inclusions:
	• Individuals, aged 50–74, who had an abnormal FOBT result in LRT in each time period:
	  • If an individual had multiple abnormal FOBT results in a given period, the date of the first abnormal result was selected
	• Abnormal FOBT result was followed by large bowel endoscopy or colonic surgical resection within 183 days
	• Large bowel endoscopy was defined as a record in CIRT or in CHDB by OHIP fee codes Z555 ± other related codes, or Z580
	• Colonic surgical resections were defined as resection with or without stoma, bypass or local excisions of colon and rectum, using the relevant Canadian Classification of Health Interventions (CCI) codes developed by the Canadian Institute for Health Information (CIHI). The codes used are listed in the *Technical Appendix* to Urbach DR, Simunovic M, Schultz SE, editors. *Cancer Surgery in Ontario: ICES Atlas*. Toronto: Institute for Clinical Evaluative Sciences, 2008. The Technical Appendix is located at http://www.ices.on.ca/file/Technical%20appendix%20full%20FINAL.pdf
	• Admission date was used as proxy of surgical date if surgical date was missing in CIHI database
	• FOBT date was used to determine age and time period
	
	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Individuals with a diagnosis of colorectal cancer in OCR prior to the FOBT date defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0
	• Individuals who had a total colectomy (in CHDB with OHIP fee codes S169, S170, S172) prior to the FOBT date
	
	Data Sources:
	• CHDB – Large bowel endoscopy and total colectomy claims
	• CIHI DAD and NACRS – Colorectal related surgery records
	• CIRT – CCC program colonoscopy records
	• LRT – CCC program FOBT records
	• OCR – Malignant cancer cases
	• RPDB – Demographics

Data availability & limitations	• Number of persons who had completed a CCC program FOBT kit is available through LRT as of April 1, 2008 • A small number of additional cancers might have been missed as not all individuals were followed for the same amount of time after the date of large bowel endoscopy to the cancer diagnosis
Similar indicator in other jurisdictions	• CPAC: Number of individuals with abnormal fecal test results who are subsequently confirmed cancer cases at diagnostic follow-up, divided by total number of individuals with abnormal fecal tests who undergo diagnostic follow-up (%) (Quality Determinants for Colorectal Cancer Screening in Canada, September 30, 2009) • EU: Number of people with a cancer detected during the time frame/number of people positive to FOBT having attended a colonoscopy in the time frame (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010) • Definition of an abnormal FOBT result for an FOBT kit varies across jurisdictions and will vary by type of FOBT used [guaiac FOBT (gFOBT) vs. fecal immunologic test]: Ontario defines abnormality as one or more abnormal f aps on gFOBT, regardless of the number of f aps containing a stool sample
Analysis	• For calendar years 2008–2010, by year (year 2008 includes April - December only); observation window for diagnosis of colorectal cancer was up to June 2011 • Crude rate, overall; by five-year age groups; by LHIN; by SES (income quintile) • SES information was based on income quintiles developed by Statistics Canada based on 2006 Census summary; it was obtained through PCCF+, version 5h. Income quintiles ranged from 1–5 (lowest to highest) • LHIN assignment was based on PCCF+, version 5h. The provider's postal code was used to identify the participant's LHIN, if the participant's postal code was missing **Data Sources:** • CHDB – Large bowel endoscopy (April 2008 – June 2011) and total colectomy claims (April 2004 – December 2010) • CIHI DAD and NACRS – Colorectal related surgery records (April 2008 – June 2011) • CIRT – CCC program colonoscopy records (April 2008 – June 2011) • LRT – CCC program FOBT records (April 2008 – December 2010) • OCR – Malignant cancer cases (1964 – June 2011) • RPDB – Demographics (April 2008 – December 2010)

TABLE 7 Diagnostic follow-up: Follow-up colonoscopy rate methodology

INDICATOR	DIAGNOSTIC FOLLOW-UP: FOLLOW-UP COLONOSCOPY RATE
Definition	The percentage of Ontario residents, aged 50–74, with an abnormal FOBT result who underwent colonoscopy within six months in each time period
Calculation	$\frac{\text{Number of individuals with an abnormal FOBT result who underwent colonoscopy within six months}}{\text{Number of individuals with an abnormal FOBT result}} \times 100 = \text{Follow-up colonoscopy rate (\%)}$

