Ontario Health
Cancer Care Ontario

The Ontario Cancer Screening Performance Report 2020

February 2021

Foreword

Cancer is the leading cause of death in Ontario. One in four people in the province will die of the disease and nearly one in two people will develop it in their lifetime. The number of newly diagnosed cancers is increasing, primarily due to an aging population. To address this ongoing public health issue, Ontario Health (Cancer Care Ontario), in partnership with the Ontario Ministry of Health operates three organized cancer screening programs: the Ontario Cervical Screening Program, the Ontario Breast Screening Program and ColonCancerCheck. The goal of these programs is to reduce mortality and morbidity associated with cervical, breast and colorectal cancer.

Other important objectives of the screening programs include:

- increasing screening participation;
- improving follow-up for participants with abnormal results; and
- improving the quality and appropriateness of screening.

The Ontario Cancer Screening Performance Report 2020 is an update of *The Ontario Cancer Screening Performance Report 2016*, which was the first document to provide data on the performance of all three screening programs in a single report. The 2016 report provided data on performance up to 2014. The 2020 report provides program performance data up to 2018.

The 2020 report also describes enhancements to Ontario's cancer screening programs that were made since the release of the 2016 report, such as the June 2017 launch of the Lung Cancer Screening Pilot for People at High Risk and the June 2019 launch of the fecal immunochemical test as the screening test for people at average risk of colorectal cancer.

We will use the findings in this report to continually strengthen our cancer screening programs to meet the needs of the people in Ontario, following international standards for organized cancer screening programs. Future plans for the programs include implementing the human papillomavirus test as the recommended cervical screening test in Ontario, developing and designing a high risk colorectal cancer screening program for people with or at risk for Lynch syndrome, improving average risk colorectal cancer screening participation and follow-up of those with abnormal test results, and transitioning the Lung Cancer Screening Pilot to a program.

Together with our partners at the Ministry of Health, we are working to decrease the burden of cancer in Ontario through the design, implementation and operation of organized cancer screening programs.

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Contents

Executive Summary

Effective organized cancer screening programs are critical to reducing the burden of cancer in Ontario. In order to fully realize the benefits of organized cancer screening, participation and retention of target populations must be high. Ontario Health (Cancer Care Ontario) is the province's advisor on cancer. Ontario Health (Cancer Care Ontario) plans, implements, operates, and evaluates three cancer screening programs: the Ontario Breast Screening Program (OBSP), the Ontario Cervical Cancer Screening Program (OCSP) and ColonCancerCheck (CCC). In addition, Ontario Health (Cancer Care Ontario) also plans, implements, operates and evaluates new programs such as the Lung Cancer Screening Pilot for People at High Risk. Ontario's cancer screening programs follow the International Agency for Research on Cancer's (IARC's) requirements for organized cancer screening programs.

Prior to 2016, separate performance reports were published for each of Ontario's cancer screening programs. The first *Ontario Cancer Screening Performance Report*, released in 2016, covered cancer screening program performance for all three screening programs up to 2014, with a focus on participation and retention. The *2020 Ontario Cancer Screening Performance Report* presents program performance from 2014 to 2018.

Program Performance and Achievements

Ontario Breast Screening Program (OBSP)

From 2000 to 2018, breast cancer screening participation ranged from 61% to a high of 66% in 2009-2010. From 2012 to 2018, retention declined, with 77% of participants returning for a subsequent mammogram within 30 months in 2018 compared to 83% in 2012. Ensuring that people with abnormal screening results receive prompt follow-up is one of the key benefits of an organized cancer screening program. From 2000 to 2018, more than 90% of women with an abnormal mammogram received follow-up within six months. Follow-up within five weeks for those with an abnormal mammogram who did not need a tissue biopsy exceeded the Canadian performance target of 90% or greater (1) from 2014 to 2018. Follow-up within seven weeks for women with an abnormal mammogram who need tissue biopsy remained a challenge, falling short of the Canadian performance target of 90% or greater (1), at 76% in 2018. However, Ontario ranks within the top three provinces in Canada for this indicator (1) and Ontario Health (Cancer Care Ontario) continues to address ways to improve performance. From 2014 to 2018, the positive predictive value (PPV) of mammography remained steady at 4% for initial screens and 8% for re-screens.

