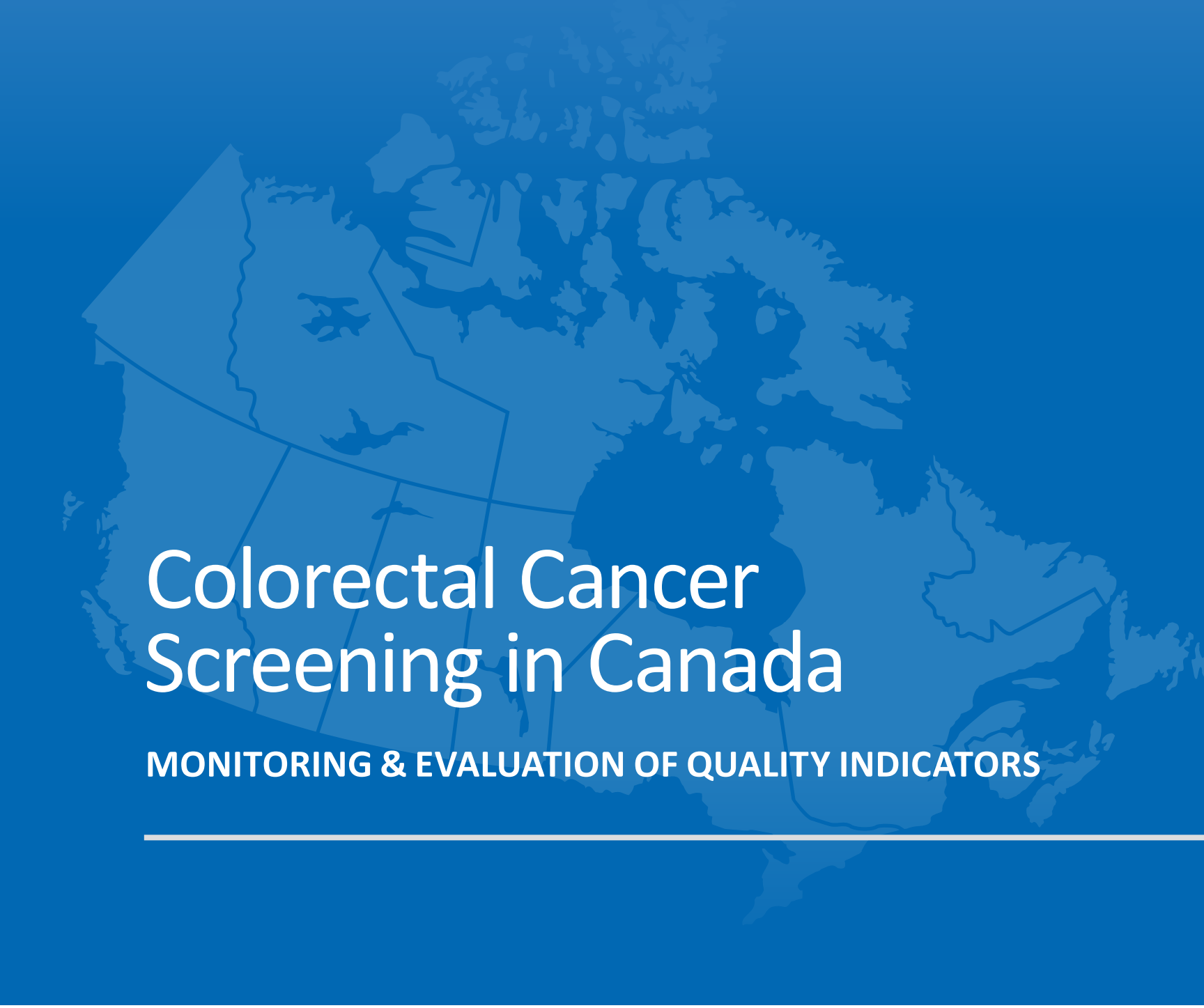

Colorectal Cancer Screening in Canada

MONITORING & EVALUATION OF QUALITY INDICATORS

RESULTS REPORT
JANUARY 2013 – DECEMBER 2014

CANADIAN PARTNERSHIP AGAINST CANCER
PARTENARIAT CANADIEN CONTRE LE CANCER

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Table of Contents

List of Figures and Tables

LIST OF FIGURES

LIST OF TABLES

Executive Summary

This report presents the results for national monitoring of colorectal cancer screening programs by the National Colorectal Cancer Screening Network (NCCSN) from January 1, 2013, to December 31, 2014. The NCCSN developed a set of quality indicators for colorectal cancer screening for reporting at the national level in Canada in 2009, including quality indicators within five domains: coverage, follow-up, quality of screening, detection and disease extent at diagnosis.

Results are intended to facilitate improvements in colorectal cancer screening delivery. For the first time, the report provides a breakdown of indicator data by first and subsequent screens because the characteristics of individuals screened for the first time differ from those of individuals returning for subsequent screens.

Colorectal cancer is the second most commonly diagnosed cancer (excluding non-melanoma skin cancers) and the second leading cause of death from cancer in Canada.[1] Colorectal cancer burden is projected to increase from 25,100 cases in 2015 to 35,075 cases by 2028–32, a relative increase of 40%.[1] Strong evidence demonstrates that regular colorectal cancer screening with a fecal test enables early detection of colorectal cancer and allows for more successful treatment, leading to a reduction in colorectal cancer mortality.[2–6] For the period covered by this report, the Canadian Task Force on Preventive Health Care's 2001 guidelines on colorectal cancer screening recommended colorectal cancer screening with a fecal test every one to two years or with flexible sigmoidoscopy every five years starting at age 50 for people at average risk for colorectal cancer.[7]

Organized colorectal cancer screening programs were first announced in 2007 (in Alberta, Manitoba and Ontario). By the end of 2014, programmatic colorectal screening had been implemented in five additional provinces (British Columbia, Saskatchewan, Nova Scotia, Prince Edward Island and Newfoundland and Labrador).[8] Organized population-based screening programs provide an administrative structure responsible for service delivery, follow-up of abnormal results, quality assurance and ongoing evaluation.[9] Organized colorectal cancer screening may therefore offer more potential to reduce mortality, minimize harms and reduce costs than opportunistic colorectal cancer screening.[10]

Participation rates should not be used to evaluate the programs' effectiveness during this time period as provinces were in different stages of implementation of colorectal cancer screening programs. In addition, the participation figures are defined differently in different provinces (see the 'Data Considerations' section for additional information). With these limitations in mind, the following comments are made.

Highlights of the results

- While program participation rates for 2013–14 fell short of the national target of 60%, the range from 8.6% to 53.0% represents an increase over program participation rates for 2011–12. However, program participation represents only one component of the percentage of the population that is up to date for colorectal cancer screening. Looking at the percentage of the population that reported having had a colorectal cancer screening test for screening or for any other reason, the range was 44% to 70% in 2013 and 48% to 68% in 2014.
- Retention rates ranged from 38.9% to 77.4% and were higher with age and for participants undergoing subsequent screens compared to first screens.
- While the fecal test inadequacy rates varied by province, all met the target of 5% or less.
- As expected, positivity rates varied as a result of the type of fecal test used, the brand and the cut-off point selected. Positivity rates ranged from 3.4% to 4.0% for provinces using guaiac fecal tests (FTg) and from 8.3% to 16.1% for provinces using immunochemical fecal tests (FTi). No province met the target of 85% for follow-up colonoscopy uptake, though Manitoba was close (82.8%) and uptake was higher among those completing a subsequent screen.
- For wait times for follow-up colonoscopy after an abnormal fecal test, while the target of 60 days was met for half of the population in four provinces, 90th percentile wait times in seven provinces indicated that many still wait twice the recommended number of days (ranging from 104 to 151 days).
- The median wait time from follow-up colonoscopy to definitive pathological diagnosis varied from three days to 12 days. Ninetieth percentile wait times in two provinces met the European target of 15 days.
- The positive predictive value of a fecal test for the detection of adenomas ranged from 28.9% to 49.7% among those with an abnormal fecal test and from 34.9% to 67.5% among those with an abnormal fecal test who also completed a follow-up colonoscopy within 180 days.
- The program adenoma detection rate and program invasive colorectal cancer detection rate varied substantially across provinces from 9.8 to 80.0 per 1,000 individuals screened and from 1.0 to 7.7 per 1,000 individuals screened, respectively. As expected, a smaller proportion of invasive cancers detected in subsequent screens were at Stage III or IV compared with first screens.
- Finally, interval cancer rates ranged from 0.3 to 1.9 per 1,000 people screened.

While more provinces were able to provide monitoring and evaluation data for this report than for previous reports, significant variation in available information remains, in terms of both the stage of program implementation and data available across the country. In this report, data were collected for first-time screening participants and for individuals undergoing a subsequent screen. While the difference in quality indicator results for the two groups is small, in future the effect of additional rounds of screening is expected to result in lower cancer and adenoma detection rates in individuals undergoing a subsequent screen. As programs mature, increased standardization of data definitions, collection and submission will improve the ability to evaluate the impact of organized colorectal cancer screening programs on colorectal cancer mortality, screening-related harms and cost-effectiveness, as well as identify best practices.

Introduction

Purpose of the report

This report presents the results for national monitoring of colorectal cancer screening activities from January 1, 2013, to December 31, 2014. The findings presented in this report aim to inform organized colorectal cancer screening delivery in order to reduce colorectal cancer morbidity and mortality in Canada.

Compared with the previous national colorectal cancer screening monitoring and evaluation report for 2011–12, more provinces were able to provide data and those data covered a greater proportion of the Canadian population. Of the 13 provinces and territories, the following provided at least some data for this report: Alberta, Saskatchewan, Manitoba, Ontario, Nova Scotia, Prince Edward Island and Newfoundland and Labrador. The increased data available for analysis for this report allows for a more in-depth assessment of the status and impact of colorectal cancer screening across the country.

The 2013–14 Colorectal Cancer Screening Monitoring and Evaluation of Quality Indicators – Results Report

- provides an overview of key indicators and progress toward targets in colorectal cancer screening programs in Canada for 2013–14;
- presents a breakdown of data by screening round (first or subsequent screen) for each indicator, where available; and
- contextualizes the data by highlighting the interrelationship between indicators such as positivity rate, positive predictive value (PPV) for adenoma and cancer detection rate.

Burden of disease

Colorectal cancer is a significant health problem in Canada, where it is the second most commonly diagnosed cancer (excluding non-melanoma skin cancers). It is also the second leading cause of death from cancer in Canada.[1]

The lifetime probability of dying from colorectal cancer is 3.5% for men and 3.1% for women.[11] Figures 1 and 2 provide the colorectal cancer incidence and mortality rates across Canada.

It is estimated that in 2015,

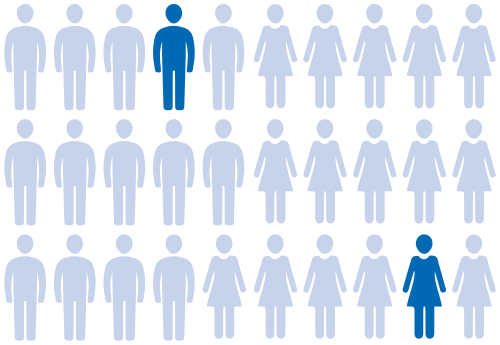
25,100

Canadians will be diagnosed with colorectal cancer, with an average of **69** Canadians diagnosed every day.

9,300

Canadians will die from colorectal cancer, with an average of **25** Canadians dying every day.

1/14
males



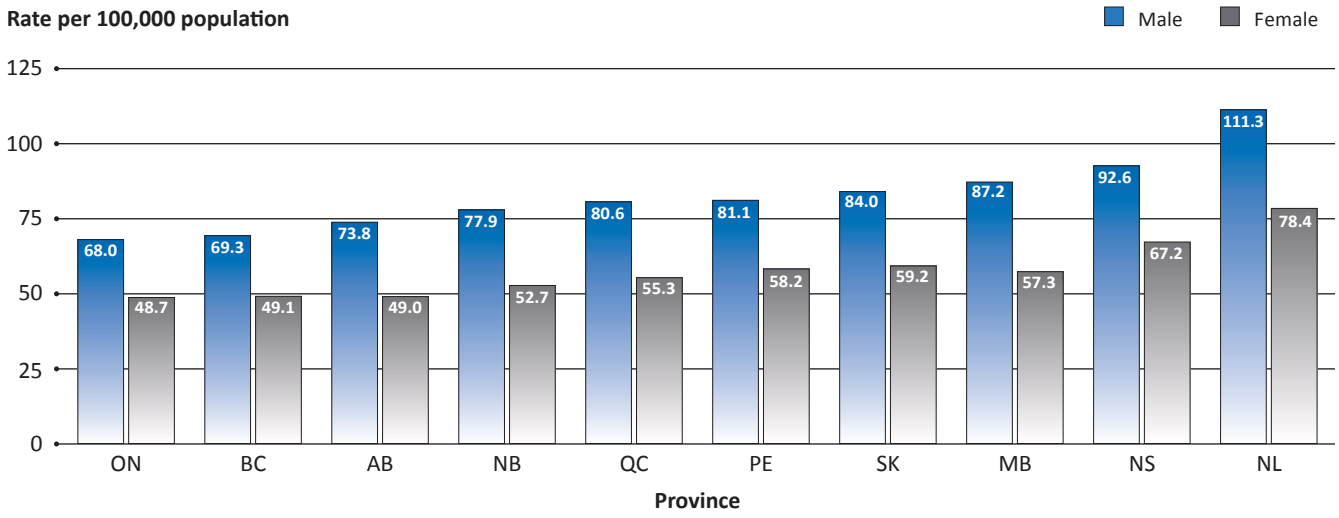
1/16
females

are expected to develop colorectal cancer in their lifetime.[1]

There are a number of known risk factors for colorectal cancer. A meta-analysis of colorectal cancer risk factors found a much higher risk of colorectal cancer among those with inflammatory bowel disease or a first-degree relative with colorectal cancer.[12] Additional risk factors associated with a moderately increased risk of colorectal cancer include increased body mass index, red meat intake, cigarette smoking, low physical activity, low vegetable consumption, and low fruit consumption.[12]

FIGURE 1

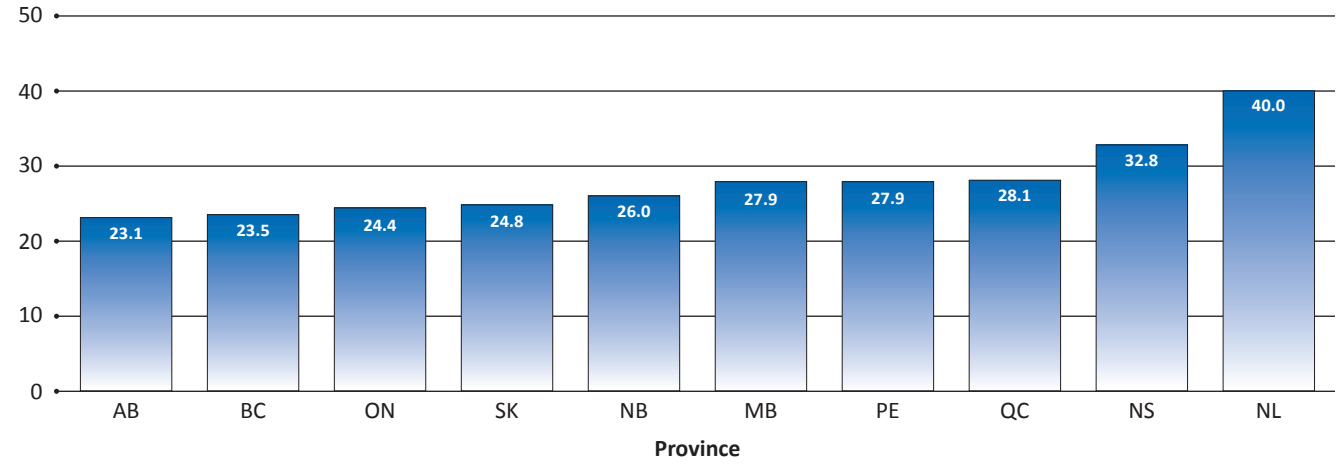
Colorectal cancer incidence rates, by sex and province, 2010–12 diagnosis years combined



Age-standardized to the 2011 Canadian population.
Data extracted December 2015.
Data source: Statistics Canada, Canadian Cancer Registry.

FIGURE 2

Colorectal cancer mortality rates, by province, 2009–11 years combined



Age-standardized to the 2011 Canadian population.
Data extracted August 2014.
Data source: Statistics Canada, Vital Statistics Death Database.

Screening for Colorectal Cancer

Evidence for the effectiveness of colorectal cancer screening

There is strong evidence that regular colorectal cancer screening with a fecal test enables early detection of colorectal cancer and allows for more successful treatment, leading to a reduction in colorectal cancer mortality.[2–6] Colorectal cancer screening has the potential to be effective because most colorectal cancers evolve from colonic polyps that can become malignant over an extended period of time.[7] Less-invasive surgery may be required for the treatment of cancers that are detected at an earlier stage by screening.[4]

Prevention and early detection of colorectal cancer through organized screening, combined with effective treatment, is intended to prevent disease and reduce colorectal cancer mortality in an asymptomatic population.[13] Comprehensive quality assurance is required in order to maximize the benefits while minimizing any potential harms that could occur in otherwise healthy individuals. Organized population-based screening programs provide an administrative structure responsible for service delivery, follow-up of abnormal results, quality assurance and ongoing evaluation.[9]

Colorectal cancer screening tests

There are a number of modalities for screening for colorectal cancer, including the guaiac (FTg) or immunochemical (FTi) fecal tests, flexible sigmoidoscopy and colonoscopy. Data from randomized controlled trials demonstrate that screening for colorectal cancer with guaiac fecal occult blood testing or flexible sigmoidoscopy reduces colorectal cancer mortality and the incidence of late-stage colorectal cancer.[7] A systematic review conducted by Cancer Care Ontario found that FTi had higher advanced adenoma and colorectal cancer detection rates as well as increased participation rates compared with FTg. Positivity rates were higher with FTi, but both tests had similar positive predictive values for the detection of advanced adenoma and colorectal cancer when using the manufacturer's standard cut-off levels.[14] Pooled analyses from a number of studies, including randomized controlled trials, found that the use of flexible sigmoidoscopy as a screening test in individuals aged 55 to 74 reduced colorectal cancer mortality and incidence of late-stage colorectal cancer.[15] As no randomized controlled trials have reported on the mortality benefit of screening colonoscopy, there is insufficient evidence of the efficacy of colonoscopy in comparison with other screening tests.[7] While it may be assumed, to be at least as effective as flexible sigmoidoscopy, wait times may be longer and the potential harms are greater than for flexible sigmoidoscopy.[7]

Colorectal cancer screening recommendations

For the period covered by this report, the Canadian Task Force on Preventive Health Care's 2001 guidelines on colorectal cancer screening recommended colorectal cancer screening with a fecal test every one to two years or flexible sigmoidoscopy every five years starting at age 50 for people at average risk for colorectal cancer.[16] The guideline did not include recommendations specifying use of these screening modalities alone or in combination, nor whether to include or exclude colonoscopy as an initial screening test. In March 2016, the Canadian Task Force on Preventive Health Care issued updated guidelines that recommended screening for colorectal cancer in average-risk adults aged 50 to 74 with a fecal test every two years or with flexible sigmoidoscopy every 10 years.[7] The use of colonoscopy as a screening test for colorectal cancer was not recommended.