Numerator	**Definition:**
	• Total number of eligible individuals, aged 50–74, with an abnormal FOBT result in each time period who underwent colonoscopy within six months
	
	Inclusions:
	• Individuals, aged 50–74, with an abnormal FOBT result in each time period who underwent colonoscopy within six months
	  • If an individual had multiple abnormal FOBT results in a given period, the date of the first abnormal result was selected
	• Colonoscopy was defined as a record in CIRT or in CHDB by the OHIP fee codes Z555 ± other related codes
	• Time to colonoscopy was calculated from the date of the first abnormal FOBT result to the date of the first colonoscopy
	
	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Individuals with a diagnosis of colorectal cancer in OCR prior to the FOBT date defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0
	• Duplicate records:
	  • Multiple records with the same HIN, procedure date and type of procedure were assumed to be a single record
	
	Data Sources:
	• CHDB – Colonoscopy claims
	• CIRT – CCC program colonoscopy records
	• LRT – CCC program FOBT records
	• OCR – Malignant cancer cases
	• RPDB – Demographics

Denominator	**Definition:**
	• Total number of eligible individuals, aged 50–74, with an abnormal FOBT result in each time period
	
	Inclusions:
	• Individuals, aged 50–74, with an abnormal FOBT result in each time period
	• Each individual was counted once regardless of the number of FOBTs performed in a given time period
	• Index date was used to determine age and time period. Index date was defined as:
	  • FOBT date in LRT
	  • If an individual had multiple abnormal FOBT result in a given period, the date of first abnormal FOBT result was selected
	
	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Individuals with a diagnosis of colorectal cancer in OCR prior to the FOBT date defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0

	Data Sources: • CHDB – Large bowel endoscopy claims • CIRT – CCC program colonoscopy records • LRT – CCC program FOBT records • OCR – Malignant cancer cases • RPDB – Demographics
Data availability & limitations	• Number of persons who completed a CCC program FOBT kit is available in LRT as of April 1, 2008
Similar indicator in other jurisdictions	• CPAC: Follow-up completion = Percentage of participants with abnormal screen test result undergoing recommended diagnostic follow-up within program-defined interval (Quality Determinants for Colorectal Cancer Screening in Canada, September 30, 2009) • EU: Follow-up colonoscopy compliance rate = Number of individuals having attended a colonoscopy examination during a time frame/Number of individuals with an abnormal screening test and referred during the same time frame (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010)
Analysis	• For calendar years 2008–2010, by year (year 2008 includes April - December only); observation window for follow-up colonoscopy was up to June 2011 • Crude rate, overall; by five-year age groups; by LHIN • LHIN assignment was based on PCCF+, version 5h. The provider's postal code was used to identify the participant's LHIN, if the participant's postal code was missing **Data Sources:** • CHDB – Large bowel endoscopy claims (April 2008 – June 2011) • CIRT – CCC program colonoscopy records (April 2008 – June 2011) • LRT – CCC program FOBT records (April 2008 – December 2010) • OCR – Malignant cancer cases (1964 – December 2010) • RPDB – Demographics (April 2008 – December 2010)

TABLE 8 Diagnostic follow-up: Endoscopists above the target for colonoscopies methodology

INDICATOR	DIAGNOSTIC FOLLOW-UP: ENDOSCOPISTS ABOVE THE TARGET FOR COLONOSCOPIES
Definition	The percentage of endoscopists who were above the target for colonoscopies in each time period
Calculation	$\frac{\text{Number of endoscopists above the target in each time period}}{\text{Total number of endoscopists in Ontario in each time period}} \times 100 = \text{Endoscopists above the target rate (\%)}$

Numerator	**Definition:**
	• Total number of endoscopists who were above the target for colonoscopies in each time period
	