High Risk Ontario Breast Screening Program (OBSP)

The High Risk OBSP is the first and only population-based organized breast screening program for women at high risk of breast cancer in Canada. Retention in the High Risk OBSP increased from 70% in 2015 to 77% in 2017. The overall abnormal call rate for participants in the High Risk OBSP decreased from 2013, when it was 25% to 2018, when it was 19%. This decrease may have been driven by an increasing proportion of re-screens (rather than initial screens) in the program. Within the High Risk OBSP, the combined positive predictive value (PPV) for initial screens and re-screens increased from 6% in 2013 to 7% in 2017. The percentage of women who were screened within 90 days of confirmation of high risk status decreased from 2014 (55%) to 2016 (44%) and then increased after 2016 to a high of 59% in 2018.

Ontario Cervical Screening Program (OCSP)

Opportunistic screening for cervical cancer began in Ontario in the 1960s with the introduction of the Pap test. In 1997, the Ministry of Health and Long-Term Care approved funding to Cancer Care Ontario to establish an organized cervical screening program. The OCSP was launched in 2000 and has further contributed to reductions in cervical cancer incidence and mortality that were seen after adoption of the Pap test.

When the OCSP started in 2000, 59% of eligible women in Ontario were getting cervical screening. Participation in cervical screening peaked at 67% in 2007–2009, and remained stable at 60% from 2013—2015 to 2016—2018. Retention in the OCSP decreased from 2011 (71%) to 2014 (60%). Decreases in retention beginning in 2013 coincided with changes to Ontario's cervical screening guidelines extending the recommended interval for Pap tests to once every three years.

Follow-up of abnormal results increased from the start of the OCSP in 2000 to 2018. By 2018, 86% of women with a high-grade abnormal Pap test result received appropriate follow-up within six months, compared to 49% in 2000. Like other jurisdictions around the world, Ontario is planning to transition from the Pap test to human papillomavirus (HPV) testing. The HPV test is more sensitive than the Pap test (i.e. HPV testing more accurately identifies people who are at risk for cervical cancer). As the recommended cervical screening test, the HPV test will better detect pre-cancers and it will more accurately inform referrals to colposcopy when combined with appropriate cytology triage testing (a subsequent test that is performed in people with positive HPV results to determine appropriate next steps).

ColonCancerCheck (CCC)

From the time the ColonCancerCheck program was launched in 2008 until 2018, performance on several key program indicators has substantially improved. The percentage of people overdue for colorectal cancer screening declined (improved) from 50% in 2008 to 38% in 2018. Ontario's performance on this indicator exceeds the European performance target of no more than 55% (2). The percentage of people who did not undergo follow-up colonoscopy within six months of an abnormal gFOBT test also declined (improved) from 2008 to 2018, from 37% to 20%. Additionally, the number of colonoscopy-related adverse events decreased in Ontario, including the perforation rate. From 2014 to 2018, the perforation rate in Ontario was consistently below the national and European minimum performance targets of <1 per 1,000 colonoscopies (3,4).

Fecal Immunochemical test (FIT) launch

On June 24, 2019, the ColonCancerCheck program transitioned to the FIT as the recommended screening test for people at average risk for colorectal cancer. FIT was chosen to replace the previously used guaiac fecal occult blood test (gFOBT) because it is more sensitive at detecting colorectal cancer and pre-cancerous polyps (5). FIT is also more user-friendly than gFOBT, partly because it only requires one sample and does not require dietary or medication restrictions. Furthermore, studies have shown that people prefer screening with FIT over gFOBT, leading to greater participation in colorectal cancer screening when FIT is used (5).

Future Directions

Human Papillomavirus (HPV) testing implementation

Ontario Health (Cancer Care Ontario) is working with the Ministry of Health to implement HPV testing in colposcopy services and as the recommended cervical screening test. HPV testing more accurately identifies people who are at risk for cervical cancer than the currently used Pap test.