Organized Colorectal Cancer Screening in Canada

History

Organized colorectal cancer screening programs were first announced in three provinces in 2007 (Alberta, Manitoba and Ontario). By the end of 2014, programmatic colorectal screening had been implemented in five additional provinces (British Columbia, Saskatchewan, Nova Scotia, Prince Edward Island and Newfoundland and Labrador);[8] New Brunswick implemented a program in 2015.

Figure 3 provides an overview of the availability of colorectal cancer screening programs across Canada over time from March 2013 until July 2016 based on pan-Canadian environmental scans conducted by the Canadian Partnership Against Cancer (the Partnership). While the data in this report pertain to 2013–14; as of the date of report publication in 2016, organized screening programs have been announced in Quebec and Yukon. The Northwest Territories and Nunavut are reviewing the feasibility of implementing organized colorectal cancer screening. The implementation of organized screening in some parts of Canada has been associated with an increase in screening uptake.[17]

FIGURE 3.1

Colorectal cancer screening program availability over time

% of the population for whom organized CRC programs were available

No organized program
Announced or planning
10–49%
100%
Reviewing feasibility
1–9%
50–99%

March 2013

FIGURE 3.2

Colorectal cancer screening program availability over time

% of the population for whom organized CRC programs were available

- No organized program
- Reviewing feasibility
- Announced or planning
- 1–9%
- 10–49%
- 50–99%
- 100%

August 2014

FIGURE 3.3

Colorectal cancer screening program availability over time

% of the population for whom organized CRC programs were available

No organized program
Announced or planning
10–49%
100%
Reviewing feasibility
1–9%
50–99%

July 2016

Data source: Colorectal Cancer Screening Guidelines Across Canada: Environmental Scan, March 2013; Colorectal Cancer Screening Guidelines Across Canada: Environmental Scan, August 2014; National Colorectal Cancer Screening Network Report Survey; July 2016.

National Colorectal Cancer Screening Network

The Partnership convened the National Colorectal Cancer Screening Network (NCCSN) in 2007. The NCCSN exists as a national platform for knowledge exchange to support the colorectal cancer screening community, improve the patient experience, leverage expertise and make evidence-based recommendations to the cancer control system. The NCCSN's primary aim is to improve appropriate participation and enhance quality in colorectal cancer screening in Canada.

The NCCSN brings together representatives from the following areas:

- provincial/territorial ministries of health
- provincial/territorial cancer screening programs
- the Public Health Agency of Canada, Health Canada, and one representative from other relevant national health/cancer organizations, professional organizations and patient advocacy organizations
- patient/family advisor(s)

One of the NCCSN's priorities is reporting on colorectal cancer screening indicators to monitor participation and facilitate quality improvement. To that end, a standing NCCSN working group, the Colorectal Cancer Monitoring and Evaluation Working Group, is tasked with

- developing quality determinants and indicators for colorectal cancer screening in Canada
- monitoring quality indicators (based on the quality determinants)
- setting national targets
- reporting pan-Canadian results regularly

Screening approaches

This report provides data for 2013–14 and focuses on quality indicators for organized colorectal cancer screening (i.e., population-based programmatic screening) rather than on opportunistic screening (i.e., screening that occurs outside of programs, or non-programmatic screening). Both programmatic and non-programmatic screening occur in Canada and must be taken into account when evaluating colorectal cancer screening uptake overall.

Table 1 provides an overview of colorectal cancer screening across all provinces and territories for 2013–14. Even among provinces with organized colorectal cancer screening programs, approaches to screening delivery vary. Colorectal screening programs in Canada have evolved at different rates and are shaped by provincial characteristics and factors, including the availability of resources, the adoption of different entry-level screening fecal tests, and the cut-off value for an abnormal screening result. Some of these differences have implications when comparing some of the indicators across provinces and the results that follow should be interpreted cautiously in this context. While the data presented in this report provide the opportunity to make initial hypotheses about the status and implications of different approaches to colorectal cancer screening across Canada, national data monitoring over a longer period will be required in order to draw more formal conclusions.

TABLE 1

Overview of colorectal cancer screening across provinces and territories in 2013–14

Province/ territory	Program start date	Target population	Screening interval	Primary screening test	Primary screening test brand	FTi cut-off value for an abnormal screening result*
AB	March 2007	50–74	Annual or biennial	FTi replaced FTg in November 2013	Polymedco	≥75 ng/ml
BC	2009 pilot; province-wide November 2013	50–74	Biennial	FTi	Alere	≥50 ng/ml
MB	April 2007	50–74	Biennial	FTg	Hemoccult II SENSA	
NB	November 2014	50–74	Biennial	FTi	Polymedco	≥100 ng/ml
NL	July 2012	50–74	Biennial	FTi	Alere	≥100 ng/ml
NT	No organized screening program	50–74	Annual or biennial	FTi	Hemoccult ICT	≥75 ng/ml
NS	April 2009	50–74	Biennial	FTi	Hemoccult ICT	≥100 ng/ml
NU	No organized screening program			FTi		
ON	March 2008	50–74	Biennial	FTg	Hema-screen	
PE	2009; province-wide May 2011	50–74	Biennial	FTi	Alere	≥100 ng/ml
QC	No organized screening program	50–74	Biennial	FTi		≥175 ng/ml
SK	January 2009	50–74	Biennial	FTi	Polymedco	≥100 ng/ml
YT	No organized screening program	50–74	According to physician	FTg	Hemoccult	

* Unable to report in mcg Hb/g stool as volume information unavailable. Future reports will list cut-off values in mcg Hb/g stool.
FTi = immunochemical fecal test; FTg = guaiac fecal test; ng/ml = nanogram/milliletre.
AB: Polymedco available province-wide as of November 18, 2013.
NB: Although 22% of target population was invited to participate in November 2014, distribution of FTi kits only started in January 2015. Data will be available for January 2015 onwards.
NL: Province-wide as of July 2015.
Data source: Provincial/territorial cancer agencies and programs.

The screening process

As of December 2016, Canadian provinces delivering colorectal cancer screening programs recommend a fecal test, either immunochemical (FTi) or guaiac (FTg), as the primary screening test and target people aged 50 to 74 of average risk (i.e., those with no personal or family risk factors for colon cancer other than being 50 or older). Some colorectal cancer screening programs also recommend the use of flexible sigmoidoscopy as a screening test.

For the period covered in this report, all provinces except Ontario and Manitoba used FTi as the primary screening test. Alberta transitioned from using FTg to FTi in November 2013. As of December 2016, Ontario is developing a plan to implement FTi and Manitoba was piloting FTi to compare it with the highly sensitive FTg Hemoccult II SENSA currently in use. Individuals with an abnormal fecal test result are then referred for a colonoscopy. Colonoscopy may be recommended as the screening test for individuals considered to be at above-average risk of colorectal cancer.

Quality Indicator Framework

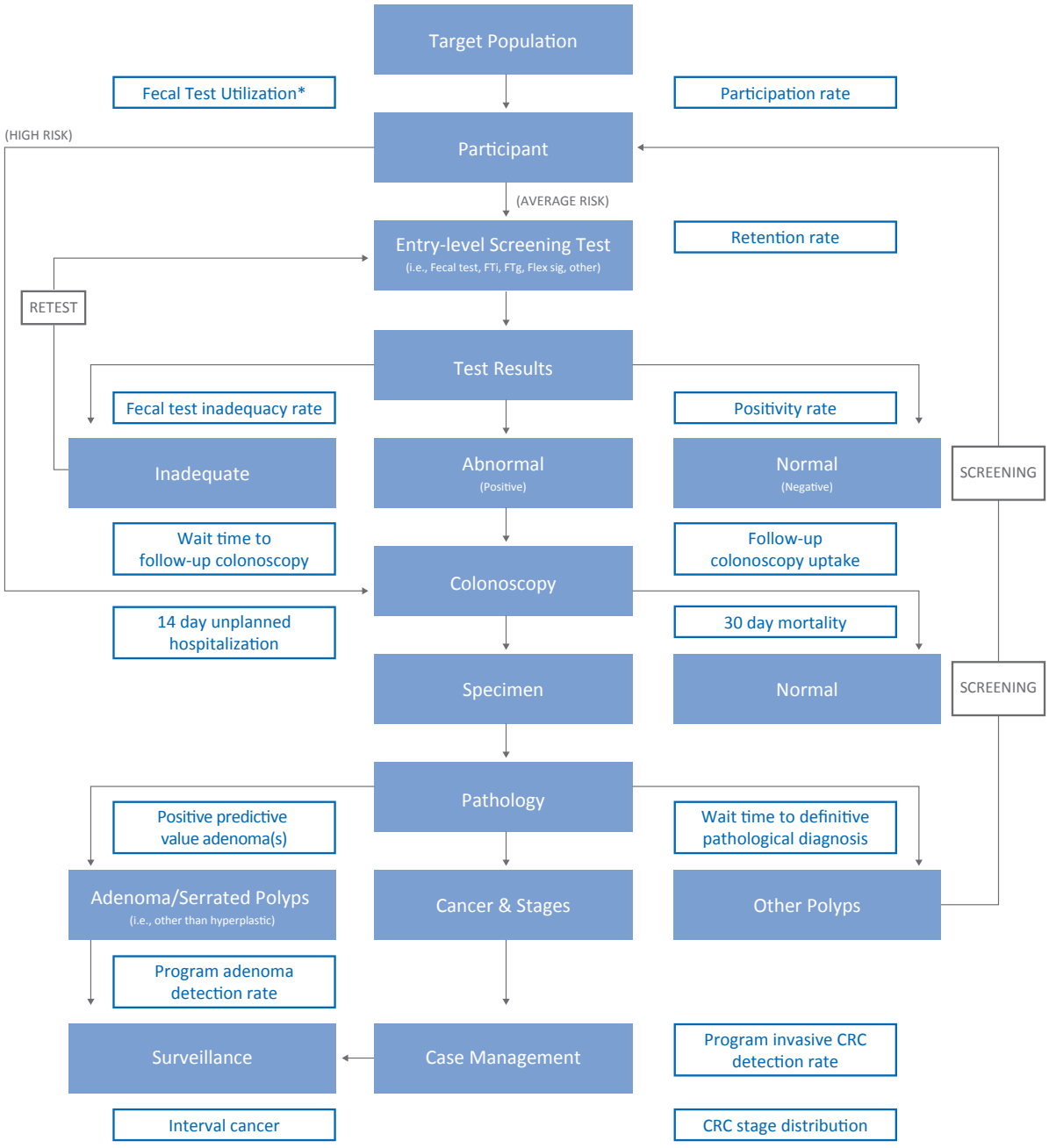
A set of quality indicators for colorectal cancer screening was developed in 2009 for reporting at the national level in Canada. Subsequent work by the NCCSN in 2011 resulted in the development of targets for six of the indicators.

In 2013, the Partnership released a revised version of the report *Quality determinants and indicators for measuring colorectal cancer screening program performance in Canada,* which included new and revised quality determinants and indicators included in this report.[18]

Appendix A describes the 13 quality indicators and associated six targets for which data are provided in this report. Figure 4 outlines the colorectal cancer screening pathway and provides an overview of the quality indicators included in this report.

FIGURE 4

Colorectal cancer screening pathway with national quality indicators



*Not a programmatic indicator.
FT = fecal test; FTi = immunochemical fecal test; FTg = guaiac fecal test; Flex sig = flexible sigmoidoscopy; PPV = positive predictive value; CRC = colorectal cancer.

Data Considerations

Data for this report were obtained from provinces and territories for screening and follow-up, from cancer registries and from the Canadian Community Health Survey. Note that in some cases, provinces were unable to provide data for some (or all) of the 13 indicators in this report. For example, CCHS data are reported only for provinces or territories that opted to participate in the screening module, which was optional in 2013–14.

In this report, for seven indicators (retention rate, fecal test inadequacy rate, positivity rate, follow-up colonoscopy rate, positive predictive value for adenoma(s), adenoma detection rate, and program invasive colorectal cancer screening rate) data are presented for first and subsequent screens. This approach provides more comprehensive monitoring of quality because characteristics of individuals screened for the first time differ from those returning for subsequent screens.

For the purposes of the report, only one fecal test was counted per individual for the report period from January 1, 2013, to December 31, 2014. If more than one was completed, the test with the most severe abnormal result was counted. If there was more than one normal fecal test, the most recent one was counted. Provinces classified all individuals who completed a fecal test within the report period (successful or inadequate) as first screens if there was no record of a previous programmatic fecal test (successful or inadequate) prior to January 1, 2013. All other individuals who completed a fecal test within the report period (successful or inadequate) were classified as subsequent screens. While the inclusion of both successful and inadequate screens as first screens may introduce some bias, it is consistent across indicators and provinces for which subsequent screens were reported.

To simplify the presentation of figures and tables, the following information describing program exclusions, changes in type of fecal test, or availability of data during the report timeframe is presented only once, below. Only additional pertinent information will appear in the footnotes of figures and tables where needed.

- **Alberta:** The Alberta Colorectal Cancer Screening Program was launched in 2007. FTi was implemented province-wide in November 2013, replacing FTg as the primary screening test for colorectal cancer. Data reported for all indicators except positivity rate include both FTg and FTi tests; however, where the provinces are separated by test modality in the figures, Alberta is listed under FTi given it was in use for a greater proportion of the reporting period. Data reported for the positivity rate include only FTi tests.
- **Saskatchewan:** The Saskatchewan Screening Program for Colorectal Cancer receives all FTi results from both the programmatic and opportunistic pathways. Once screened, all individuals are followed by the program and invited when their next screen is due.
- **Manitoba:** For the period covered in this report, Manitoba used FTg as the primary screening test for colorectal cancer. Individuals are excluded from invitation if they have had a fecal test within the previous two years or a colonoscopy within the previous five years (via opportunistic screening) or if they have had a related cancer. This is done to prevent overscreening or inappropriate screening. If an individual has invalid health coverage or an invalid mailing address, they are also excluded.
- **Ontario:** For the period covered in this report, Ontario used FTg as the primary screening test for colorectal cancer. The following individuals are excluded from invitation: those under the age of 50 or over the age of 74 years; those with a missing or invalid health insurance number, date of birth, or postal code; those who have withdrawn from correspondence; those with an FTg in the past two years, a flexible sigmoidoscopy in the past 10 years; and those with a previous invasive colorectal cancer and/or total colectomy.
- **Newfoundland and Labrador:** The Newfoundland and Labrador Colon Cancer Screening Program was implemented using a phased-in approach. For the period of this report, the data are representative of three of the province's four regional health authorities: Western Regional Health Authority, Central Regional Health Authority and Labrador-Grenfell Regional Health Authority. The population includes those meant to be excluded from the screening program (e.g., those who recently received a colonoscopy). The program was launched in the Eastern Health Authority region after the period of this report, in July 2015.
- **Nova Scotia:** All individuals in the target age range (50 to 74 years) were sent a kit unless they left the province (i.e., they no longer appear in the provincial insurance file) or contacted the program to opt out. The participation denominator is interpreted as the number of FTi kits sent to unique participants from January 1, 2013, to December 31, 2014.
- **Prince Edward Island:** The participation denominator uses Statistics Canada population data. The population therefore includes those meant to be excluded from the screening program (e.g., those who recently received a colonoscopy). Multi-site distribution of kits prevented thorough screening for program eligibility. Individuals in the target population may also have been tested via primary care providers and would therefore not be linked to the program.

Quality Indicators

Participation Rate

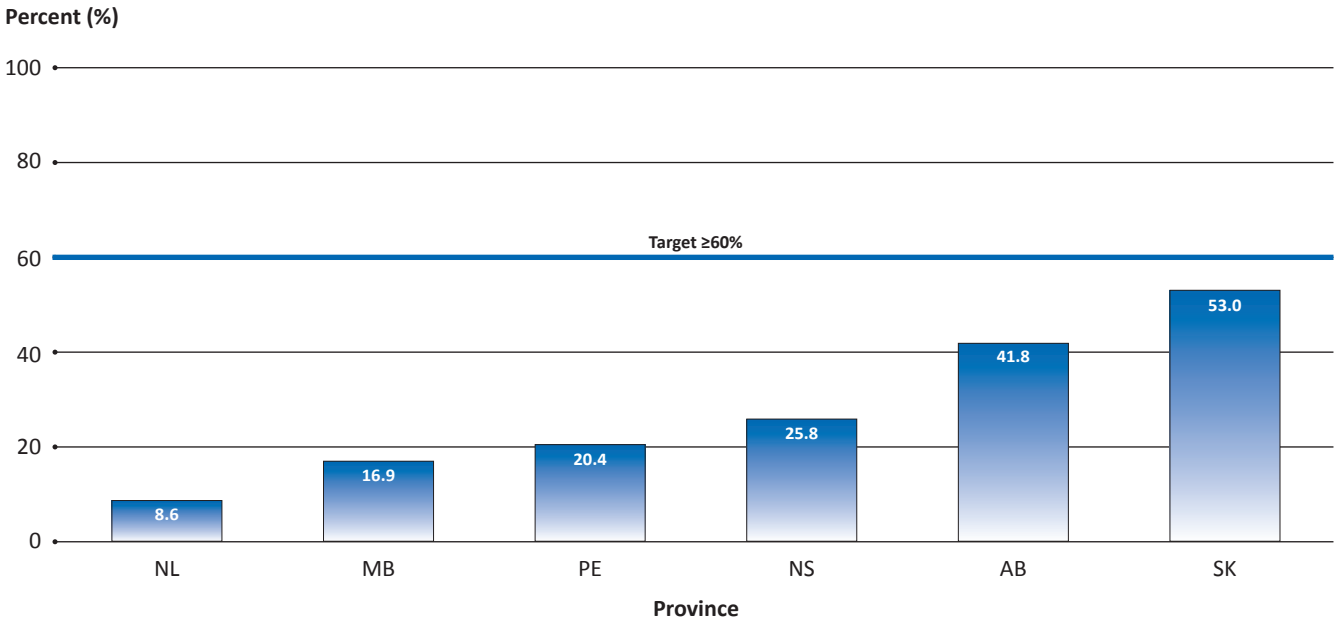
Participation is the percentage of the target population who successfully completed at least one fecal test in the program within the measurement timeframe.

Target: *≥60%*

Screening participants serve as the entry cohort for the measurement of the rest of the indicators along the screening pathway. The denominator used is the population to which the program is available. A participant is included in the numerator if screened within 30 months as opposed to 24 months from the beginning of the measurement timeframe to allow individuals who become part of the target age group near the end of the measurement timeframe a grace period of six months within which to be screened. Program participation rates range between 8.6% in Newfoundland and Labrador and 53.0% in Saskatchewan (Figure 5). Compared with data in the colorectal cancer screening report for 2011–12, where program participation rates ranged between 12.1% in Manitoba and 36.3% in Saskatchewan, programmatic participation rates have increased overall. Colorectal cancer screening participation rates are higher in older age groups and in women (Figure 6).