	Inclusions:
	• Endoscopists with a valid CPSO number in either CIRT or OHIP:
	  • Missing CPSO numbers in CIRT were replaced with OHIP information
	  • If CPSO numbers were different in CIRT and OHIP, CIRT information was used
	• For each endoscopist, the total number of colonoscopies included both CCC program and non-program procedures, defined as:
	  • Record in CIRT
	  • OHIP fee code Z555 ± other related codes in CHDB
	  • CIRT and CHDB colonoscopy records that occurred within ± two days were considered to be the same procedure and CIRT information was kept
	  • Both inpatient and outpatient colonoscopies were counted
	• Only endoscopists who were above the target for colonoscopies in each time period were counted in the numerator; for the definition of the target, see Analysis section
	
	Exclusions:
	• Endoscopists with missing or invalid CPSO number in CIRT and CHDB
	• Colonoscopies for individuals with missing or invalid HIN
	
	Data sources:
	• CHDB – Colonoscopy volumes
	• CIRT – CCC program colonoscopy volumes

Denominator	**Definition:**
	• Total number of endoscopists who performed five or more colonoscopies in each time period
	
	Inclusions:
	• Endoscopists with a valid CPSO number in either CIRT or OHIP:
	  • Missing CPSO numbers in CIRT were replaced with OHIP information
	  • If CPSO numbers were different in CIRT and OHIP, CIRT information was used
	• For each endoscopist, the total number of colonoscopies included both CCC program and non-program procedures, defined as:
	  • Record in CIRT
	  • OHIP fee code Z555 ± other related codes in CHDB
	  • CIRT and CHDB colonoscopy records that occurred within ± two days were considered to be the same procedure and CIRT information was kept
	  • Both inpatient and outpatient colonoscopies were counted
	• Endoscopists who performed five or more colonoscopies in each time period
	
	Exclusions:
	• Endoscopists with missing or invalid CPSO number in CIRT and CHDB
	• Colonoscopies for individuals with missing or invalid HIN
	
	Data sources:
	• CHDB – Colonoscopy volumes
	• CIRT – CCC program colonoscopy volumes

Data availability & limitations	• As the CCC program began in April 2008, data is reported by fiscal year rather than calendar year
Similar indicator in other jurisdictions	• CCO Colonoscopy Standards: 200 colonoscopies or more per year (CCO Colonoscopy Standards: Standards and Evidentiary Base, 2007) • EU: The annual number of procedures performed by each endoscopist should be recorded to ensure that the sample size for other performance indicators is sufficient: at least 300 procedures per year (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010) • UK Bowel Cancer Screening Programme: Minimum number of screening colonoscopies undertaken annually by each endoscopist: greater than 150 BCSP colonoscopies per annum (Quality Assurance Guideline for Colonoscopy, NHS BCSP Publication No. 6, March 2010)
Analysis	• For fiscal years 2008–2010, by year; by endoscopist CCC program status • Target described in numerator was defined as 200 or more colonoscopies per year • Endoscopist CCC program status: Endoscopists were classified as "in CCC program" (defined as those who performed five or more CCC program colonoscopies among inpatient or outpatient of all ages in each time period) or "outside of CCC program" (defined as those who did perform five or more colonoscopies among inpatients or outpatients of all ages in each time period BUT did not meet criteria for "in CCC program") **Data Sources:** • CHDB – Colonoscopy volumes (April 2008 – March 2011) • CIRT – CCC program colonoscopy volumes (April 2008 – March 2011)

TABLE 9 Outcomes: Colorectal cancer detection rate methodology

INDICATOR	OUTCOMES: COLORECTAL CANCER DETECTION RATE
Definition	The proportion of Ontario residents with a detected colorectal cancer per 1,000 screened using a CCC program FOBT or using colonoscopy for family history (FH) indication in each time period
Calculation	$\frac{\text{Number of individuals with a detected colorectal cancer}}{\text{Number of Ontario residents with a completed CCC program FOBT kit or FH colonoscopy}} \times 1{,}000 = \text{Colorectal cancer detection rate (per 1,000)}$