To support the implementation of HPV testing, a comprehensive change management and education strategy is being developed to help participants and healthcare providers through this transition. In 2016, the Ontario Cervical Screening Program (OCSP) established a provincial Colposcopy Community of Practice (CoP) as a forum for engaging and supporting discussion among colposcopists and other healthcare providers involved in colposcopy services across the province. The Colposcopy CoP will play an important role in engaging colposcopy service providers throughout the transition to HPV testing in Ontario. Ontario Health (Cancer Care Ontario) will also be strengthening quality improvement in the colposcopy system through the implementation of quality reporting for facilities and providers.

Colorectal cancer screening for people at increased risk or high risk

People with a family history of colorectal cancer that includes one or more first-degree relatives (i.e., parent, brother, sister or child) who have been diagnosed with the disease are considered to be at increased risk for colorectal cancer. Currently, the ColonCancerCheck program recommends that people who have no symptoms and are at increased risk should get screened with a colonoscopy starting at age 50, or 10 years earlier than the age their first-degree relative was diagnosed with colorectal cancer, whichever comes first. Ontario Health (Cancer Care Ontario) is currently reviewing clinical evidence and working with experts to update its screening recommendations for people at increased risk for colorectal cancer.

In 2018, before it transitioned to Ontario Health, Cancer Care Ontario completed an evidence summary on Lynch Syndrome, which puts people at high risk for colorectal cancer. The aim of the evidence summary was to inform the development of screening recommendations and risk reduction strategies for people with or at risk for Lynch syndrome. Over the next few years, Ontario Health (Cancer Care Ontario) will use findings from this evidence summary and expert panel recommendations to guide the development and design of Ontario's high risk colorectal cancer screening program for people with or at risk for Lynch syndrome.

Improving average risk screening participation and abnormal follow-up

Currently in the ColonCancerCheck program, primary care providers need to request the FIT for their patients and the test is then mailed to eligible people. Primary care providers are also responsible for referring people with abnormal FIT results for follow-up colonoscopy. Evidence from Ontario and other jurisdictions shows that directly mailing FIT kits to people who are eligible for screening can improve screening participation. To implement direct mailing of kits without requiring requests from primary care providers, ColonCancerCheck would have to make program design changes and organize follow-up for people with abnormal results. Therefore, centralized navigation of people with abnormal results will be implemented before direct mailing of FIT kits.

From 2017 to 2019, before it transitioned to Ontario Health, Cancer Care Ontario conducted a two-phase pilot project to understand opportunities to improve follow-up of abnormal colorectal cancer screening results. Phase 1 was a qualitative study that evaluated the reasons people do not follow up with colonoscopy after an abnormal gFOBT. The second phase was a study that explored using centralized navigation to improve follow-up with colonoscopy. The results of this work will inform future strategies for improving follow-up of abnormal FIT results with colonoscopy, including navigating people with abnormal results to colonoscopy.

Lung cancer screening for people at high risk

Before it transitioned to Ontario Health, Cancer Care Ontario launched the Lung Cancer Screening Pilot for People at High Risk (the pilot) in June 2017 at specific hospitals in Ontario. The main purpose of the pilot is to assess how to implement organized lung cancer screening across Ontario for people at high risk of the disease. Key components of the pilot include using a risk assessment to determine eligibility for screening, a comprehensive screening navigator model to support participants throughout the screening process, smoking cessation services that are offered to all smokers referred to the pilot and a robust radiology quality assurance program. The pilot, which will conclude in March 2021, will be evaluated and findings will be used to inform the transition to operations. Findings from the interim evaluation of the pilot are very promising, with high rates of smoking cessation program acceptance and detection of early stage lung cancers (6).

Personalized breast cancer risk assessment study

Ontario Health (Cancer Care Ontario) researchers have partnered with researchers from other jurisdictions in Canada and internationally to conduct a large-scale project on screening for breast cancer based on individualized risk. They will study a large cohort of women to calculate their personal breast cancer risk level and provide them with information that will help them make an informed choice about breast cancer screening. This research will examine how personalized risk assessment, including genetic testing, may change breast cancer screening practice, and will ensure better use of human and financial resources.