FIGURE 5

Colorectal cancer screening program participation in a 30-month period, both sexes combined, by province, 2013 and 2014 screening years combined

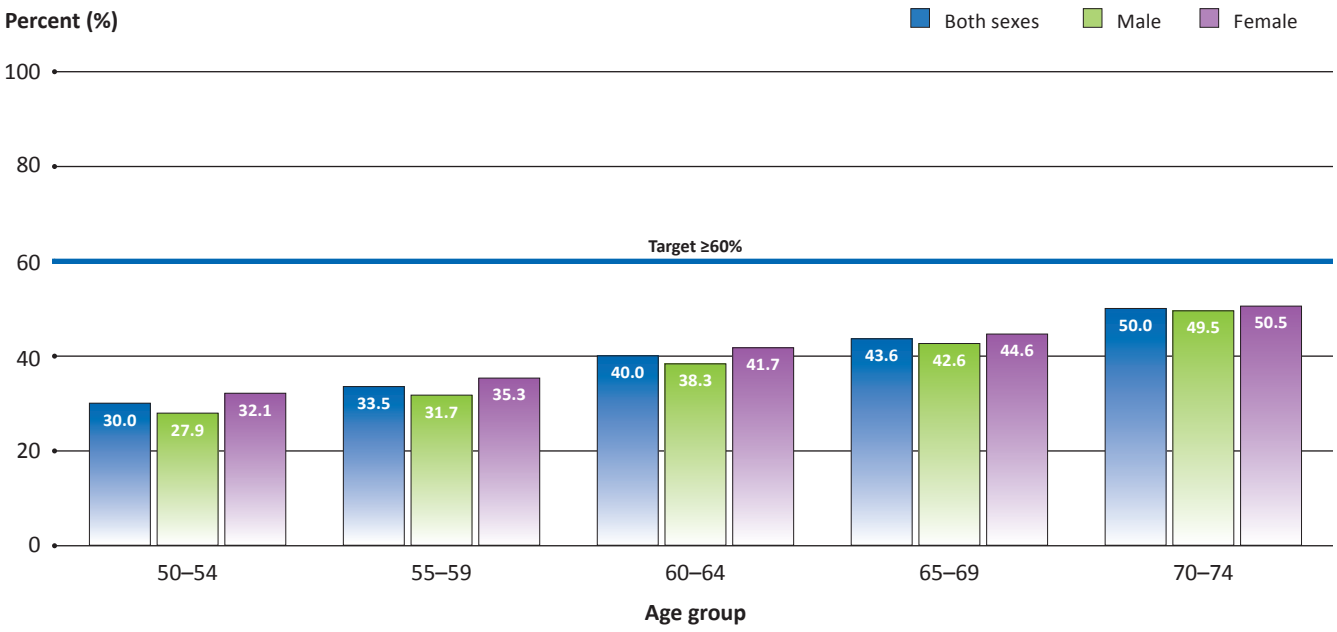


	NL*	MB	PE	NS	AB	SK
Individuals with successful fecal tests	—	50,655	9,831	85,523	443,026	161,071
Population to whom the programs were available	—	298,891	48,120	331,455	1,060,110	303,640

—: Data not available
*: Numerator and denominator were not provided. The estimate in Figure 5 was calculated using population weighting.
NL: Program was implemented in phases. Participation rate was calculated using population weighting. Data represent approximately 40% of the total eligible population aged 50–74 years in the province for the eligible population of the specific health region where the program was offered. Program was not available to the remainder of the population during the reporting period.
PE: Participation denominator uses Statistics Canada population data, which include individuals meant to be excluded from the screening program (e.g., individuals who recently obtained a colonoscopy).
SK: Data include individuals completing a fecal test obtained through the program or opportunistically.
Data source: Provincial cancer agencies and programs.

FIGURE 6

Colorectal cancer screening program participation in a 30-month period, by age group and sex, 2013 and 2014 screening years combined



Data include AB, SK, MB and NS.
NL: Data excluded as it only provided numbers for the 50–74 age group combined.
PE: Data excluded as participation denominator uses Statistics Canada population data, which include individuals meant to be excluded from the screening program (e.g. individuals with colorectal cancer).
Data source: Provincial cancer agencies and programs.

Fecal test utilization

Fecal test utilization is defined as the percentage of the target population who completed at least one fecal test, either programmatic or non-programmatic within the measurement timeframe.

***Target:** Not yet determined*

When evaluating colorectal cancer screening in Canada, both programmatic and opportunistic screening must be taken into consideration. Data from a variety of sources, including fee-for-service data and self-reported data, may be used in conjunction with programmatic data to present a more comprehensive assessment of the percentage of the eligible population that completed a fecal test within the last two years. Until screening programs are able to obtain data on fecal test use from multiple sources, the Canadian Community Health Survey (CCHS) provides valuable insight into overall fecal test use – be it programmatic or opportunistic. Note that colorectal cancer screening questions were part of an optional module in 2013 and 2014, which is why data are missing for some provinces and territories.

Figure 7 shows the percentage of Canadians aged 50 to 74 at average risk for colorectal cancer who reported having had a fecal test in the past two years for screening purposes using CCHS data. This is defined as respondents who reported having a fecal test for any of the following reasons: family history, regular check-up/routine screening, age or race. It excludes respondents who reported having a fecal test for the following reasons: follow-up of problem, follow-up of colorectal cancer treatment, or 'other' reason. Fecal test utilization rates for 2013 ranged from 12.1 in Quebec to 51.0 in Manitoba. For 2014, fecal test utilization rates ranged from 16.9 in Newfoundland and Labrador to 49.0 in Manitoba. Fecal testing may be carried out for reasons other than screening and the data were also analyzed further to examine to what degree this was occurring. Only a small percentage of fecal test were reported as being done for reasons other than screening.

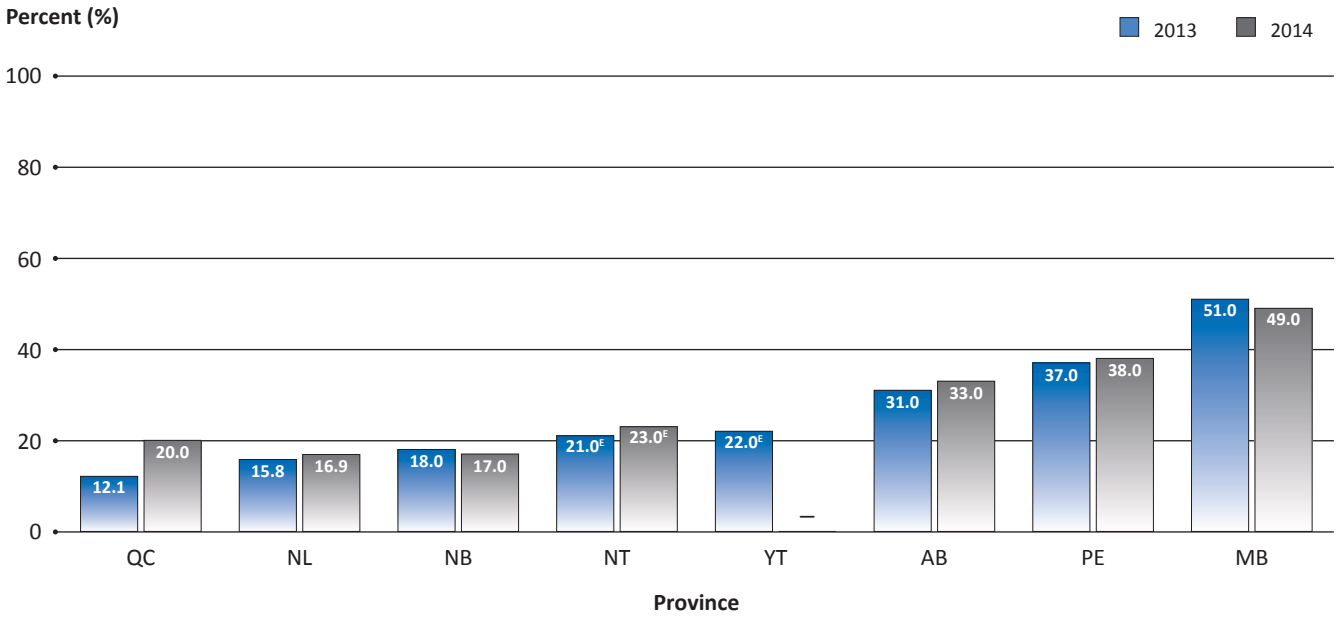
Comparing participation rates and fecal test utilization for screening purposes for each province, some of the differences may be due to the timeframe used (30 months versus 24 months). The difference between Manitoba's program participation rate in Figure 5 (16.9% in 2013–14) and self-reported utilization in Figure 7 (51.0% in 2013 and 49.0% in 2014) may be due to the fact that a large proportion of fecal tests in Manitoba are completed outside the screening program. In an effort to avoid overscreening, Manitoba does not invite individuals known to have completed a fecal test from another source individuals who had a colonoscopy in the previous 5 years, or those who have a colorectal-related cancer diagnosis. While no screening program participation rates have reached the national target of at least 60%, self-reported fecal test utilization for screening purposes is generally around double the rate of program participation, suggesting that a complete assessment of screening uptake in the population requires both indicators.

Monitoring screening program participation rates provides only one component of the total uptake of colorectal cancer screening. Individuals who have undergone testing with either a fecal test, flexible sigmoidoscopy or colonoscopy within specified time periods may be considered to be up to date with regard to their screening history. This status would apply even if individuals were not tested explicitly for cancer screening purposes, since testing would not need to be repeated for screening.[19] CCHS data on self-reported fecal testing or endoscopy use for any reason among individuals are useful to estimate the percentage of the population that is up to date for colorectal cancer screening in Canada. The percentage of the population aged 50 to 74 that reported having a fecal test in the past two years or a flexible sigmoidoscopy or colonoscopy in the past 10 years for any reason ranged from 44% to 70% in 2013 and from 48% to 68% in 2014 (Figure 8).

In *Screening rates for colorectal cancer in Canada: A cross-sectional study,* data from the 2012 CCHS survey were used to calculate the prevalence of people aged 50 to 74 who were up to date with screening using fecal testing or endoscopic tests in Canada.[19] The results showed that the percentage of the population up to date colorectal cancer screening among people aged 50 to 74 in 2012 (defined as having had a fecal test within the past two years or flexible sigmoidoscopy or colonoscopy within the past 10 years, or both) was 55.2%, ranging from 41.3% in the territories to 67.2% in Manitoba. The rate for sigmoidoscopy or colonoscopy was 37.2% (highest in Ontario, at 43.3%); for fecal testing it was 30.1% (highest in Manitoba, at 51.7%). Further, about 41% of those who had a fecal test also had a sigmoidoscopy or colonoscopy. Finally, individuals in the highest income group were more likely than those in lower-income groups to be up to date with colorectal cancer screening, even in provinces with well-established population-based screening programs.[19]

FIGURE 7

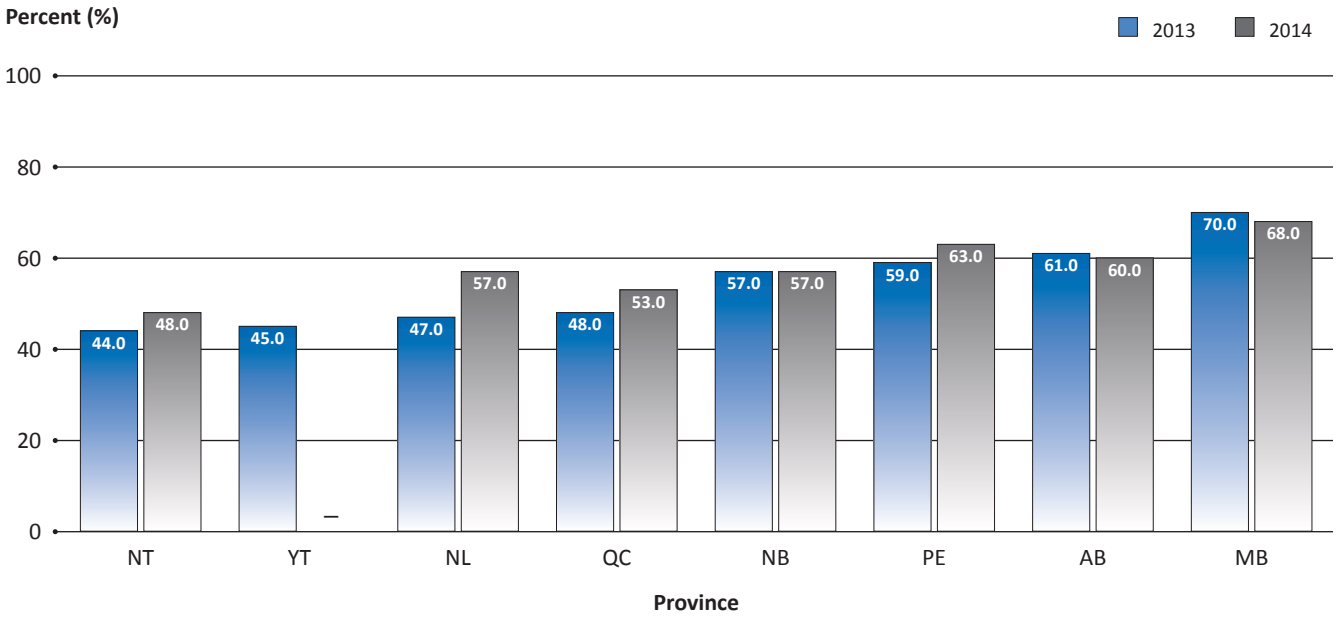
Percentage of the population aged 50–74 that reported having had a fecal test in the past two years for screening purposes, by province/territory, CCHS 2013 and 2014 reporting years



—: Data not available.
E: Interpret with caution owing to large variability in the estimate.
Data presented for provinces and territories participating in the colorectal cancer screening module for the 2013 and 2014 Canadian Community Health Survey.
Data source: Statistics Canada, Canadian Community Health Survey.

FIGURE 8

Percentage of the population aged 50–74 up to date for colorectal cancer screening (any modality, any reason), CCHS 2013 and 2014 reporting years



—: Data not available.
Up to date for colorectal cancer screening defined as having had a fecal test in the past two years and/or a sigmoidoscopy/colonoscopy in the past 10 years for any reason.
Data presented for provinces and territories participating in the colorectal cancer screening module for the 2013 and 2014 Canadian Community Health Survey.
Data source: Statistics Canada, Canadian Community Health Survey.

Retention rate

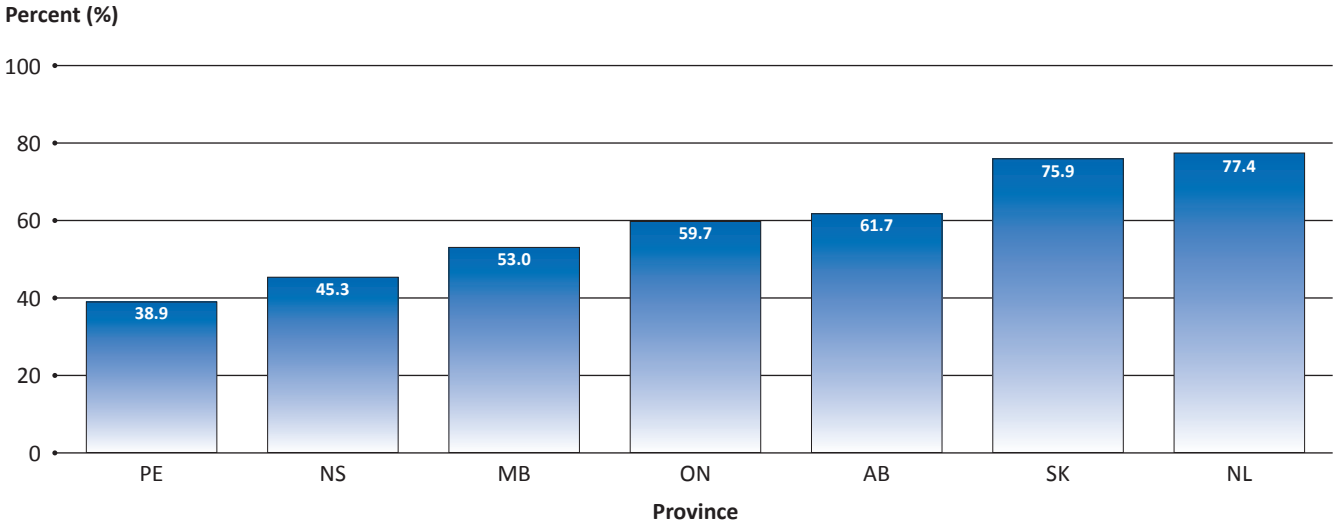
Retention rate is defined as the percentage of individuals aged 50 to 72 years rescreened within 30 months after a normal fecal test in the measurement timeframe.

***Target:** Not yet determined*

Monitoring colorectal cancer screening program retention rates are particularly important given the sensitivity of fecal tests is not 100%, which means that lesions may be missed if the test is not repeated at a regular interval.[20] Retention rates vary considerably among provinces, from 38.9% to 77.4 % (Figure 9). Except for the 70 to 72 age group, the retention rate increases with age and is also higher after a subsequent screen than after a first screen (Figures 10 and 11). This pattern is also observed in other organized screening programs, such as those for breast cancer. As programs continue to reach full implementation, an increase in retention rates should be observed over time for all screening programs. Note that the denominator for the retention rate includes individuals up to the age of 72 as individuals older than 72 would no longer be of screening age for a subsequent screen 30 months after a successful fecal test based on most provincial colorectal cancer screening guidelines.

FIGURE 9

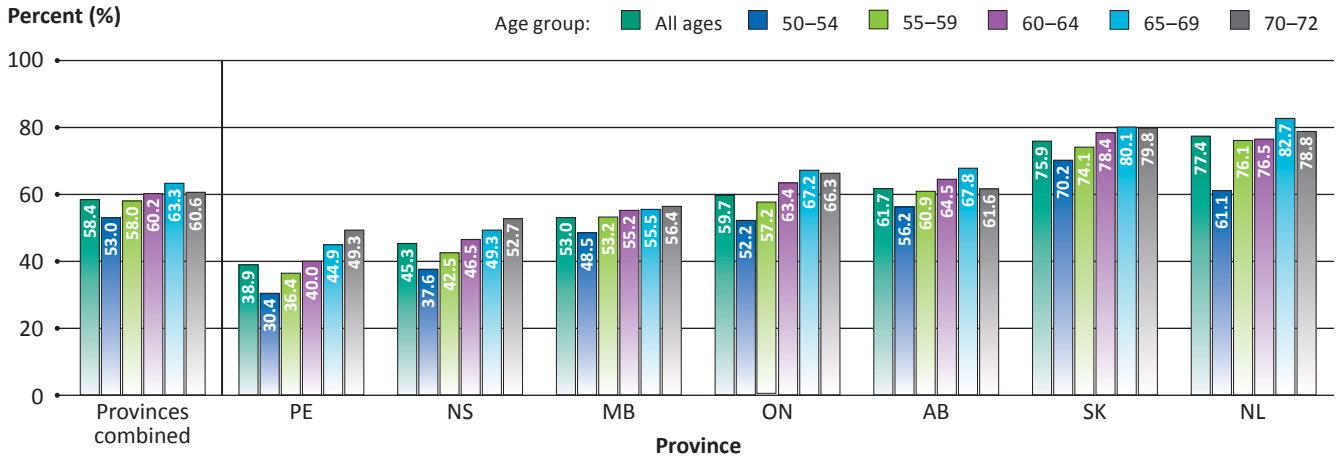
Colorectal cancer screening retention rate in a 30-month period, age 50–72, by province, 2011 and 2012 screening years combined



ON: 2011 data only. The following exclusions were applied: individuals who had an abnormal test result in the given year, who died during the follow-up period, who had invasive colorectal cancer and/or total colectomy during the follow-up interval or who were up to date with colonoscopy or flexible sigmoidoscopy up to and including the follow-up interval.
Data source: Provincial cancer agencies and programs.