Numerator	**Definition:**
	• Total number of eligible individuals with a detected colorectal cancer among those screened for CCC program indications (aged 50–74 for FOBT and aged 20–74 for FH colonoscopy) in each time period
	
	Inclusions:
	• Individuals who were screened for program indications (aged 50–74 for FOBT and aged 20–74 for FH colonoscopy) in each time period:
	  • Individual who completed both an FOBT and a FH colonoscopy were counted in the FH colonoscopy group
	• Only colorectal cancers detected as a result of screening for a CCC program indication (abnormal FOBT or FH colonoscopy) were counted:
	  • Abnormal FOBT result was followed by large bowel endoscopy or colonic surgical resection within 183 days, and
	  • Date of colorectal cancer in OCR occurred between seven days before and up to 91 days after large bowel endoscopy or within ± seven days of surgery, and
	  • Date of colorectal cancer in OCR occurred up to 190 days after the abnormal FOBT result, and
	  • Colorectal cancer was identified in OCR as ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0, excluding histologic codes 9590–9989 (lymphomas)
	OR
	  • Date of colorectal cancer in OCR occurred between seven days before and up to 91 days after FH colonoscopy, and
	  • Colorectal cancer was identified in OCR as ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0, excluding histologic codes 9590–9989 (lymphomas)
	• Large bowel endoscopy was defined as a record in CIRT or in CHDB by OHIP fee codes Z555 ± other related codes, or Z580
	• Colonic surgical resections were defined in CIHI as resection with or without stoma, bypass or local excisions of colon and rectum, using the relevant Canadian Classification of Health Interventions (CCI) codes developed by the Canadian Institute for Health Information (CIHI). The codes used are listed in the *Technical Appendix* to Urbach DR, Simunovic M, Schultz SE, editors. *Cancer Surgery in Ontario: ICES Atlas*. Toronto: Institute for Clinical Evaluative Sciences, 2008. The Technical Appendix is located at http://www.ices.on.ca/file/Technical%20appendix%20full%20FINAL.pdf
	• Admission date was used as proxy of surgical date if surgical date was missing in CIHI database
	
	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Individuals with a diagnosis of colorectal cancer prior to the index date with the exception of those diagnosed with colorectal cancer seven days before FH colonoscopy defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0
	• Individuals who had a total colectomy prior to the index date identified in CHDB by OHIP fee codes S169, S170, S172
	
	Data sources:
	• CHDB – Large bowel endoscopy claims
	• CIHI DAD and NACRS – Colorectal related surgery records
	• CIRT – FH colonoscopy date and indication
	• LRT – CCC program FOBT records
	• OCR – Malignant cancer cases
	• RPDB – Demographics

Denominator	**Definition:**
	• Total number of eligible individuals screened for CCC program indications (aged 50–74 for program FOBT tests, aged 20–74 for FH colonoscopy) in each time period
	
	Inclusions:
	• Individuals who were screened for program indications (aged 50–74 for FOBT and aged 20–74 for FH colonoscopy) in each time period
	  • Individuals who had completed both an FOBT and a FH colonoscopy were counted in the FH colonoscopy group
	• FOBT or FH colonoscopy date was used to determine age and time period
	
	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Individuals with a diagnosis of colorectal cancer prior to the index date with the exception of those diagnosed with colorectal cancer seven days before FH colonoscopy defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0
	• Individuals who had a total colectomy prior to the index date identified in CHDB by OHIP fee codes S169, S170, S172
	
	Data sources:
	• CHDB – Total colectomy claims
	• CIRT – FH colonoscopy date and indication
	• LRT – CCC program FOBT records
	• OCR – Malignant cancer cases
	• RPDB – Demographics