Burden of Disease

Temporal Trends in the Burden of Cancer in Ontario

Note: at the time of report publication, incidence and mortality data were available up to 2017 in Ontario.

In 2017, cancer caused 28.4% of all deaths in Ontario (7). It also caused about 1.5 times more deaths than heart disease and 5.2 times more deaths than unintentional injuries, the next two most common causes of death (7). The cost of cancer care in Ontario rose from about $1 billion in 2005 to $2.6 billion in 2012 (8).

Ontario's First Nations people are known to face inequities in cancer incidence and mortality. The *Ontario Cancer Screening Performance Report 2016* emphasized the need to assess the burden of cancer in Ontario's First Nations people (9). Since the release of the 2016 report, the Indigenous Cancer Control Unit (ICCU) at Ontario Health (Cancer Care Ontario), in partnership with the Chiefs of Ontario and the Institute for Clinical Evaluative Sciences (IC/ES), published a report on the burden of cancer in Ontario's First Nations people (10).

In the past, Ontario Health (Cancer Care Ontario) focused on morbidity and mortality when reporting on burden of cancer. However, a comprehensive understanding of the burden of cancer requires a good knowledge of the health and economic aspects of burden of disease. This section presents data on the health and economic burden of cancer in Ontario, focusing on cancers covered by Ontario's three organized cancer screening programs.

Health Burden of Cancer in Ontario

The health aspect of disease burden emphasizes the impact of disease on the body and mind, including disease incidence and mortality and their trends.

Overall cancer incidence in Ontario, 2016

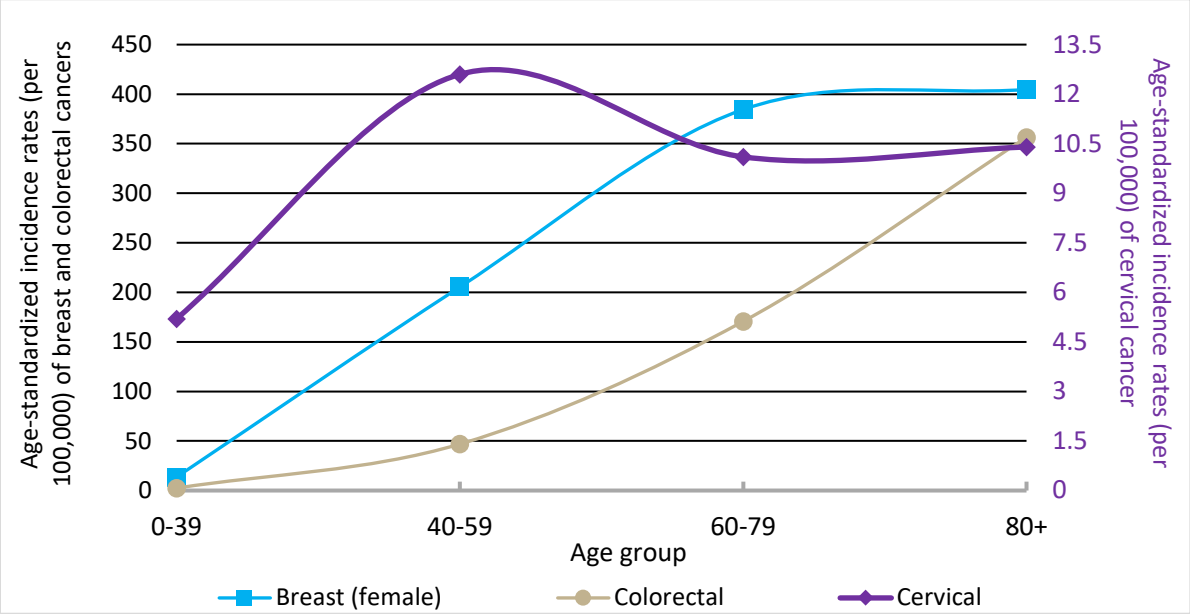
In 2016, the age-standardized incidence rate (ASIR) for all cancers combined was 504.2 new cases per 100,000 people. The cancer incidence rate in Ontario has been stable since 2001 (11).