FIGURE 10

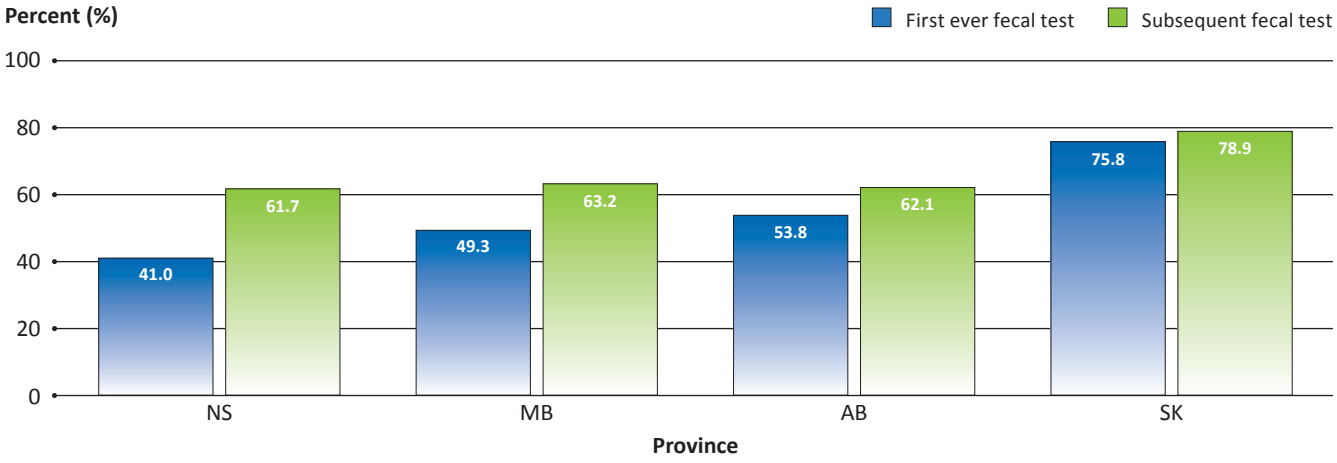
Colorectal cancer screening retention rate in a 30-month period, by province and age group, 2011 and 2012 screening years combined



Provinces combined excludes ON.
PE: Program began in May 2011. Data include pilot participation January–April 2011, which was a subset of the target population. All tests completed were first screen (programmatic and pilot). Retention rate does not reflect those rescreened outside the program (e.g., through primary care provider).
NS: The largest health district in Nova Scotia, Capital District Health Authority (CDHA), started its first cycle of the colorectal cancer screening program April 1, 2011. CDHA contains approximately half of Nova Scotia's population, so most screens were first-time screens. Additionally, program was suspended for six months within the reporting period owing to manufacturing problems with FTi testing cards.
ON: 2011 data only. The following exclusions were applied: individuals who had an abnormal test result in the given year, who died during the follow-up period, who had invasive colorectal cancer and/or total colectomy during the follow-up interval or who were up to date with colonoscopy or flexible sigmoidoscopy up to and including the follow-up interval.
NL: Data represent last five months of the reporting period.
Data source: Provincial cancer agencies and programs.

FIGURE 11

Colorectal cancer screening retention rate in a 30-month period, by province and screening round, 2011 and 2012 screening years combined



Data source: Provincial cancer agencies and programs.

Fecal test inadequacy rate

Fecal test inadequacy rate is defined as the percentage of individuals whose fecal test was inadequate and who have not repeated the test within the measurement timeframe to get a successful fecal test result.

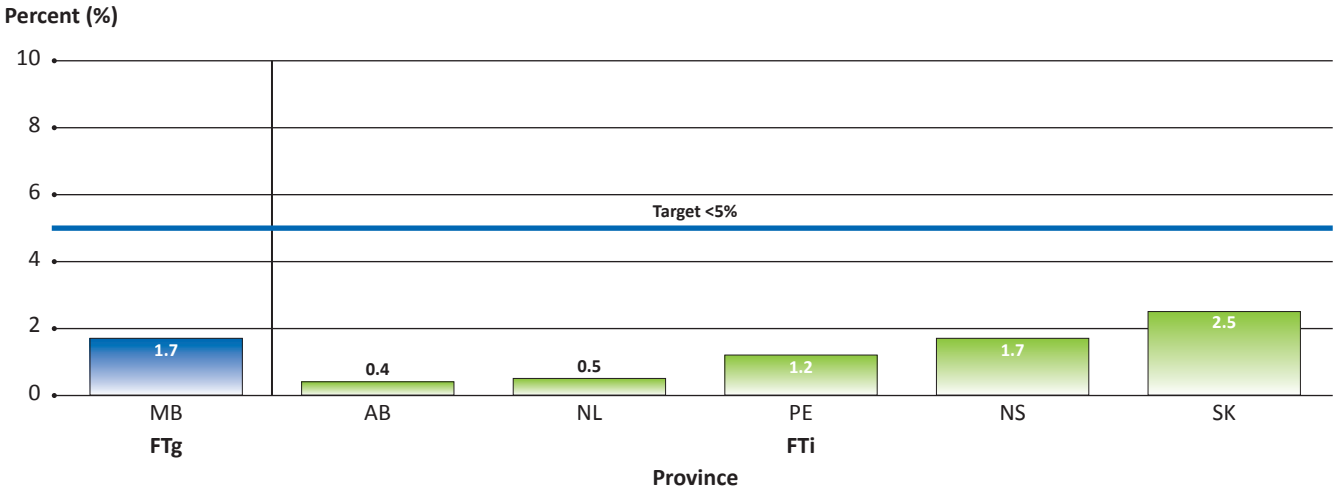
Target: *≤5%*

The fecal test inadequacy rate provides information about the successful completion of the process of performing the test by the target population. Factors that may influence inadequate results include improper fecal sampling, missing participant information, excessive time from sample collection to analysis, or quality assurance problems associated with the laboratory or vendor.[21] Note that the proportion of individual tests which are inadequate will be higher than the rates quoted, which refer to inadequacy of testing patients within the time period.

In 2013–14, fecal test inadequacy rates varied among the reporting provinces (Figure 12) but all met the target of 5% or less. In provinces with the highest inadequacy rates, those rates were lower in subsequent screens (Figure 13). In the case of Newfoundland and Labrador, the number of inadequate fecal tests was so low that the rate by screening round had to be suppressed. The Canadian target, which was set in 2011[22], is higher than the targets set by the European Union guidelines of less than 3% as the acceptable level and less than 1% as the desired level.[23]

FIGURE 12

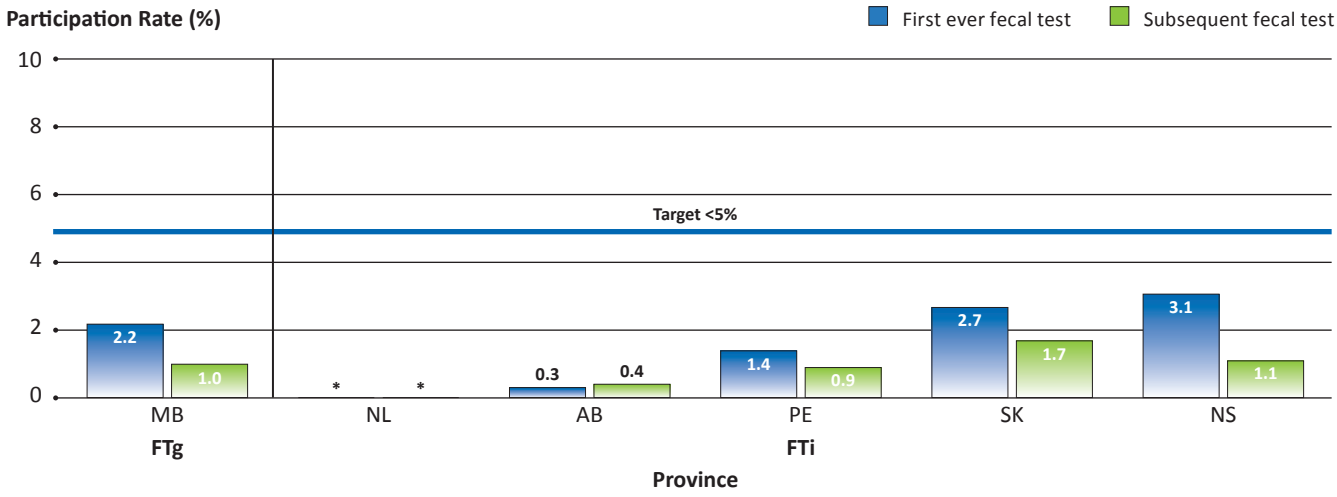
Fecal test inadequacy rate, by province, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
Data source: Provincial cancer agencies and programs.

FIGURE 13

Fecal test inadequacy rate, by province and screening round, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
—: Data not available.
*: Suppressed owing to small numbers.
Data source: Provincial cancer agencies and programs.

Positivity rate

Positivity rate is defined as the percentage of individuals with an abnormal fecal test result in the measurement timeframe.

Target: *Not yet determined*

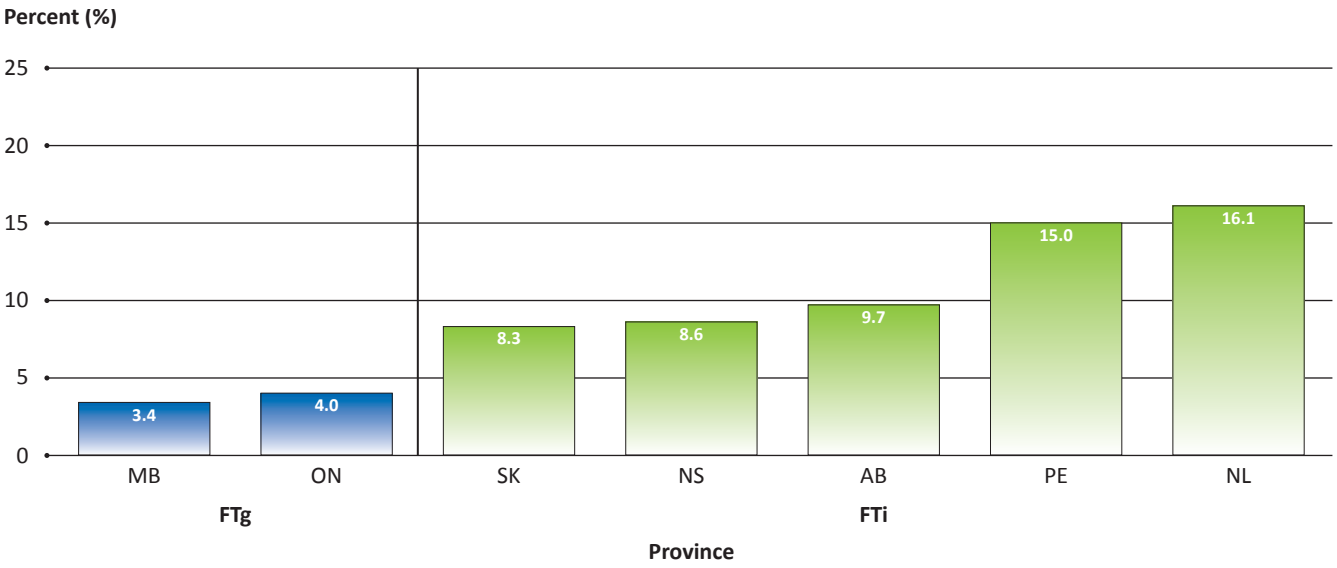
Monitoring the positivity rate gives an indication of what proportion of the screened population has received an abnormal screening test result. Abnormal screening test results include both individuals who have significant pathology, such as adenomas or colorectal cancer (true positives), and individuals who do not have any neoplastic lesion (false positives). Positivity rate is influenced by colorectal cancer prevalence and the sensitivity of the fecal test used. Factors influencing sensitivity include the type and subtype of fecal test (FTg or FTi—qualitative or quantitative, and the manufacturer), the number of fecal samples required and threshold cut-off values. See the table below Figure 14 for more details.

The positivity rate should be assessed alongside the positive predictive value (PPV) (Figures 23–26) and adenoma and cancer detection rates (Figures 27 and 28). An increase in sensitivity must be balanced against a potential loss of specificity; if high positivity rates are not related to high PPVs and adenoma and cancer detection rates, the number of individuals with false-positive results will likely also be high. These individuals could experience unnecessary anxiety and the risks of follow-up colonoscopy. High positivity rates will increase the burden on endoscopy resources (human and financial).

Positivity rates varied noticeably among provinces (Figure 14), with the lowest rates occurring in provinces that use FTg (3.4% in Manitoba, 4.0% in Ontario) and much higher rates among provinces using FTi (ranging from 8.3% in Saskatchewan to 16.1% in Newfoundland and Labrador). Provincial differences in the latter group may be due to the different brands of fecal tests being used, the number of samples taken, the number of samples used to define positivity, and different cut-off points for a positive test result. The table beneath Figure 14 shows the different characteristics of the fecal tests that were in use during the report timeframe. Higher positivity rates among males, and in first versus subsequent screens, are consistent with the literature (Figures 15–17).[24,25] Positivity rates increase with age for those who underwent FTi (notwithstanding the positivity cut-off levels used) but there was no similar trend for those who underwent FTg (Figure 17).

FIGURE 14

Positivity rates for fecal tests, by province, 2013 and 2014 screening years combined

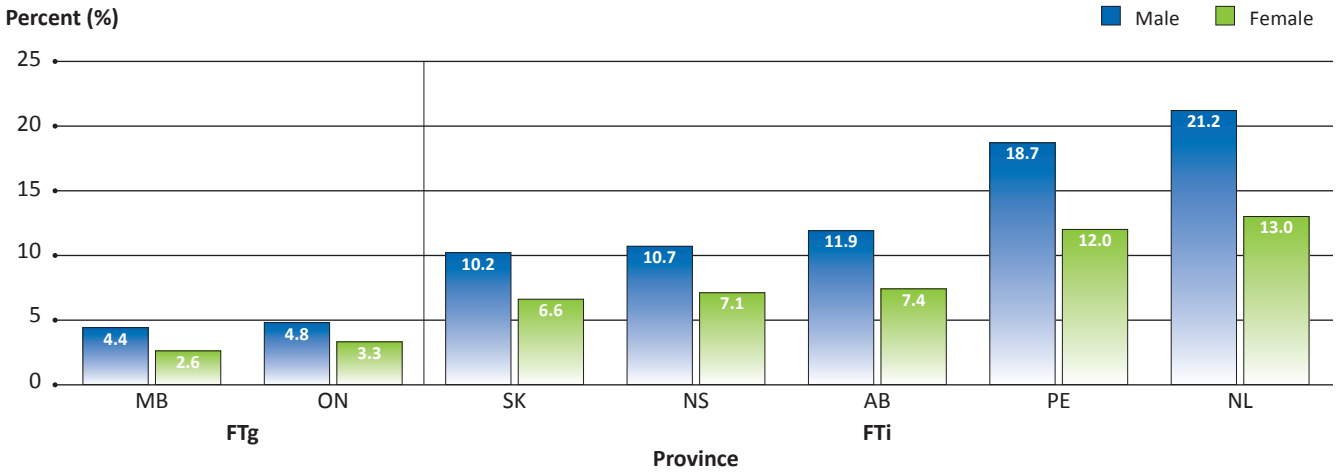


	MB	ON	SK	NS	AB	PE	NL
Individuals with positive fecal tests	1,596	19,731	11,603	5,823	24,864	1,236	734
Individuals with successful fecal tests	47,062	495,560	139,886	67,536	257,576	8,226	4,564
Cut-off value for abnormal result (FTi only)			≥100 ng/ml	≥100 ng/ml	≥75 ng/ml	≥100 ng/ml	≥100 ng/ml
Number of samples	2 samples per stool from 3 stools	2 samples per stool from 3 stools	1	2	1	2	2
Fecal test brand	Hemoccult II SENSA	Hema-screen	Polymedco	Hemoccult ICT	Polymedco	Alere	Alere

FTg = guaiac fecal test; FTi = immunochemical fecal test.
AB, ON: Data are for 2014 only.
Data source: Provincial cancer agencies and programs.

FIGURE 15

Positivity rates for fecal tests, by province and sex, 2013 and 2014 screening years combined

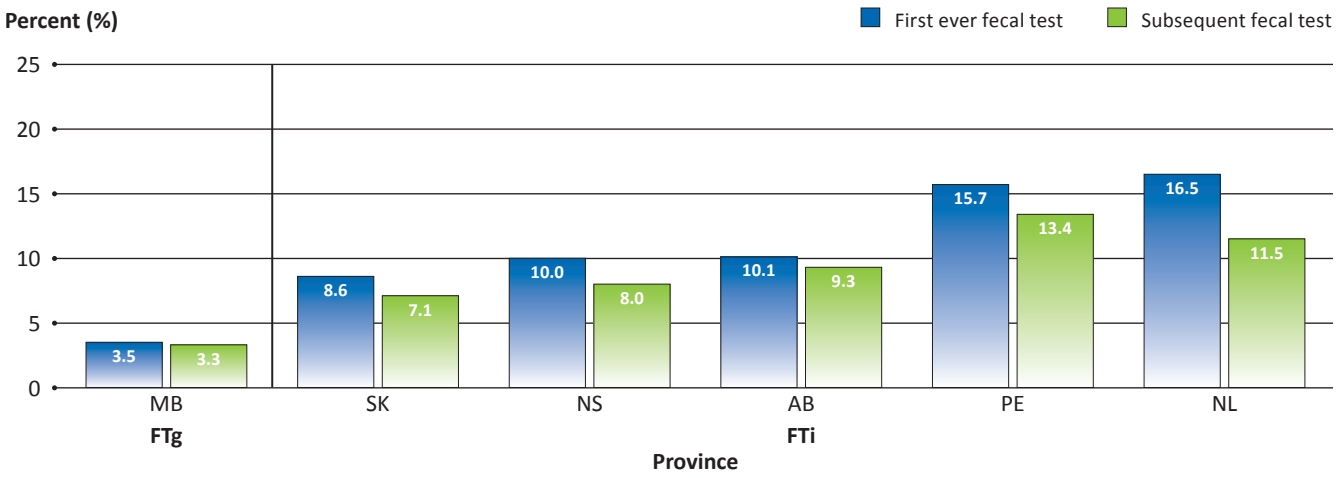


Province	Both sexes			Male			Female		
	Individuals having positive fecal tests	Individuals having successful fecal tests	Rate(%)	Individuals having positive fecal tests	Individuals having successful fecal tests	Rate (%)	Individuals having positive fecal tests	Individuals having successful fecal tests	Rate (%)
MB	1,596	47,062	3.4	900	20,480	4.4	696	26,582	2.6
ON	19,731	495,560	4.0	10,582	220,954	4.8	9,149	274,606	3.3
SK	11,603	139,886	8.3	6,768	66,277	10.2	4,835	73,609	6.6
NS	5,823	67,536	8.6	3,130	29,376	10.7	2,693	38,160	7.1
AB	24,864	257,576	9.7	15,129	126,754	11.9	9,735	130,822	7.4
PE	1,236	8,226	15.0	701	3,756	18.7	535	4,470	12.0
NL	734	4,564	16.1	364	1,717	21.2	370	2,847	13.0

FTg = guaiac fecal test; FTi = immunochemical fecal test.
AB, ON: Data are for 2014 only.
Data source: Provincial cancer agencies and programs.