Data availability & limitations	• Number of persons who completed a CCC program FOBT kit is available in LRT as of April 1, 2008 • This indicator was limited to CCC Program FOBT kits captured in LRT and FH colonoscopies in CIRT • A small number of additional cancers might have been missed as not all individuals were followed for the same amount of time after the date of large bowel endoscopy to the cancer diagnosis
Similar indicator in other jurisdictions	• CPAC: Program CRC detection rate = Proportion of participants diagnosed with cancer by screening process (Quality Determinants for Colorectal Cancer Screening in Canada, September 30, 2009) • EU: Cancer detection rate = Number with at least one detected cancer during time frame/ Number adequately tested during time frame (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010)
Analysis	• For calendar years 2008–2010, by year (year 2008 includes April – December only); observation window for diagnosis of colorectal cancer was up to June 2011 • Stratified into two indicators: (1) CCC program FOBT as the primary screen, (2) FH colonoscopy as the primary screen; • Crude rate, overall; by five-year age groups; by LHIN; by SES (income quintile) • SES information was based on income quintiles developed by Statistics Canada based on 2006 Census summary; it was obtained through PCCF+, version 5h. Income quintiles ranged from 1–5 (lowest to highest) • LHIN assignment was based on PCCF+, version 5h. The provider's postal code was used to identify the participant's LHIN, if the participant's postal code was missing **Data Sources:** • CHDB – Large bowel endoscopy (April 2008 – June 2011) and total colectomy claims (April 2004 – December 2010) • CIHI DAD and NACRS – Colorectal related surgery records (April 2008 – June 2011) • CIRT – CCC program colonoscopy records (April 2008 – June 2011) • LRT – CCC program FOBT records (April 2008 – December 2010) • OCR – Malignant cancer cases (1964 – June 2011) • RPDB – Demographics (April 2008 – December 2010)

TABLE 10 Outcomes: Interval colorectal cancer incidence methodology

INDICATOR	OUTCOMES: INTERVAL COLORECTAL CANCER INCIDENCE
Definition	The percentage of Ontario residents, aged 50–74, who developed colorectal cancer in the two years following a normal FOBT result in each time period
Calculation	$\frac{\text{Number of individuals who developed colorectal cancer in the two years following a normal FOBT result}}{\text{Number of eligible Ontario residents who had a normal FOBT result}} \times 100 = \text{Interval colorectal cancer rate (\%)}$

Numerator	**Definition:**
	• Total number of eligible individuals, aged 50–74, who developed colorectal cancer in the two years following a normal FOBT result
	
	Inclusions:
	• Individuals, aged 50–74, who completed a CCC program branded kit with a normal FOBT result in each time period
	  • If there was more than one FOBT in a given period, the date of first normal result was selected
	• Individuals with a diagnosis of colorectal cancer in OCR in the two-year period following the date of the normal FOBT result defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0, excluding histologic codes 9590–9989 (lymphomas)
	
	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Individuals with a diagnosis of colorectal cancer in OCR prior to the FOBT date defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0
	• Individuals who had an abnormal FOBT result in the two years prior to the FOBT date
	• Individuals who had a large bowel endoscopy in the seven years prior to the FOBT date
	  • Large bowel endoscopy was defined as a record in CIRT or in CHDB by the codes Z555 ± other related codes, or Z580
	• Individuals who had a total colectomy prior to the index date identified in CHDB by OHIP fee codes S169, S170, S172
	
	Data sources:
	• CHDB – Large bowel endoscopy claims
	• CIRT – CCC program colonoscopy records
	• LRT – CCC program FOBT records
	• OCR – Malignant cancer cases
	• RPDB - Demographics

Denominator	**Definition:** • Total number of eligible individuals, aged 50–74, who had a normal FOBT result in each time period **Inclusions:** • Individuals, aged 50–74, who had completed a program branded kit with a normal FOBT result in each time period • If there was more than one FOBT in a given period, the date of first normal result was selected

	Exclusions:
	• Individuals with missing or invalid HIN, date of birth, sex or postal code
	• Individuals with a diagnosis of colorectal cancer in OCR prior to the FOBT date defined as:
	  • ICD-O-3 codes C18 (excluding C18.1), C19, C20 and C26.0
	• Individuals who had an abnormal FOBT result in the two years prior to the FOBT date
	• Individuals who had a large bowel endoscopy in the seven years prior to the FOBT date
	  • Large bowel endoscopy was defined as a record in CIRT or in CHDB by the code Z555 ± other related codes, or Z580
	• Individuals who had a total colectomy prior to the index date identified in CHDB by OHIP fee codes S169, S170, S172
	