Breast, colorectal and cervical cancer incidence in Ontario, 2016

In 2016, the ASIR for breast cancer was 129.1 new cases per 100,000 women. For colorectal cancer it was 52.7 new cases per 100,000 people and for cervical cancer it was 8.2 new cases per 100,000

women. Except for cervical cancer, incidence increased with age and was highest in people age 80 and older (Figure 1). Cervical cancer incidence was highest for people ages 40 to 59.

Figure 1: Age-specific incidence rates for breast (female), colorectal, and cervical cancer, Ontario, 2016

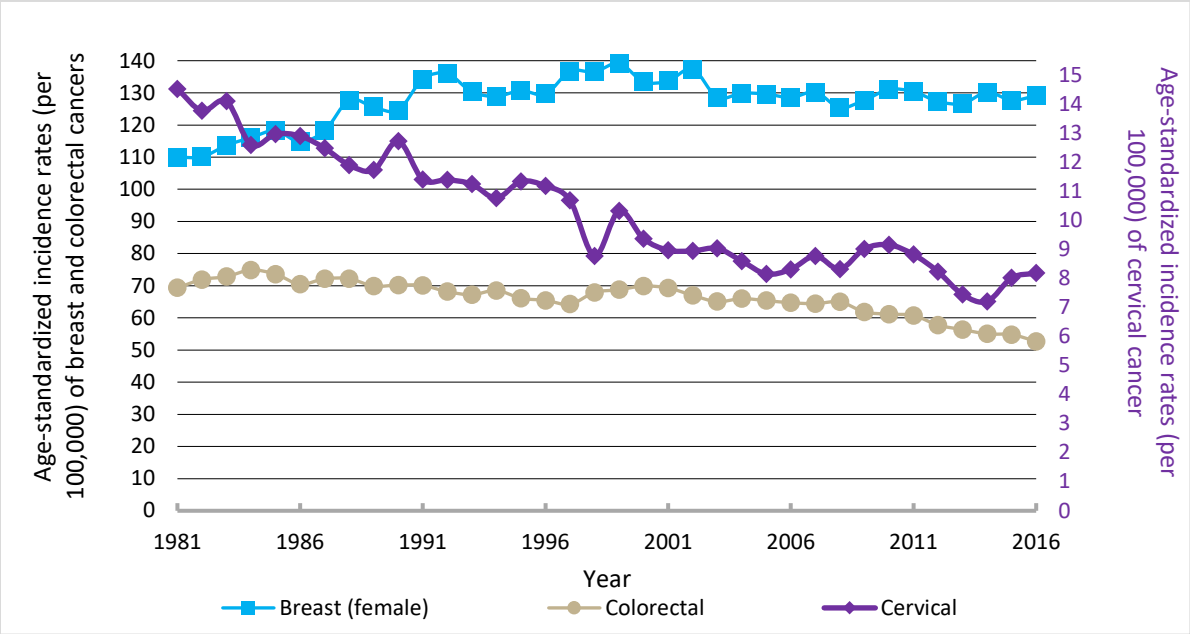


Data source: Ontario Cancer Registry (December 2018) Ontario Health (Cancer Care Ontario)
Analysis by: Surveillance, Analytics and Informatics, Ontario Health (Cancer Care Ontario)

For data, see Table 5 in Appendix 1.

Since 1992, the age-standardized incidence rate (ASIR) of female breast cancer in Ontario has been steadily decreasing (Figure 2). The ASIR for colorectal cancer for men and women combined decreased between 2008 and 2016 (Figure 2). Cervical cancer incidence also decreased between 1981 and 2016 (Figure 2).