FIGURE 16

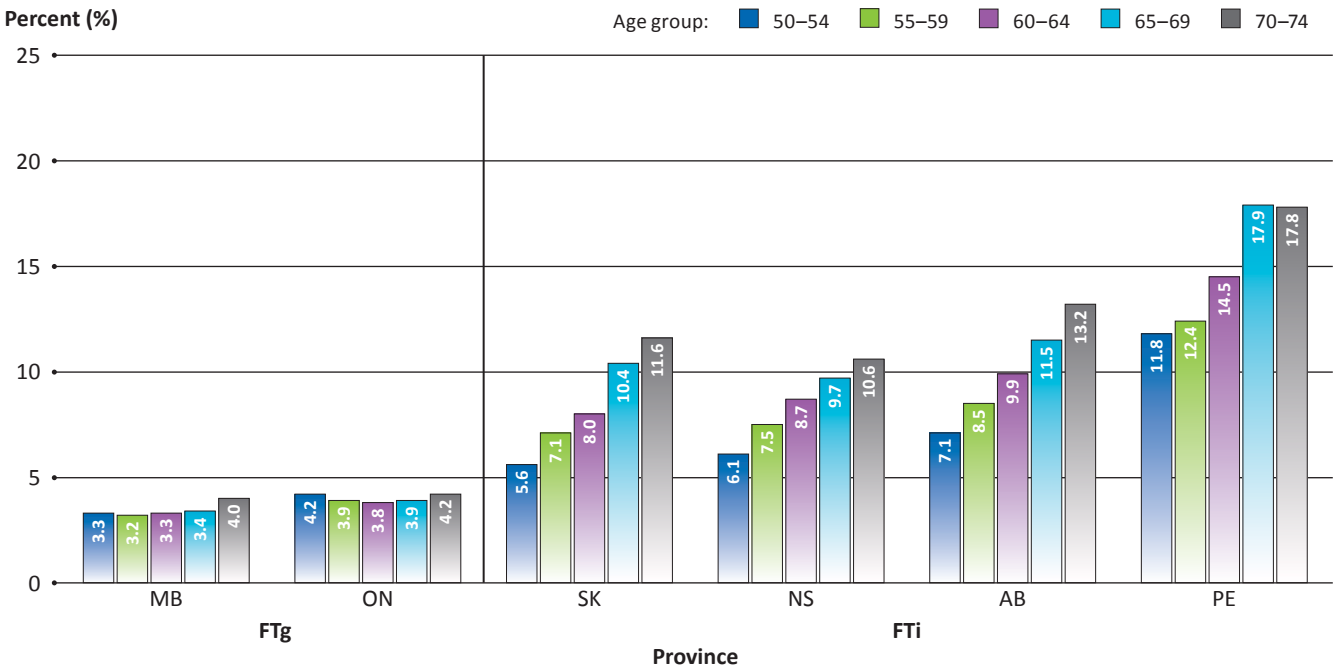
Positivity rates for fecal tests, by province and screening round, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
—: Data not available.
AB: Data are for 2014 only.
NL: Data represent last five months of the reporting period.
Data source: Provincial cancer agencies and programs.

FIGURE 17

Positivity rates for fecal tests, by province and age group, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
AB, ON: Data are for 2014 only.
Data source: Provincial cancer agencies and programs.

Follow-up colonoscopy uptake

Follow-up colonoscopy uptake rate is defined as the percentage of individuals who had a follow-up colonoscopy performed within 180 days of an abnormal fecal test result in the measurement timeframe.

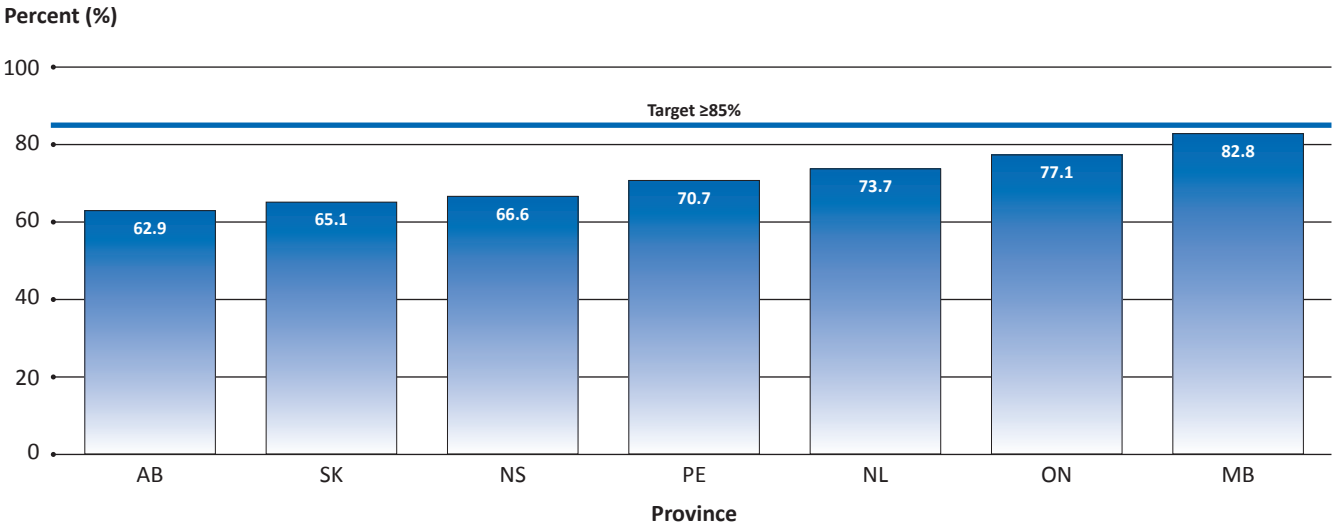
***Target:** ≥85%*

The effectiveness of a screening program requires that individuals with an abnormal test result complete the appropriate diagnostic follow-up with colonoscopy. Monitoring this indicator provides important information to plan strategies to improve follow-up. This indicator includes follow-up colonoscopies performed within 180 days of the abnormal test result. While this interval is used for monitoring and evaluation purposes only, not as a recommended target, screening programs may use these data to inform strategies to decrease wait times.

In 2013–14, follow-up colonoscopy uptake varied from 62.9% in Alberta to 82.8% in Manitoba (Figure 18), where positivity rates were 13.8% and 3.4%, respectively. While no province reached the target of 85%, Manitoba was close (82.8%). Follow-up colonoscopy uptake was higher in subsequent screens than first screens in all provinces (Figure 19). A lower follow-up colonoscopy uptake rate associated with a higher positivity rate could indicate the need to improve notification and follow-up of positive fecal test results, to revise cut-off levels for fecal testing and/or to invest in endoscopic resources. Follow-up colonoscopy uptake must be interpreted in relation to positive predictive values and program adenoma and cancer detection rates (see Table 2 for a summary).

FIGURE 18

Follow-up colonoscopy uptake among individuals with abnormal fecal test results, both sexes combined, by province, 2013 and 2014 screening years combined

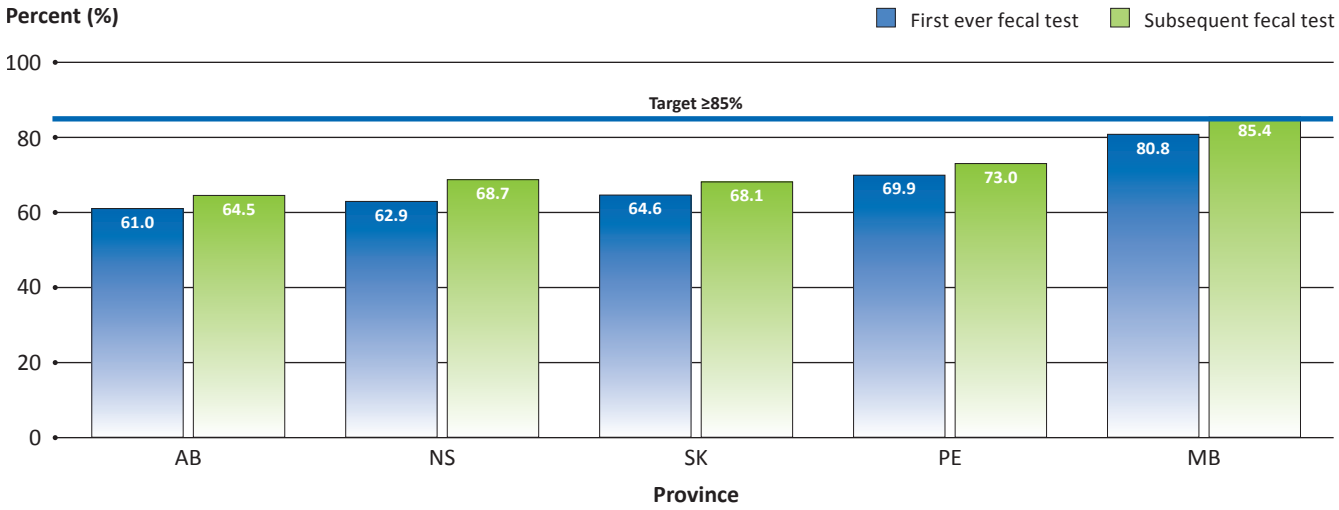


	AB	SK	NS	PE	NL	ON	MB
Individuals having follow-up colonoscopy within 180 days	19,717	7,559	3,877	874	541	15,395	1,322
Individuals with abnormal fecal test results	31,332	11,603	5,823	1,236	734	19,962	1,596

Follow-up colonoscopy uptake rate among those who had a follow-up colonoscopy performed within 180 days of an abnormal fecal test result.
AB: Follow-up colonoscopy uptake is underestimated owing to incomplete colonoscopy data. There is a delay between colonoscopy date and reporting date. Multiple data sources have been used to capture follow-up colonoscopies (National Ambulatory Care Reporting System [NACRS], Discharge Abstract Database [DAD] and physician claim database [billing data]). For NACRS and DAD, reporting delays may be six weeks or more. Available physician claims data in the data repository cover procedures up to March 31, 2015. The population for follow-up colonoscopy uptake is different from the numerator for the positivity rate, where data were for FTi only.
SK: Follow-up colonoscopy uptake is underestimated owing to incomplete colonoscopy data. Not all colonoscopy data has been retrieved for this measurement timeframe.
NS: Owing to a change in the sensitivity of the particular FTi being used and a subsequent increase in positive results, there was an increase in the number of colonoscopies required. This led to longer wait times than anticipated. Additionally, 10% of program participants chose follow-up outside the program. No data are available on these individuals.
ON: Data are for 2014 only.
MB: Includes data on individuals who were referred by ColonCheck and by primary care providers. Eight more people had one or more other follow-up procedures (computed tomographic colonography, flexible sigmoidoscopy); 117 people had no colonoscopy for medical reasons, patient refusal or other reasons not controlled by the screening program.
Data source: Provincial cancer agencies and programs.

FIGURE 19

Follow-up colonoscopy uptake among individuals with abnormal fecal test results, by province and screening round, 2013 and 2014 screening years combined



Follow-up colonoscopy uptake rate among those who had a follow-up colonoscopy performed within 180 days of an abnormal fecal test result.
AB: Follow-up colonoscopy uptake is underestimated owing to incomplete colonoscopy data. There is a delay between colonoscopy date and reporting date. Multiple data sources have been used to capture follow-up colonoscopies (National Ambulatory Care Reporting System [NACRS], Discharge Abstract Database [DAD] and physician claim database [billing data]). For NACRS and DAD, reporting delays may be six weeks or more. Available physician claims data in the data repository cover procedures up to March 31, 2015. The population for follow-up colonoscopy uptake is different from the numerator for the positivity rate, where data were for FTi only.
NS: Owing to a change in the sensitivity of the particular FTi being used and a subsequent increase in positive results, there was an increase in the number of colonoscopies required. This led to longer wait times than anticipated. Additionally, 10% of program participants chose follow-up outside the program. No data are available on these individuals.
SK: Follow-up colonoscopy uptake is underestimated owing to incomplete colonoscopy data. Not all colonoscopy data has been retrieved for this measurement timeframe.
MB: Includes data on individuals who were referred by ColonCheck and by primary care providers. Eight more people had one or more other follow-up procedures (computed tomographic colonography, flexible sigmoidoscopy); 117 people had no colonoscopy for medical reasons, patient refusal or other reasons not controlled by the screening program.
Data source: Provincial cancer agencies and programs.

Wait time to follow-up colonoscopy

Wait time to follow-up colonoscopy is defined as the time interval from an abnormal fecal test result to follow-up colonoscopy in the measurement timeframe.

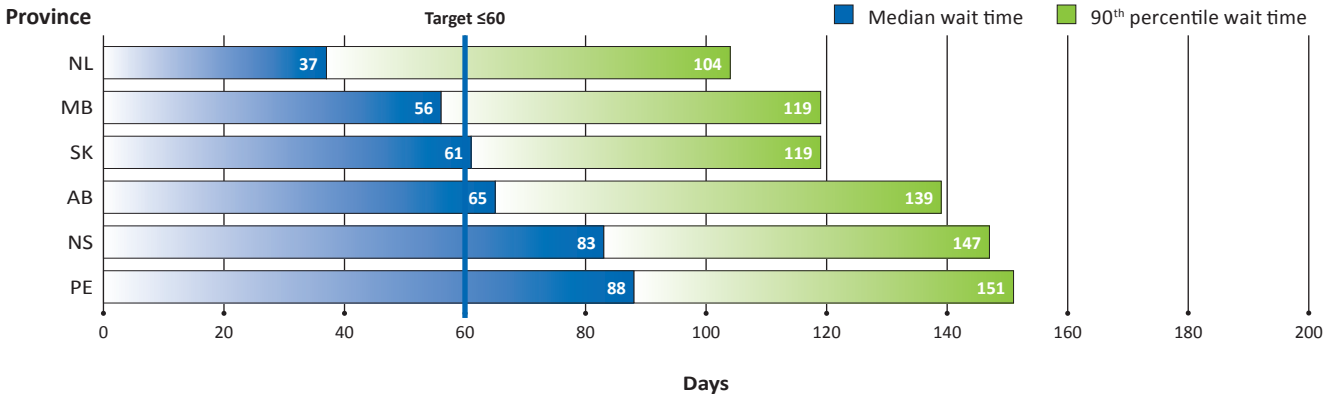
***Target:** ≥90% within 60 days of an abnormal fecal test result*

The wait time to follow-up colonoscopy provides information on the effectiveness of the referral system and the availability of the diagnostic procedure. Wait time to follow-up colonoscopy is presented as the median and 90th percentile number of calendar days from an abnormal fecal test result to a follow-up colonoscopy within 180 days of the abnormal fecal test. Colonoscopies performed more than 180 days after the abnormal fecal test are not included. The date of the abnormal fecal test is the date the result is reported by the laboratory for each individual test; if there is more than one abnormal fecal test, the date of the first test is used.

Among provinces that provided data in both the 2011–12 and 2013–14 colorectal cancer screening monitoring and evaluation reports, the 90th percentile for wait times to follow-up colonoscopy have decreased in some provinces, but increased in others. Among individuals who had a follow-up colonoscopy within 180 days of an abnormal fecal test result in 2013–14, wait times were within or near the target of 60 days for half of the individuals (median) in four provinces: Newfoundland and Labrador, Manitoba, Saskatchewan and Alberta. However, no province met the target and 90th percentile wait times in the seven reporting provinces indicate that many individuals had to wait twice the recommended number of days for their follow-up colonoscopy, ranging from 104 to 151 days (Figure 20). For all but one province, 90th percentile wait times were shorter in 2013–14 than in 2011–12 (Figure 21). Median wait time to follow-up colonoscopy is likely to be affected by the follow-up colonoscopy uptake rate, or the percentage of patients who undergo colonoscopy within 180 days (Figure 18), which ranged from 61.9% to 82.8%.

FIGURE 20

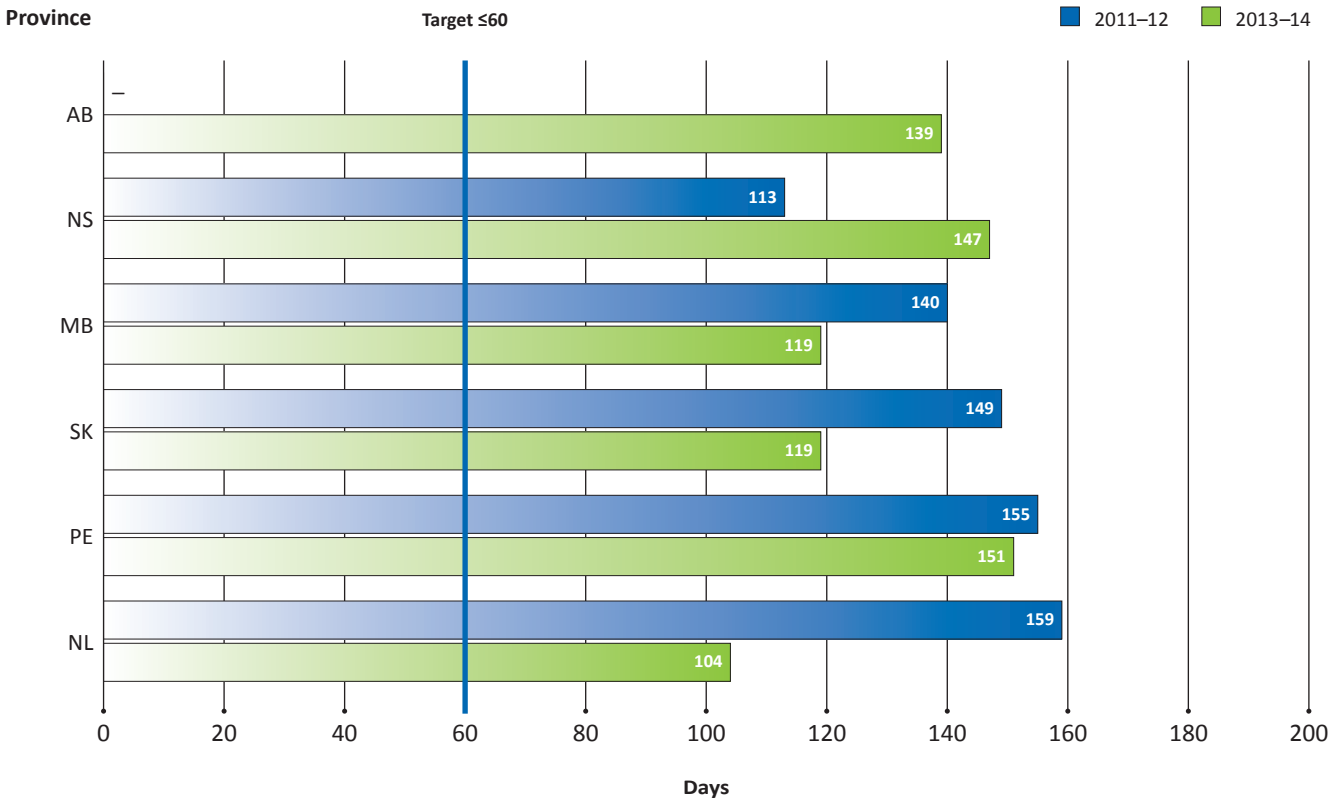
Median and 90th percentile wait times from abnormal fecal test result to follow-up colonoscopy, by province, 2013 and 2014 screening years combined



Wait time to follow-up colonoscopy is calculated among those who completed a colonoscopy within 180 days of an abnormal fecal test.
AB: Follow-up colonoscopy uptake is underestimated owing to incomplete colonoscopy data. There is a delay between colonoscopy date and reporting date. Multiple data sources have been used to capture follow-up colonoscopies (National Ambulatory Care Reporting System [NACRS], Discharge Abstract Database [DAD] and physician claim database [billing data]). For NACRS and DAD, reporting delays may be six weeks or more. Available physician claims data in the data repository cover procedures up to March 31, 2015. The population for wait time to follow-up colonoscopy is different from the numerator for the positivity rate, where data were for FTi only.
MB: Includes data on individuals who were referred by ColonCheck and by primary care providers. Eight more people had one or more other follow-up procedures (computed tomographic colonography, flexible sigmoidoscopy); 117 people had no colonoscopy for medical reasons, patient refusal or other reasons not controlled by the screening program.
NS: Owing to a change in the sensitivity of the particular FTi being used and a subsequent increase in positive results, there was an increase in the number of colonoscopies required. This led to longer wait times than anticipated. Additionally, 10% of program participants chose follow-up outside the program. No data are available on these individuals.
Data source: Provincial cancer agencies and programs.