	Data Sources:
	• CHDB – Large bowel endoscopy and total colectomy claims
	• CIRT – CCC program colonoscopy records
	• LRT – CCC program FOBT records
	• OCR – Malignant cancer cases
	• RPDB - Demographics

Data availability & limitations	• Number of persons who completed a CCC program FOBT kit is available in LRT as of April 1, 2008 • Data limitations only allow a seven-year look back window for large bowel endoscopy currently, when the full CHDB data are available, the look back window will be changed to 10 years
Similar indicator in other jurisdictions	• CPAC: Percentage of participants with normal screening results (i.e., normal fecal test, or abnormal fecal test followed by normal colonoscopy) subsequently diagnosed with colorectal cancer before next scheduled screening test (Quality Determinants for Colorectal Cancer Screening in Canada, September 30, 2009) • EU: Number of colorectal cancers occurring following a negative screening episode before next invitation is due, adjusted for background incidence rates by age/sex group (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010) • UK Bowel Cancer Screening Programme: *FOBT interval cancer* – a cancer diagnosed in the two year interval between a negative FOBT result and the next proposed FOBT. If the individual is 70 (later to be 75 or over) an interval cancer will be defined as a cancer diagnosed within two years of their last screening episode (Quality Assurance Guideline for Colonoscopy, NHS BCSP Publication No. 6, March 2010)
Analysis	• For calendar year 2008 only (April 2008 – December 2008); observation window of two years up to December 2010 for development of interval cancer • Crude rate, overall; by five-year age groups **Data Sources:** • CHDB – Large bowel endoscopy (April 2001 – December 2008) and total colectomy claims (April 2004 – December 2008) • CIRT – CCC program colonoscopy records (April 2008 – December 2008) • LRT – CCC program FOBT records (April 2008 – December 2008) • OCR – Malignant cancer cases (April 2008 – December 2010) • RPDB – Demographics (April 2008 – December 2008)

Appendix C: List of Abbreviations

CCC	ColonCancerCheck
CCI	Canadian Classification of Health Interventions
CCO	Cancer Care Ontario
CHDB	Claims History Database
CIHI	Canadian Institute for Health Information
CIRT	Colonoscopy interim reporting tool
CPAC	Canadian Partnership Against Cancer
CPSO	College of Physicians and Surgeons of Ontario
CRC	Colorectal cancer
DAD	Discharge Abstract Database
EU	European Guidelines for Quality Assurance in Colorectal Screening
FH	Family history
FIT	Fecal immunochemical test
FOBT	Fecal occult blood test
gFOBT	Guaiac fecal occult blood test
HIN	Health insurance number
ICD	International Classification of Diseases
ICD-O	International Classification of Diseases for Oncology
ICES	Institute for Clinical Evaluative Sciences
LHIN	Local Health Integration Network
LRT	Laboratory Reporting Tool
NACRS	National Ambulatory Care Reporting System
NHS	National Health Service (United Kingdom)
OCR	Ontario Cancer Registry
OHIP	Ontario Health Insurance Plan
PCCF	Postal Code Conversion File
RPDB	Registered Persons Database
SES	Socioeconomic status
UK	United Kingdom

Appendix D: List of Figures

Appendix E: List of Tables

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For More Information

Supplemental materials are available at www.cancercare.on.ca/coloscreening and include the numbers on which the information in this report is based.

Cancer screening resources are available at www.cancercare.on.ca/screenforlife, including program reports from the Ontario Breast Screening Program (OBSP) and the Ontario Cervical Screening Program (OCSP).

The **Cancer System Quality Index** is a web-based tool that reports on a variety of evidence-based indicators covering every aspect of cancer control, from cancer prevention to end-of-life care, and tracking progress against six dimensions of quality. Please see www.csqi.on.ca.

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