Figure 2: Incidence rates for breast (female), colorectal, and cervical cancer, Ontario, 1981—2016



Note: Rates are per 100,000 and age-standardized to the 2011 Canadian population
Data source: Ontario Cancer Registry (December 2018) Ontario Health (Cancer Care Ontario)
Analysis by: Surveillance, Analytics and Informatics, Ontario Health (Cancer Care Ontario)

For data, see Table 6 in Appendix 1.

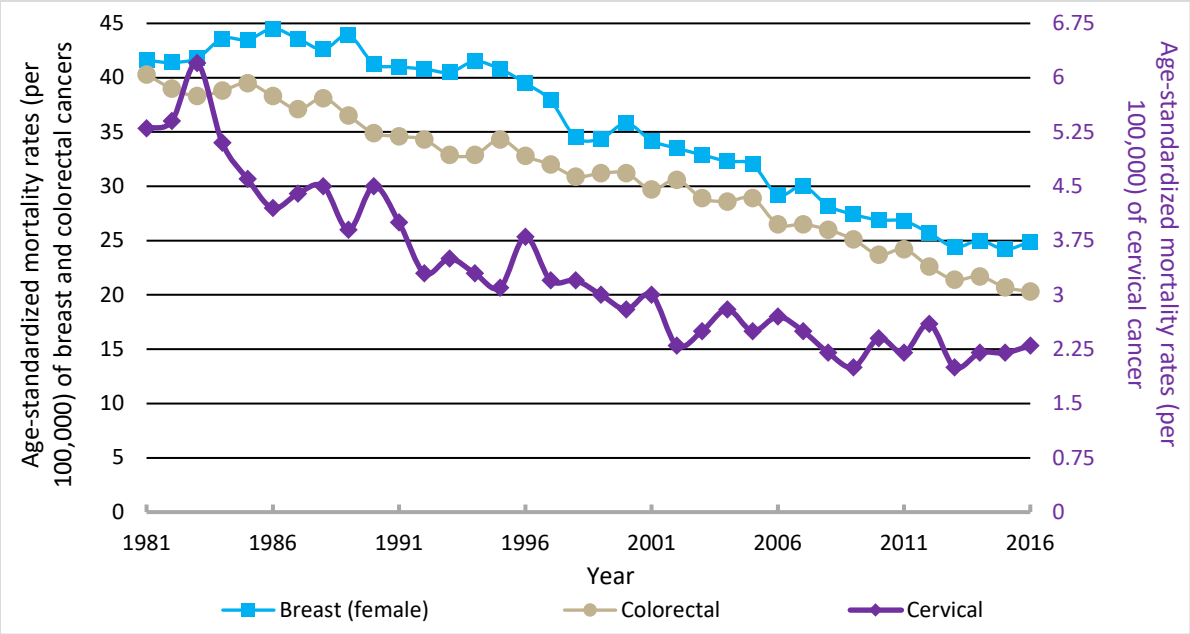
Overall cancer mortality in Ontario, 2016

In 2016, the age-standardized mortality rate (ASMR) for all cancers combined was 190 deaths per 100,000 people. Overall, cancer mortality in Ontario has been declining over the past three decades. Most of this decrease in mortality occurred from the early 2000s (11).

Breast, colorectal and cervical cancer mortality in Ontario, 2016

In 2016, the ASMR for female breast cancer was 24.9 deaths per 100,000 women, for colorectal cancer it was 20.3 deaths per 100,000 people and for cervical cancer it was 2.3 deaths per 100,000 women (Figure 3). The mortality rate for all three cancers increased with age and was highest in people age 80 and older (Figure 4).