FIGURE 21

90th percentile wait times from abnormal fecal test result to follow-up colonoscopy, by province, 2011–12 and 2013–14 screening years



—: Data not available.
Wait time to follow-up colonoscopy is calculated among those who completed a colonoscopy within 180 days of an abnormal fecal test.
AB: In 2013–14, follow-up colonoscopy uptake is underestimated owing to incomplete colonoscopy data. There is a delay between colonoscopy date and reporting date. Multiple data sources have been used to capture follow-up colonoscopies (National Ambulatory Care Reporting System [NACRS], Discharge Abstract Database [DAD] and physician claim database [billing data]). For NACRS and DAD, reporting delays may be six weeks or more. Available physician claims data in the data repository cover procedures up to March 31, 2015. The population for wait time to follow-up colonoscopy is different from the numerator for the positivity rate, where data were for FTi only.
NS: For 2013–14, owing to a change in the sensitivity of the particular FTi being used and a subsequent increase in positive results, there was an increase in the number of colonoscopies required. This led to longer wait times than anticipated. Additionally, 10% of program participants chose follow-up outside the program. No data are available on these individuals.
MB: Includes data on individuals who were referred by ColonCheck and by primary care providers. For 2013–14, eight more people had one or more other follow-up procedures (computed tomographic colonography, flexible sigmoidoscopy); 117 people had no colonoscopy for medical reasons, patient refusal or other reasons not controlled by the screening program.
SK: 2011–12 FTi includes data from only one health region.
PE: Early in 2012, FTi was implemented. In June 2012, FTg was discontinued.
NL: 2011–12 data are for the final five months of the reporting period, in one health region.
Data source: Provincial cancer agencies and programs.

Wait time from follow-up colonoscopy to definitive pathological diagnosis

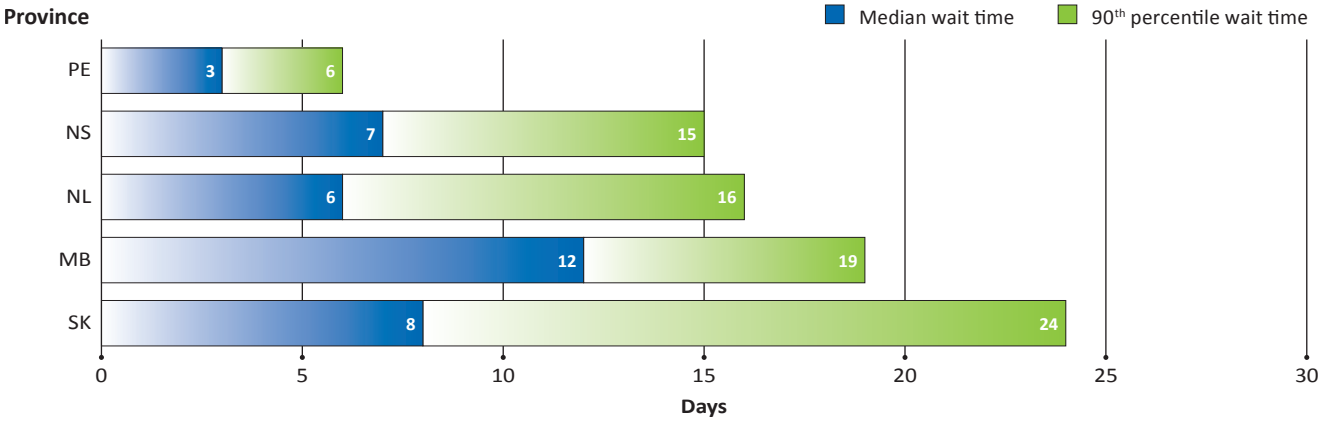
Wait time from follow-up colonoscopy to definitive pathological diagnosis is defined as the time from a follow-up colonoscopy procedure to definitive pathological diagnosis.

***Target:** Not yet determined*

While there is no national target for this indicator, the European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis (2010) suggest that the diagnosis should be available within 15 days of the colonoscopy.[26] Depending on the province, some patients wait longer than others to receive a diagnosis after colonoscopy, 90th percentile wait time varies from six days in Prince Edward Island to 24 days in Saskatchewan (Figure 22). But the suggested international target of 15 days was achieved, or nearly achieved, for 90% of individuals in three of the five provinces that provided data and was achieved for half of the individuals (median) in the five provinces.

FIGURE 22

Median and 90th percentile wait times from follow-up colonoscopy to definitive pathological diagnosis, by province, 2013 and 2014 screening years combined



Wait time from follow-up colonoscopy to definitive pathological diagnosis is calculated among those who completed a colonoscopy within 180 days of an abnormal fecal test.
Data source: Provincial cancer agencies and programs.

Positive predictive value adenoma(s)

The PPV adenoma is defined and measured in two ways.

a) the Programmatic PPV of the FT for Adenoma:

- *this is the proportion of people with abnormal fecal tests who are confirmed to have an adenoma*
- *a high PPV adenoma of a fecal test reflects a minimization of the harms of screening experienced through abnormal screening test results which do not result in a diagnosis of adenoma*
- *results are shown in figure 23 for all fecal tests and figure 24 for first and subsequent fecal tests*

b) the PPV of the FT for Adenoma(s) Among those Who Completed Follow-up:

- *this is the proportion of people with abnormal fecal tests and completed colonoscopy follow-up (within 180 days of the fecal test) who are confirmed to have an adenoma*
- *this definition is more focused on the likelihood that a follow-up colonoscopy results in a diagnosis of adenoma, and can be considered a marker of both the technical quality of the colonoscopy and the efficiency of the screening strategy*[28]
- *results are shown in figure 25 for all follow-up colonoscopies completed within 180 days of an abnormal screening result and figure 26 for follow-up colonoscopies stratified by screening round*

***Target:** ≥50% for FTi and ≥35% for FTg*

Note that the target for this indicator is currently under review.

Positive predictive value (PPV) is an indicator of the predictive validity of a screening test. It reflects the probability that a positive test result is associated with the presence of the underlying condition targeted by screening.

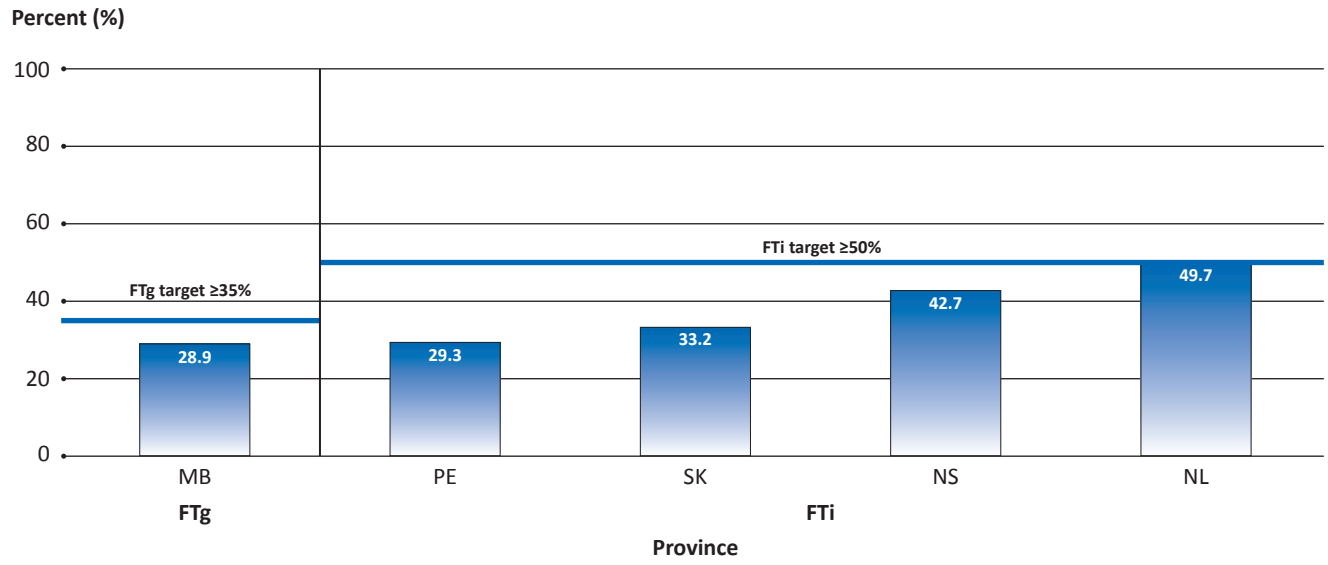
The positive predictive value adenoma (PPV adenoma) has been selected for reporting as a proxy indicator of the target disease, colorectal cancer. While less than ten percent of adenomas progress to colorectal cancer, nearly 95 percent of colorectal cancers develop from adenomas and individuals with a history of adenomas are at increased risk of developing colorectal cancer.[27] The detection and removal of adenomas may prevent progression to colorectal cancer.

The PPV for adenoma depends on the sensitivity of the screening test, the positivity rate, the positivity cut-off for the FT, the quality of the colonoscopy, follow-up compliance and underlying prevalence of disease in the screening population. The programmatic PPV of the FT for adenomas and the PPV of the FT for adenomas among those who completed follow-up show quite a variation across provinces.

Four of the five provinces providing data for this indicator achieved the target for PPV for adenoma calculated for PPV of follow-up colonoscopy (Figure 25). It appears that in this first time reporting of results by screening round, the PPV's are either similar between the initial and subsequent FT screens, or slightly higher in first ever FTs. Monitoring over time will provide confirmation of the trend between the screening rounds.

FIGURE 23

Positive predictive value of a fecal test for detection of adenomas, by province, both sexes combined, 2013 and 2014 screening years combined

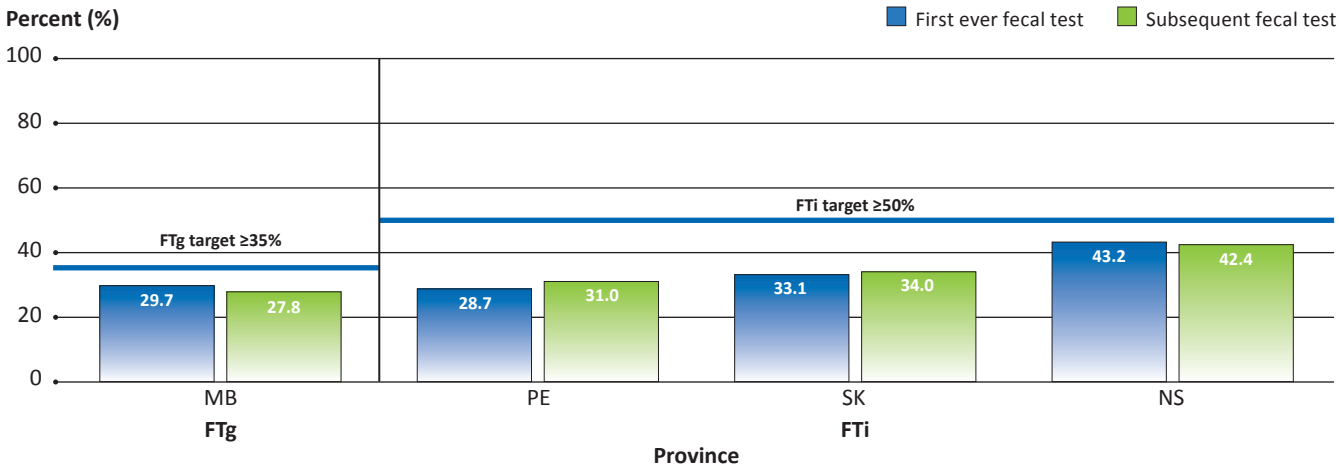


	MB	PE	SK	NS	NL
Number of individuals with an abnormal fecal test (denominator for Figures 23–24)	1,596	1,236	11,603	5,823	734
Number of individuals with adenoma(s)	461	362	3,855	2,487	365

FTg = guaiac fecal test; FTi = immunochemical fecal test.
Data for the number of individuals with adenoma were derived from the total number of individuals with neoplasia (adenomas, advanced adenomas, invasive colorectal cancer, neoplasia, advanced neoplasia) minus the total number of individuals with invasive colorectal cancer.
The numerator for PPV adenoma(s) refers to those in whom one or more adenomas were confirmed by pathology at follow-up colonoscopy performed within 180 days of the abnormal FT.
PPV of fecal test is underestimated owing to incomplete colonoscopy data. Not all colonoscopy data has been retrieved for this measurement timeframe.
NS: 10% of participants with an abnormal fecal test result for whom colonoscopy was recommended were followed up outside the program; no data are available on these individuals.
The positive predictive value of the fecal test is underestimated owing to incomplete colonoscopy data. Not all colonoscopy data has been retried for this measurement time frame.
Data source: Provincial cancer agencies and programs.

FIGURE 24

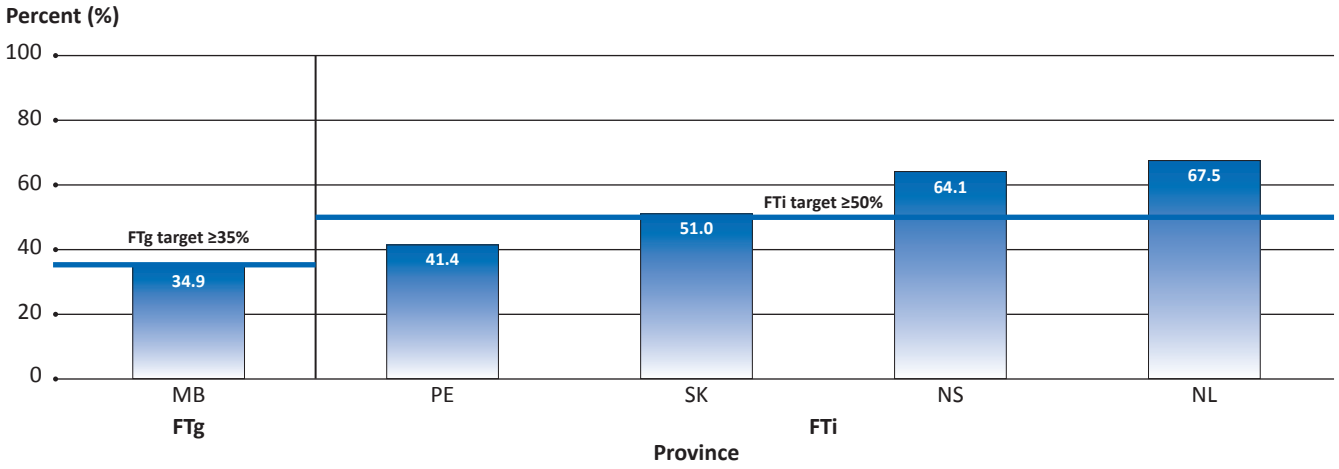
Positive predictive value of a fecal test for detection of adenomas, by province and screening round, both sexes combined, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
Data for the number of individuals with adenoma were derived from the total number of individuals with neoplasia (adenomas, advanced adenomas, invasive colorectal cancer, neoplasia, advanced neoplasia) minus the total number of individuals with invasive colorectal cancer.
The numerator for PPV adenoma(s) refers to those in whom one or more adenomas were confirmed by pathology at follow-up colonoscopy performed within 180 days of the abnormal FT.
NS: 10% of participants with an abnormal test result for whom colonoscopy was recommended were followed up outside the program; no data are available on these individuals.
Data source: Provincial colorectal cancer screening agencies and programs.

FIGURE 25

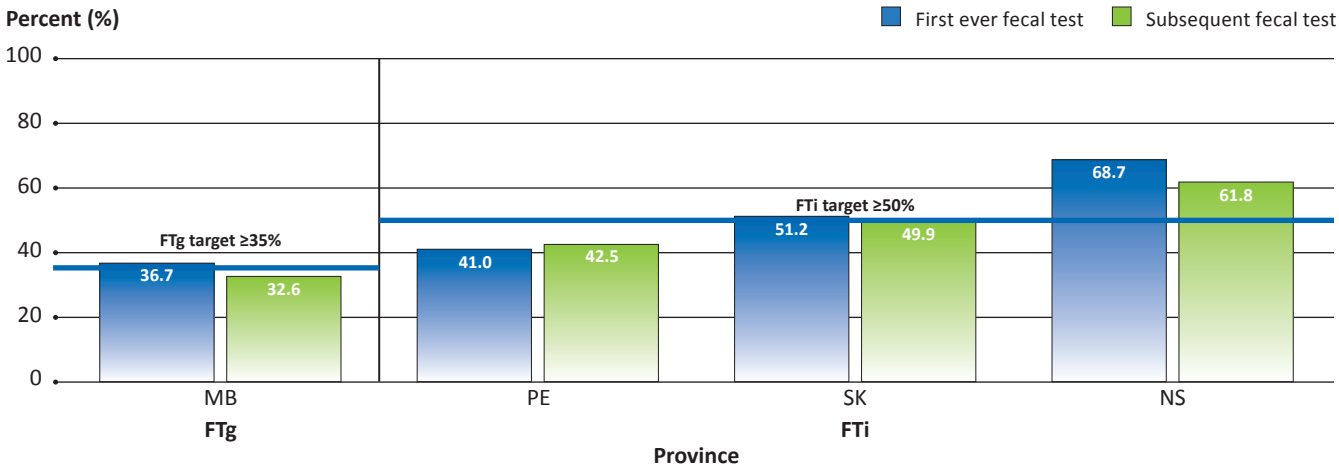
Positive predictive value of follow-up colonoscopy for detection of adenomas, by province, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
Data for the number of individuals with adenoma were derived from the total number of individuals with neoplasia (adenomas, advanced adenomas, invasive colorectal cancer, neoplasia, advanced neoplasia) minus the total number of individuals with invasive colorectal cancer.
The numerator for PPV adenoma(s) refers to those in whom one or more adenomas were confirmed by pathology at follow-up colonoscopy performed within 180 days of the abnormal FT.
NS: 10% of participants with an abnormal test result for whom colonoscopy was recommended were followed up outside the program; no data are available on these individuals.
Data source: Provincial cancer agencies and programs.

FIGURE 26

Positive predictive value of follow-up colonoscopy for detection of adenomas, by province and screening round, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
Data for the number of individuals with adenoma were derived from the total number of individuals with neoplasia (adenomas, advanced adenomas, invasive colorectal cancer, neoplasia, advanced neoplasia) minus the total number of individuals with invasive colorectal cancer.
The numerator for PPV adenoma(s) refers to those in whom one or more adenomas were confirmed by pathology at follow-up colonoscopy performed within 180 days of the abnormal FT.
NS: 10% of participants with an abnormal test result for whom colonoscopy was recommended were followed up outside the program; no data are available on these individuals.
Data source: Provincial cancer agencies and programs.