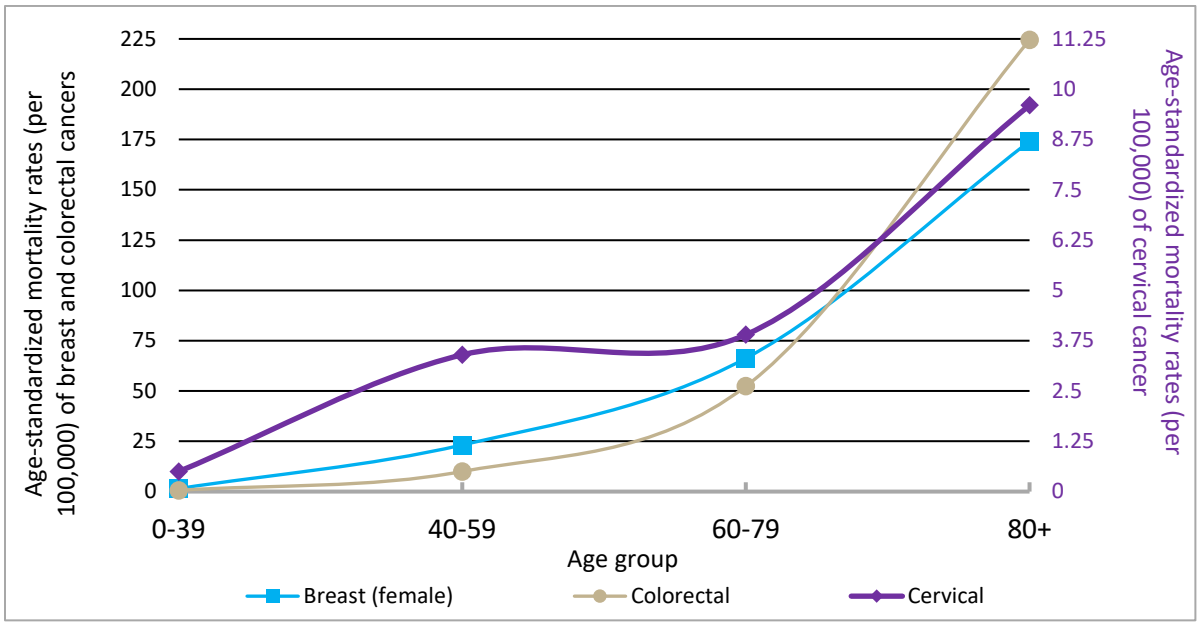
Figure 3: Mortality rates for breast (female), colorectal, and cervical cancer, Ontario, 1981—2016



Note: Rates are per 100,000 and age-standardized to the 2011 Canadian population
Data Source: Ontario Cancer Registry (December 2018) Ontario Health (Cancer Care Ontario)
Analysis by: Surveillance, Analytics and Informatics, Ontario Health (Cancer Care Ontario)

For data, see Table 7 in Appendix 1.

Figure 4: Age-specific mortality rates for breast (female), colorectal, and cervical cancer, Ontario, 2016



Data Source: Ontario Cancer Registry (December 2018) Ontario Health (Cancer Care Ontario)
Analysis by: Surveillance, Analytics and Informatics, Ontario Health (Cancer Care Ontario)

For data, see Table 8 in Appendix 1.

Economic Burden of Cancer in Ontario

The economic aspect of disease burden focuses on the financial impact of cancer on households, societies or health systems. This burden can be direct (e.g., expenditure), indirect (e.g., lost productivity) or psychosocial (e.g. stress or anxiety). In 2012, patient-level cancer cost in Ontario was about $2.6 billion, a 15.1% increase from 2011 (8).

Cancer is the leading cause of death in Ontario, with lung, colorectal, breast, and prostate cancers responsible for nearly 50% of cancer deaths in 2016 (12). The number of cancer deaths in Ontario is expected to increase in the future (12).

Approximately 1 in 2 Ontarians is expected to be diagnosed with cancer in their lifetime, with the probability of developing cancer being similar in men and women (12). In Ontario, lung, colorectal, female breast and prostate cancers accounted for almost 50% of new cancer cases diagnosed in 2016. For some common cancers, detection at an early stage is improving over time, with cervical cancer being a notable exception (12). Ontario Health (Cancer Care Ontario) releases a biennial cancer statistics report providing comprehensive information on cancer incidence, mortality, survival and prevalence. The latest report, *Ontario Cancer Statistics 2020* was released in August 2020.