Program adenoma detection rate

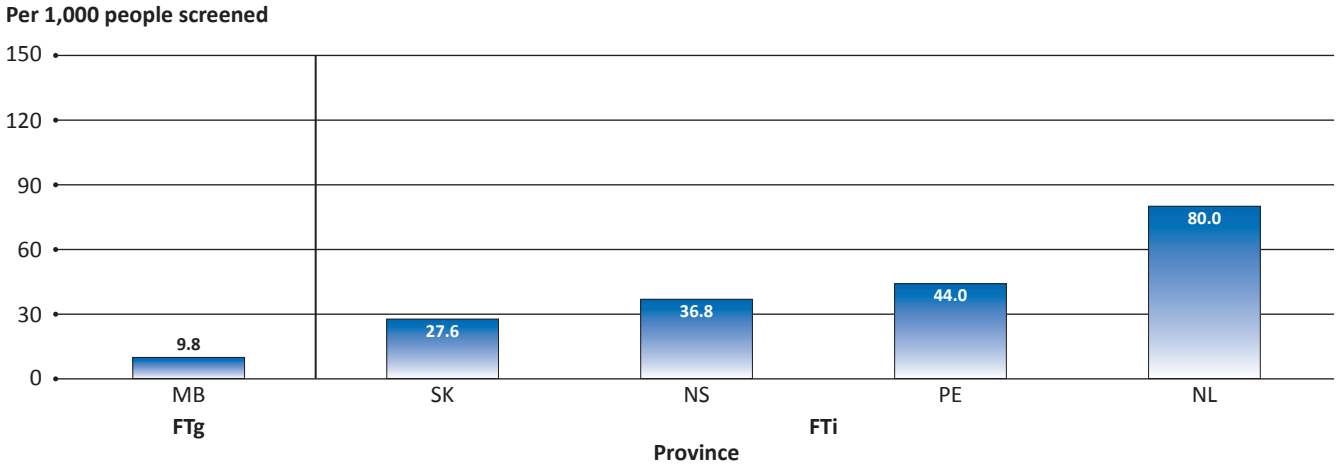
Program adenoma detection rate is defined as the number of individuals per 1,000 screened with one or more adenomas confirmed by pathology from a follow-up colonoscopy performed within 180 days of the abnormal fecal test result.

***Target:** Not yet determined*

This indicator reflects the technical quality of the colonoscopy procedure and the efficacy of the entire screening program strategy.[28] Adenoma detection rates were very different across provinces, ranging from 9.8 to 80.0 per 1,000 individuals screened with a fecal test (Figure 27). As expected based on the literature, the rate is higher in males than in females and, to a lesser extent, in first as opposed to subsequent screens (Figures 28 and 29).[21,24]

FIGURE 27

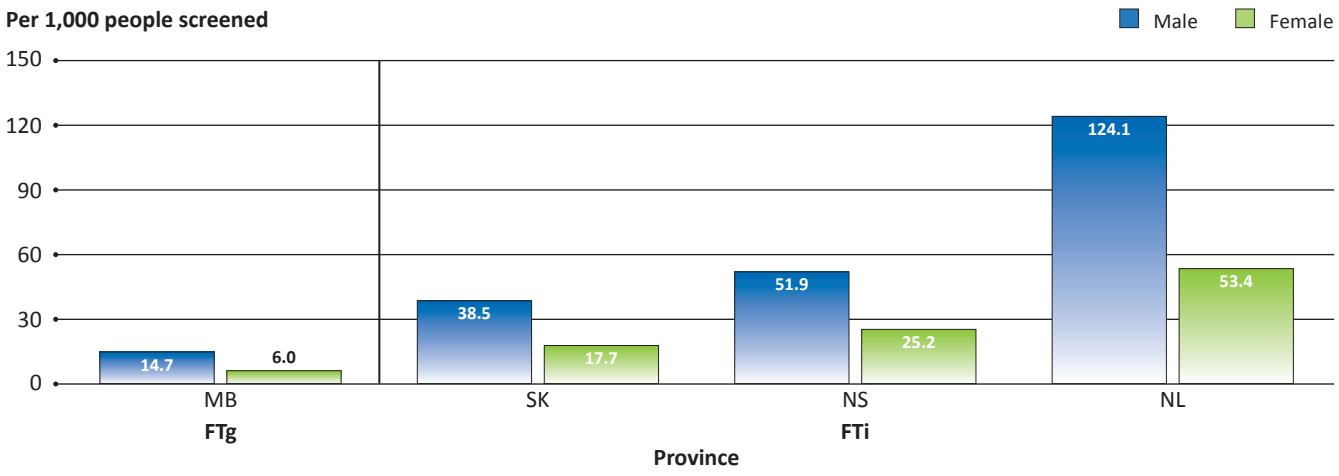
Program adenoma detection rate, by province, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
Data for the number of individuals with adenoma were derived from the total number of individuals with neoplasia (adenomas, advanced adenomas, invasive colorectal cancer, neoplasia, advanced neoplasia) minus the total number of individuals with invasive colorectal cancer.
NS: 10% of participants with an abnormal fecal test result for whom colonoscopy was recommended were followed up outside the program; no data are available on these individuals.
Data source: Provincial cancer agencies and programs.

FIGURE 28

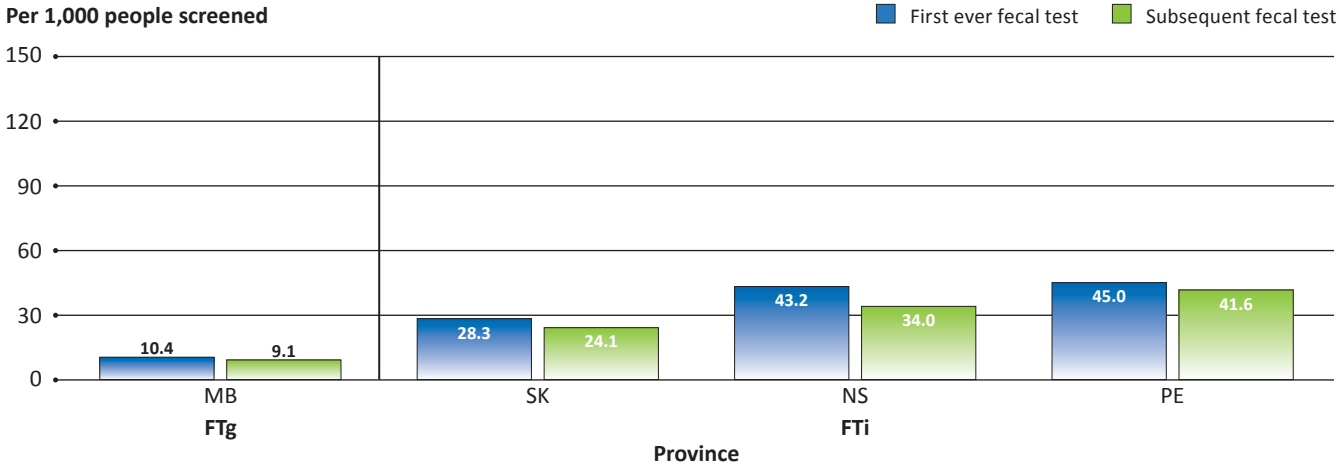
Program adenoma detection rate, by province and sex, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
Data for the number of individuals with adenoma were derived from the total number of individuals with neoplasia (adenomas, advanced adenomas, invasive colorectal cancer, neoplasia, advanced neoplasia) minus the total number of individuals with invasive colorectal cancer.
NS: 10% of participants with an abnormal fecal test result for whom colonoscopy was recommended were followed-up outside the program; no data are available on these individuals.
Data source: Provincial cancer agencies and programs.

FIGURE 29

Program adenoma detection rate, by province and screening round, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
Data for the number of individuals with adenoma were derived from the total number of individuals with neoplasia (adenomas, advanced adenomas, invasive colorectal cancer, neoplasia, advanced neoplasia) minus the total number of individuals with invasive colorectal cancer.
NL: Did not provide data by screening round.
Data source: Provincial cancer agencies and programs.

Program invasive colorectal cancer detection rate

Program invasive colorectal cancer detection rate is defined as the number of individuals per 1,000 screened with invasive colorectal cancer on pathology from a follow-up colonoscopy performed within 180 days of the abnormal fecal test result.

***Target:** ≥2 colorectal cancer cases per 1,000 people screened*

Measuring the cancer detection rate at the program level may help to assess the effectiveness of a screening program over time. Detection rates depend on many factors, including the sensitivity of the screening test and the ability to provide timely, high-quality follow-up procedures to all individuals with abnormal screening results.

In 2013–14, the colorectal cancer detection rate varied greatly among provinces, from 1.0 per 1,000 people screened in Manitoba to 7.7 per 1,000 screened in Newfoundland and Labrador (Figure 30). The type of fecal test, brand, test thresholds, screening program stage and the prevalence of colorectal cancer in specific provinces must be taken into account when interpreting results for this indicator (see Figure 1). Indicator results must also be correlated with program adenoma detection rates (Table 2) and with the stage distribution of screen-detected cancers (Figures 33 and 34).

The target of two or more colorectal cancers detected per 1,000 individuals screened was achieved in four of the six provinces providing data for this indicator. Colorectal cancer detection rates are higher in males than in females, and in first-ever rather than subsequent screens (except in Prince Edward Island, where rates are based on small numbers, and Alberta which transitioned from FTg to FTi during the report period) (Figures 30 and 31).

Table 2 presents the positivity, follow-up compliance, positive predictive value and adenoma and invasive colorectal cancer detection rates for the provinces for which data were available for 2013–14. The PPV is influenced by the positivity rate, the cancer detection rate, follow-up uptake and disease prevalence. When a high positivity rate is due to a high number of false-positive fecal test results, the PPV for adenoma will be lower. When a low positivity rate is the result of a high number of false-negative fecal test results, the adenoma detection rate will be lower. The PPV for adenoma is lower and less variable across provinces when calculated among all abnormal fecal test results (from 28.9% to 49.7%, Figure 23) than when calculated among individuals with abnormal fecal test results who also underwent follow-up colonoscopy within 180 days (from 34.9% to 67.5%, Figure 25). The former includes in the denominator screening participants who had an abnormal fecal test result but did not proceed to colonoscopy within 180 days, which is, in part, a function of provincial colonoscopy resource availability.

The interrelationship between these indicators is also affected by factors such as the colorectal cancer prevalence, the quality of the colonoscopy, and the brand and cut-off rates of the fecal test. Further, when looking at the cancer detection rates, any difference across Canada may not be statistically significant because of the relatively small number of cases in some provinces. As a result, while considering these indicators jointly may provide more contextual information on the effectiveness of screening, robust comparison across provinces may not be possible.

TABLE 2

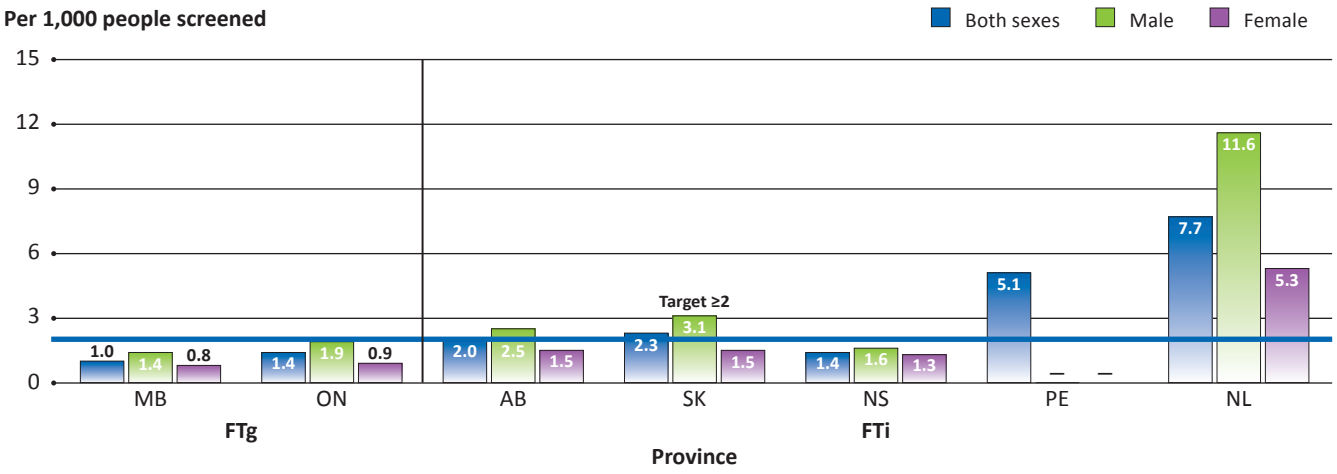
Relationship between key indicators for colorectal cancer screening, 2013 and 2014 screening years combined

Province	Test type	Positivity rate (%)	Follow-up colonoscopy uptake rate (%)	PPV for adenoma(s)		Program adenoma detection rate	Program invasive colorectal cancer rate
				Colonoscopy (%)	Fecal test (%)	per 1,000 screened	per 1,000 screened
MB	FTg	3.4	82.8	34.9	28.9	9.8	1.0
ON	FTg	4.0	77.1	—	—	—	1.4
SK	FTi	8.3	65.1	51.0	33.2	27.6	2.3
NS	FTi	8.6	66.6	64.1	42.7	36.8	1.4
AB	FTi	9.7	62.9	—	—	—	2.0
PE	FTi	15.0	70.7	41.4	29.3	44.0	5.1
NL	FTi	16.1	73.7	67.5	49.7	80.0	7.7

PPV = positive predictive value; FTg = guaiac fecal test; FTi = immunochemical fecal test.
Data for the number of individuals with adenoma were derived from the total number of individuals with neoplasia (adenomas, advanced adenomas, invasive colorectal cancer, neoplasia, advanced neoplasia) minus the total number of individuals with invasive colorectal cancer.
'—': Data not available.
ON: Data for positivity rate and follow-up colonoscopy rate are for 2014 only. Data for program invasive colorectal cancer rate are for 2013 only.
Data source: Provincial cancer agencies and programs.

FIGURE 30

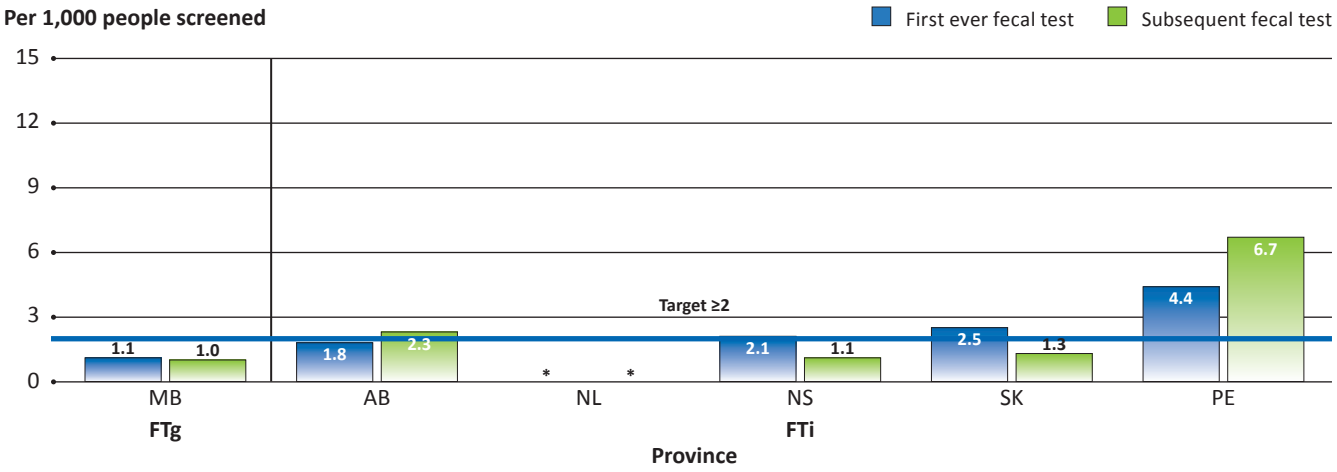
Program invasive colorectal cancer detection rate, by province and sex, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
—: Data not available.
The program invasive colorectal cancer detection rate does not include cancer of the appendix.
MB: Numerator includes eight people with colorectal cancer confirmed by pathology from other procedures within 180 days of abnormal fecal test result.
NS: Cancer registration is complete to December 31, 2013 (any available cases from 2014 are included). However, 180 days after a successful FTi on December 31, 2014, means a diagnosis date of as late as June 30, 2015. Thus, this indicator does not allow for adequate follow-up time. Projected cases would reach 2.0 per 1,000 successful FTi tests. 10% of participants with an abnormal fecal test result for whom colonoscopy was recommended were followed up outside the program; no data are available on these individuals.
ON: 2013 only.

FIGURE 31

Program invasive colorectal cancer detection rate, by province and screening round, 2013 and 2014 screening years combined



FTg = guaiac fecal test; FTi = immunochemical fecal test.
* Suppressed owing to small numbers.
The program invasive cancer detection rate does not include cancer of the appendix.
MB: Numerator includes eight people with colorectal cancer confirmed by pathology from other procedures within 180 days of abnormal fecal test result.
AB: FTi replaced FTg as the primary screening test in November 2013.
NS: Cancer registration is complete to December 31, 2013 (any available cases from 2014 are included). However, 180 days after a successful FTi on December 31, 2014, means a diagnosis date of as late as June 30, 2015. Thus, this indicator does not allow for adequate follow-up time. Projected cases would reach 2.0 per 1,000 successful FTi tests. 10% of participants with an abnormal fecal test result for whom colonoscopy was recommended were followed up outside the program; no data are available on these individuals.
PE: The greater invasive colorectal cancer detection rate in subsequent versus first screens may be due to the low number of individuals with a subsequent screen.

Invasive colorectal cancer stage distribution

Invasive colorectal cancer stage distribution is defined as the distribution of screen-detected invasive colorectal cancers by tumour, node and metastases (TNM) stage.

***Target:** Not applicable*

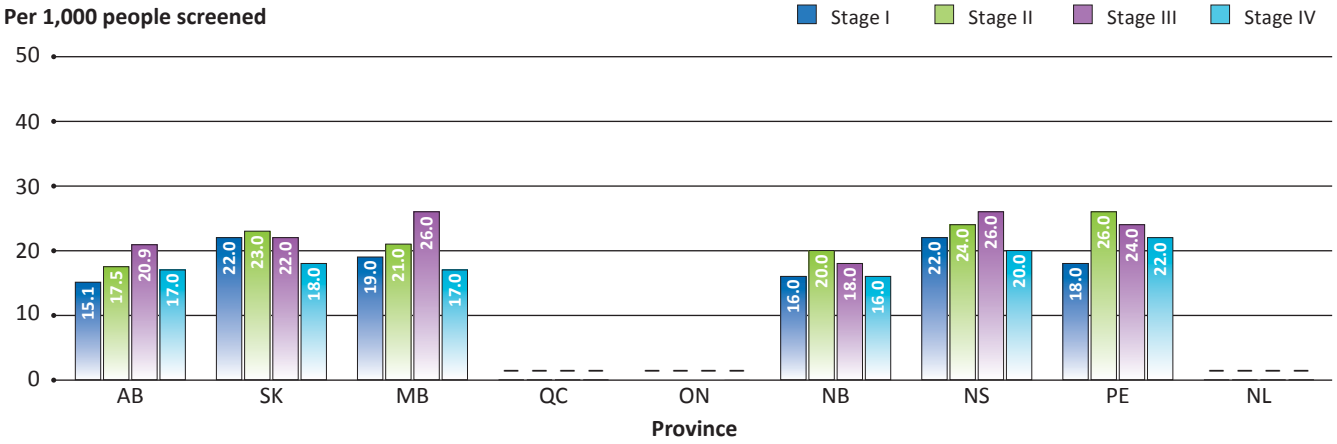
Colorectal cancer screening aims to detect cancer at an early stage, which allows for more successful treatment, leading to a reduction in colorectal cancer mortality. Figure 32 shows age-standardized incidence rates in 2011 to 2013 diagnosis years combined by province.

Figure 33 shows that the combination of Stage I and II in the distribution of invasive colorectal cancer varies from 53.7% in Prince Edward Island to 76.8% in Nova Scotia. Figure 34 shows that subsequent screens detected a smaller proportion of Stage III and IV invasive colorectal cancer than first screens, which is expected.

Although it may be too soon to see a measurable impact from colorectal cancer screening in Canada on stage at diagnosis, the incidence of colorectal cancer diagnosed at later stages (Stages III and IV) in the general population should decline as screening programs achieve higher uptake.

FIGURE 32

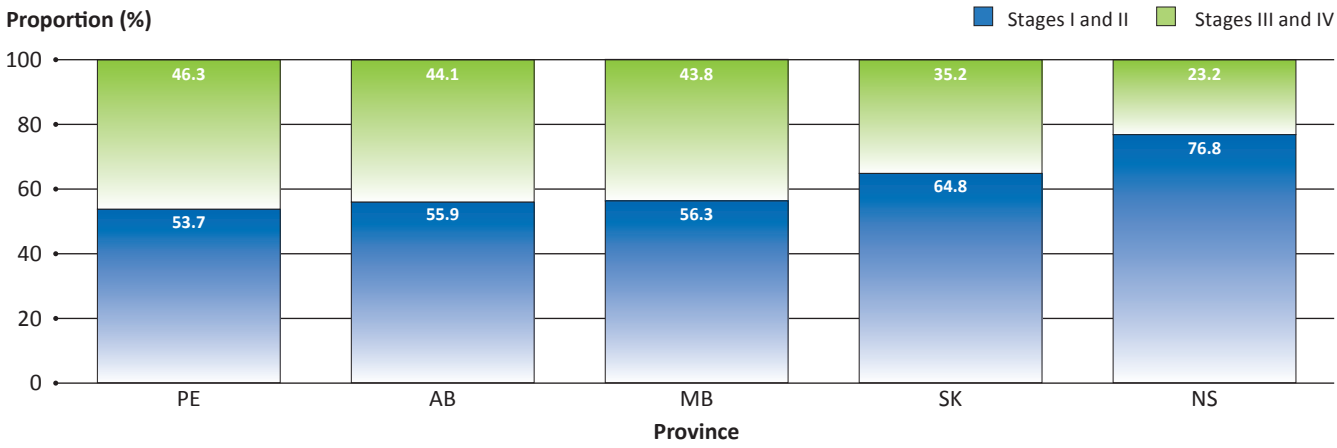
Incidence rates for colorectal cancer, by stage at diagnosis and by province, 2011–13 diagnosis years combined



—: Data not available.
Incidence rates were age standardized to the 2011 Canadian population.
Territories were excluded owing to small numbers.
The incidence rates do not include cancer of the appendix.
Data source: Provincial cancer agencies and programs.

FIGURE 33

Distribution of invasive colorectal cancer cases from follow-up colonoscopies after abnormal fecal test results, by stage and province, 2013 and 2014 screening years combined

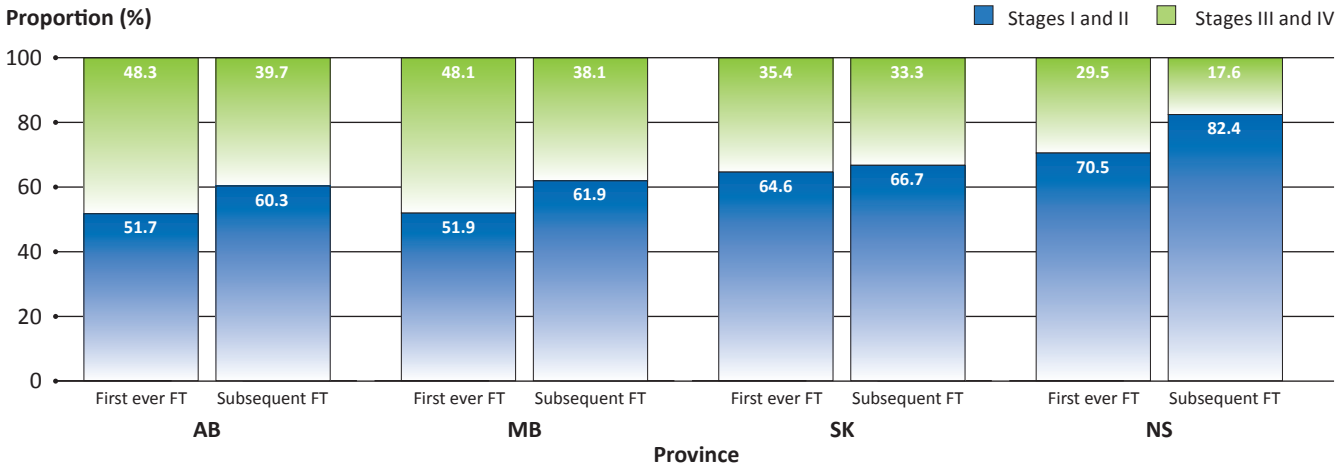


Province	Total cases	Stage I/II	Proportion (%)	Stage III/IV	Proportion (%)
PE	41	22	53.7	19	46.3
AB	701	392	55.9	309	44.1
MB	48	27	56.3	21	43.8
SK	267	173	64.8	94	35.2
NS	95	73	76.8	22	23.2

Stages I/II and III/IV combined owing to small numbers.
Invasive colorectal cancer stage distribution is calculated among those who completed a follow-up colonoscopy within 180 days of an abnormal fecal test.
AB: Colorectal cancer cases were staged using AJCC 6th and AJCC 7th.
NS: 10% of participants with an abnormal fecal test result for whom colonoscopy was recommended were followed up outside the program; no data are available on these individuals.
Data source: Provincial cancer agencies and programs.

FIGURE 34

Distribution of colorectal cancer cases from follow-up colonoscopies after abnormal fecal test results, by stage and screening sequence, 2013 and 2014 screening years combined



Province	Screening round	Total cases	Stage I/II		Stage III/IV	
			Cases	Proportion (%)	Cases	Proportion (%)
AB	First ever FT	356	184	51.7	172	48.3
	Subsequent FT	345	208	60.3	137	39.7
MB	First ever FT	27	14	51.9	13	48.1
	Subsequent FT	21	13	61.9	8	38.1
SK	First ever FT	240	155	64.6	85	35.4
	Subsequent FT	27	18	66.7	9	33.3
NS	First ever FT	44	31	70.5	13	29.5
	Subsequent FT	51	42	82.4	9	17.6

FT = fecal test.
Stages I/II and III/IV combined owing to small numbers.
Invasive colorectal cancer stage distribution is calculated among those who completed a follow-up colonoscopy within 180 days of an abnormal fecal test.
AB: Colorectal cancer cases were staged using AJCC 6th and AJCC 7th.
NS: 10% of participants with an abnormal fecal test result for whom colonoscopy was recommended were followed up outside the program; no data are available on these individuals.
Data source: Provincial cancer agencies and programs.

Interval colorectal cancer

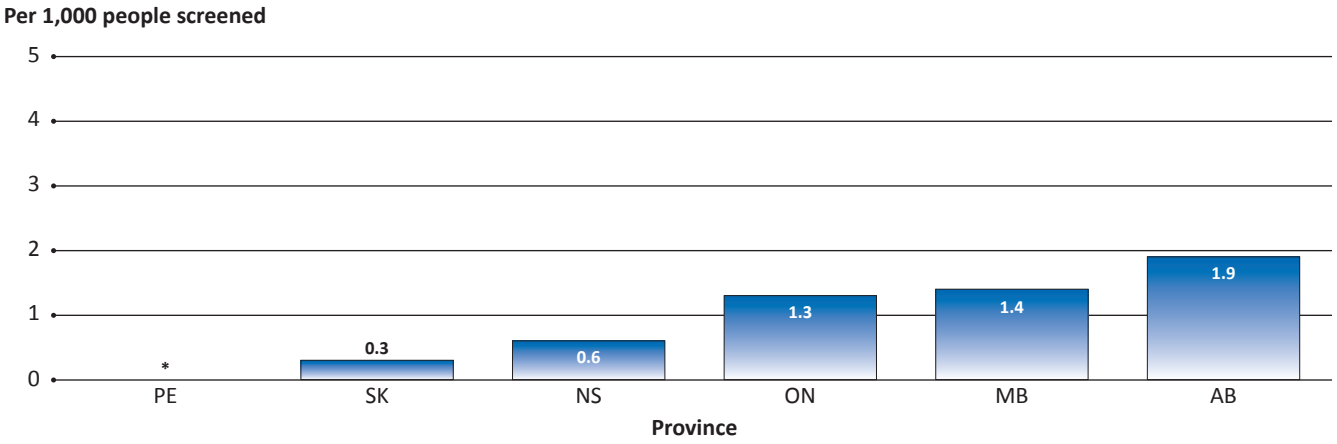
Interval colorectal cancer rate is defined as the number of individuals per 1,000 screened with a screening episode negative for colorectal cancer (i.e., negative fecal test or positive fecal test followed by negative colonoscopy) who were subsequently diagnosed with colorectal cancer before their next scheduled screening test.

***Target:** Not yet determined*

Monitoring of interval cancers is a crucial part of evaluating colorectal cancer screening programs because it provides a mechanism to evaluate the likely impact of screening programs on colorectal cancer mortality in the target population.[29] Five plausible reasons have been suggested to explain some of the interval cancers: a fecal test with a false-negative result, missed polyps or colorectal cancer during endoscopy, incompletely resected polyps, rapid progression of new polyps and failure of biopsy to diagnose a colorectal cancer that was present.[30] The number of provinces reporting on interval colorectal cancers increased in this report compared with the 2011–12 colorectal cancer screening report. Interval cancer rates ranged from 0.3 to 1.9 per 1,000 people screened for individuals screened in 2011–12 (Figure 35).

FIGURE 35

Interval colorectal cancer rate, by province, 2011 and 2012 screening years combined



* Suppressed owing to small numbers.
ON: 2012 data only.
AB: Use of the immunochemical fecal test (FTi) was implemented province-wide November 2013, replacing guaiac fecal tests (FTg) as primary screening test for colorectal cancer. Interval cancer rate per 1,000 individuals screened is FTg-based. Interval cancer cases exclude screen-detected cancer during 2013–14. Example: an individual had an FTg May 17, 2012, with a negative result, an FTi February 6, 2014, with a positive result and colonoscopy April 17, 2014, with a cancer diagnosis. According to the program's invasive colorectal cancer detection rate indicator, this is defined as screen-detected cancer. However, based on the definition of the interval cancer indicator, this case is also defined as interval cancer. Not all similar cancer cases were counted as interval cancer.
Data source: Provincial cancer agencies and programs.

Future Directions

This report reveals that significant variations remain across provinces in terms of screening program implementation, uptake and achievement of targets for quality indicators. More provinces were able to provide data to describe programmatic colorectal cancer screening in Canada in this report than for the previous colorectal cancer screening monitoring and evaluation report for 2011–12.

This report differed from the previous report in that it compared indicator results for first-time screening participants and for individuals who were undergoing a subsequent screen. The two groups differ in the number of underlying cancers and adenomas that exist at the time of the screen. First-time screening participants tend to have more underlying disease that has been developing over years and not been previously detected. Thus it would be expected that there would be higher positivity rates and higher cancer and adenoma detection rates in this group than among the screening participants undergoing a subsequent screen.[31–33]

The data do show, however, that the effect is small on this first round of analysis of the two groups. It may be that as additional data accumulate for individuals going through repeated routine screening, the differences will be larger between first and subsequent screening participants. In future, it may be possible to set targets for some of the indicators that are specific for each of these two groups.

The report also assessed the interrelationships between some of the quality indicators, though making more formal comparisons across provinces and territories remains a challenge because of differences in tests used, the number of samples required and thresholds for positivity, among other considerations.

It has been demonstrated that screening delivered through organized programs has a greater potential to reduce cancer incidence and mortality, is more cost effective and is more likely to reduce potential harms from screening than is non-programmatic screening.[10] However, increased standardization of data elements, data collection and data submission is required in order to better assess the impact of colorectal cancer screening at the national level. Research is also needed on the reasons individuals continue to be screened outside organized programs or do not participate in screening.

In future, as colorectal cancer screening programs mature, ongoing national monitoring and evaluation will provide the opportunity to identify best practices in order to continually improve colorectal cancer screening services for Canadians.

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Appendix A

Colorectal Cancer Screening Quality Indicator Definitions

Indicator definition & target	Calculation
Participation	
Participation Rate **Definition:** The percentage of the target population that successfully completed at least one FT in the program within the measurement timeframe of 30 months ***Target:*** *≥60% of the target population within the specified period*	**Numerator:** Number of individuals who successfully completed at least one FT in the program within a 30-month period **Denominator:** Number of individuals to whom the program was available in a defined 24-month period (Jan 1, 2013, to Dec 31, 2014)
Fecal Test Utilization **Definition:** The percentage of the target population that completed at least one FT, either programmatic or non-programmatic, within the measurement timeframe ***Target:*** *Not yet determined*	**Numerator:** Number of individuals within the target population with at least one FT within the measurement timeframe (programmatic or non-programmatic) **Denominator:** Number of individuals in the target population within the measurement timeframe (2013, 2014)
Retention Rate **Definition:** The percentage of the target population aged 50 to 72 years of age rescreened within 30 months after a normal FT in the measurement timeframe ***Target:*** *Not yet determined*	**Numerator:** Number of individuals with successful FTs in the measurement timeframe who had at least one subsequent successful FT in the program within 30 months **Denominator:** Number of individuals aged 50–72 with normal FT results within the measurement timeframe (Jan 1, 2011 – Dec 31, 2012)
Entry-Level Screening Test	
Fecal Test Inadequacy Rate **Definition:** The percentage of individuals whose FT was inadequate and who have not repeated the test to get a successful FT result within the measurement timeframe ***Target:*** *≤5% of all FTs*	**Numerator:** Number of individuals having an inadequate FT who have not repeated the test to obtain a successful FT laboratory result within the measurement timeframe **Denominator:** Number of individuals having a FT within the measurement timeframe (Jan 1, 2013 – Dec 31, 2014)
Positivity Rate **Definition:** The percentage of individuals with an abnormal FT result in the measurement timeframe ***Target:*** *Not yet determined*	**Numerator:** Number of individuals with an abnormal FT result **Denominator:** Number of individuals having had at least one successful FT processed by a laboratory within the measurement timeframe (Jan 1, 2013 – Dec 31, 2014)

FT = fecal test; PPV = positive predictive value; FTg = guaiac fecal test; FTi = immunochemical fecal test; CRC = colorectal cancer; TNM = tumour, node, metastases.

Indicator definition & target	Calculation
Follow-up Colonoscopy	
Follow-up Colonoscopy Uptake Rate **Definition:** The percentage of individuals who had a follow-up colonoscopy performed within 180 days of an abnormal FT result in the measurement timeframe ***Target:*** *≥85%*	**Numerator:** Number of individuals who had a follow-up colonoscopy performed within 180 days of an abnormal FT result **Denominator:** Number of individuals with an abnormal FT lab result within the measurement timeframe (Jan 1, 2013 – Dec 31, 2014)
Wait Time to Follow-up Colonoscopy **Definition:** The time from an abnormal FT result to follow-up colonoscopy ***Target:*** *≥90% within 60 days of an abnormal FT result*	Median and 90th percentile number of calendar days from an abnormal FT result in the measure timeframe (Jan 1, 2013 – Dec 31, 2014) to a follow-up colonoscopy within within 180 days
Diagnosis and Initiation of Treatment	
Positive Predictive Value (PPV) for Adenoma **Definition:** **a)** Percentage of individuals with an abnormal FT in whom one or more adenomas were confirmed by pathology **b)** Percentage of individuals with an abnormal FT who also completed a follow-up colonoscopy (within 180 days of the FT) in whom one or more adenomas were confirmed by pathology ***Target:*** *≥50% for FTi* *≥35% for FTg*	**Numerator:** Number of individuals with one or more adenoma (excluding invasive CRC) on pathology from colonoscopy within 180 days of an abnormal FT result obtained within the measurement timeframe **Denominator:** **a)** Number of individuals with an abnormal FT within the measurement timeframe (Jan 1, 2013 – Dec 31, 2014) **b)** Number of individuals with an abnormal FT within the measurement timeframe (Jan 1, 2013 – Dec 31, 2014) who had a follow-up colonoscopy within 180 days
Wait Time from Follow-up Colonoscopy to Definitive Pathological Diagnosis **Definition:** Time from a follow-up colonoscopy to definitive pathological diagnosis ***Target:*** *Not yet determined*	Median and 90th percentile number of calendar days between colonoscopy (within 180 days of the abnormal FT) and definitive pathological diagnosis
Colorectal Cancer Screening Program Outcomes	
Program Adenoma Detection Rate **Definition:** The number of individuals per 1,000 screened with one or more adenomas confirmed by pathology from a follow-up colonoscopy performed within 180 days of an abnormal FT result in the measurement timeframe ***Target:*** *Not yet determined*	**Numerator:** Number of individuals with one or more adenomas confirmed by pathology from a follow-up colonoscopy performed within 180 days of an abnormal FT result obtained within the measurement timeframe **Denominator:** Number of individuals having had at least one successful FT processed by a laboratory within the measurement timeframe (Jan 1, 2013 – Dec 31, 2014)

FT = fecal test; PPV = positive predictive value; FTg = guaiac fecal test; FTi = immunochemical fecal test; CRC = colorectal cancer; TNM = tumour, node, metastases.

Indicator definition & target	Calculation
Colorectal Cancer Screening Program Outcomes	
Program Invasive Colorectal Cancer Detection Rate **Definition:** The number of individuals per 1,000 screened with invasive CRC confirmed by pathology from a follow-up colonoscopy performed within 180 days of an abnormal FT result in the measurement timeframe ***Target:*** *≥2 CRCs per 1,000 people screened*	**Numerator:** Number of individuals with invasive CRC on pathology from a follow-up colonoscopy performed within 180 days of the date of an abnormal FT result obtained within the measurement timeframe Invasive CRC in ICD-10 includes C18.0, C18.2-C18.9, C19, C20, C26.0 with behaviour 3, but the following histology types excluded: colon lymphoma, sarcoma and carcinoid Group stages were classified using American Joint Committee on Cancer (AJCC) 7th edition **Denominator:** Number of individuals having had at least one successful FT processed by a laboratory within the measurement timeframe (Jan 1, 2013 – Dec 31, 2014)
Invasive Colorectal Cancer Stage Distribution **Definition:** The distribution of screen-detected invasive CRC by TNM stage ***Target:*** *Not yet determined*	**Numerator:** Number of individuals with invasive CRC Stage I, II, III or IV; unknown stage; and unstaged diagnosed by the screening program from a follow-up colonoscopy within 180 days after an abnormal FT result within the measurement timeframe Invasive CRC in ICD-10 includes C18.0, C18.2-C18.9, C19, C20, C26.0 with behaviour 3, but the following histology types excluded: colon lymphoma, sarcoma and carcinoid Group stages were classified using American Joint Committee on Cancer (AJCC) 7th edition **Denominator:** Number of individuals with invasive CRC (including of unknown stage) confirmed by pathology at follow-up colonoscopy within 180 days after an abnormal FT result within the measurement timeframe (Jan 1, 2013 – Dec 31, 2014)
Interval Colorectal Cancer **Definition:** The number of individuals per 1,000 screened who were subsequently diagnosed with CRC within 24 months of a negative result for CRC in the measurement timeframe ***Target:*** *Not yet determined*	**Numerator:** Number of individuals subsequently diagnosed with CRC within 24 months of an FT result that was negative for CRC in the measurement timeframe Invasive CRC in ICD-10 includes C18.0, C18.2-C18.9, C19, C20, C26.0 with behaviour 3, but the following histology types excluded: colon lymphoma, sarcoma and carcinoid **Denominator:** Number of individuals with FT screening result negative for CRC in the measurement timeframe (Jan 1, 2011 – Dec 31, 2012)

FT = fecal test; PPV = positive predictive value; FTg = guaiac fecal test; FTi = immunochemical fecal test; CRC = colorectal cancer; TNM = tumour, node, metastases.

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