Ontario's Cancer Screening Programs: Overview

Effective screening and earlier diagnosis are crucial to reducing the impact of cancer. Screening in the general asymptomatic population detects pre-cancerous changes or cancers at an early stage when treatment has a better chance of working (13). In order to fully realize the benefits of organized cancer screening programs, participation and retention in target populations must be high.

Organized Cancer Screening

As Ontario's advisor on cancer, Ontario Health (Cancer Care Ontario) plans, designs, pilots, implements and evaluates the province's cancer screening programs. Guided by published evidence and high-quality research, the Ontario Breast Screening Program (OBSP), the Ontario Cervical Screening Program (OCSP) and ColonCancerCheck encompass Ontario's province-wide cancer screening programs.

Requirements of an Organized Screening Program

Informed by the International Agency for Research on Cancer (IARC) recommendations, Ontario's organized cancer screening programs should have the following features (20,56):

- An explicit screening policy with specified age categories, methods, and screening intervals;
- A defined target population;
- A management team responsible for implementation of the screening program;
- A health team responsible for decision-making and care;
- A quality assurance structure; and
- A method for identifying cancer in the general population.

Integrated Evaluation Framework and Indicators

In 2008, with support from Cancer Care Ontario, the Canadian Partnership Against Cancer developed an integrated evaluation framework for cancer screening programs in Canada through the Screening Performance Measures Group (Table 1) (14). This framework has been adopted by other screening programs (14). The goal of the framework is to promote consistency when reporting, calculating and interpreting key cancer screening performance measures (14). The framework identifies five key performance domains that reflect the screening pathway and each performance domain has performance indicators. In this report, this framework is used to present data on key cancer screening program performance indicators.

Table 1: Cancer screening program evaluation framework (Screening Performance Measures Group) (14)

Domain	Recommended Performance Measures
Coverage	Participation Retention
Follow-up	Proportion of abnormal results Follow-up of abnormal results Diagnostic interval (time between abnormal screening test result and diagnosis)
Quality of screening	Sensitivity of screening test Positive predictive value of screening test
Detection	Pre-cancer detection rate Invasive cancer detection rate
Disease extent at diagnosis	Early stage invasive cancer detection rate

Ontario Cancer Screening Programs

Table 2: Ontario cancer screening program summary

Screening program	Target population	Screening test	Screening interval
Ontario Breast Screening Program (OBSP)	Women ages 50–74	Mammography	Every 2 years for most women*
High Risk OBSP	Women ages 30–69 who meet the High Risk OBSP eligibility criteria	Mammography and magnetic resonance imaging**	Every year
Ontario Cervical Screening Program (OCSP)	Anyone with a cervix ages 21–70*** who are or have ever been sexually active	Cytology (Pap test)	Every 3 years
ColonCancerCheck (average risk)	People ages 50–74	FIT	Every 2 years
ColonCancerCheck (increased risk)	People who have 1 or more first-degree relatives who have been diagnosed with colorectal cancer‡	Colonoscopy	Every 5–10 years ¥

* Reasons a woman would receive 1-year recalls include documented pathology of high risk lesions, a personal history of ovarian cancer, 2 or more first-degree female relatives with breast cancer at any age, 1 first-degree female relative with breast cancer under age 50, 1 first-degree relative with ovarian cancer at any age, 1 male relative with breast cancer at any age, breast density ≥75% at the time of screening or recommended by the radiologist at the time of screening.
** If magnetic resonance imaging is not medically appropriate, a woman is scheduled for a screening breast ultrasound.
*** While the OCSP currently recommends screening starting at age 21, some provinces and countries start cervical screening at age 25. The OCSP is supportive of healthcare providers who wish to initiate cytology-based screening at age 25 during the change to HPV testing. This higher age of initiation is aligned with recent evidence and recommendations from the Canadian Task Force on Preventive Health Care.
‡ The definition of increased risk for colorectal cancer is currently under review.
¥ Frequency of screening depends on family history. People with a first-degree relative who was diagnosed with colorectal cancer before age 60 should be screened every five years, while those with a first-degree relative who was diagnosed with colorectal cancer at age 60 or older should be screened every 10 years, unless they require colonoscopy surveillance at shorter intervals.

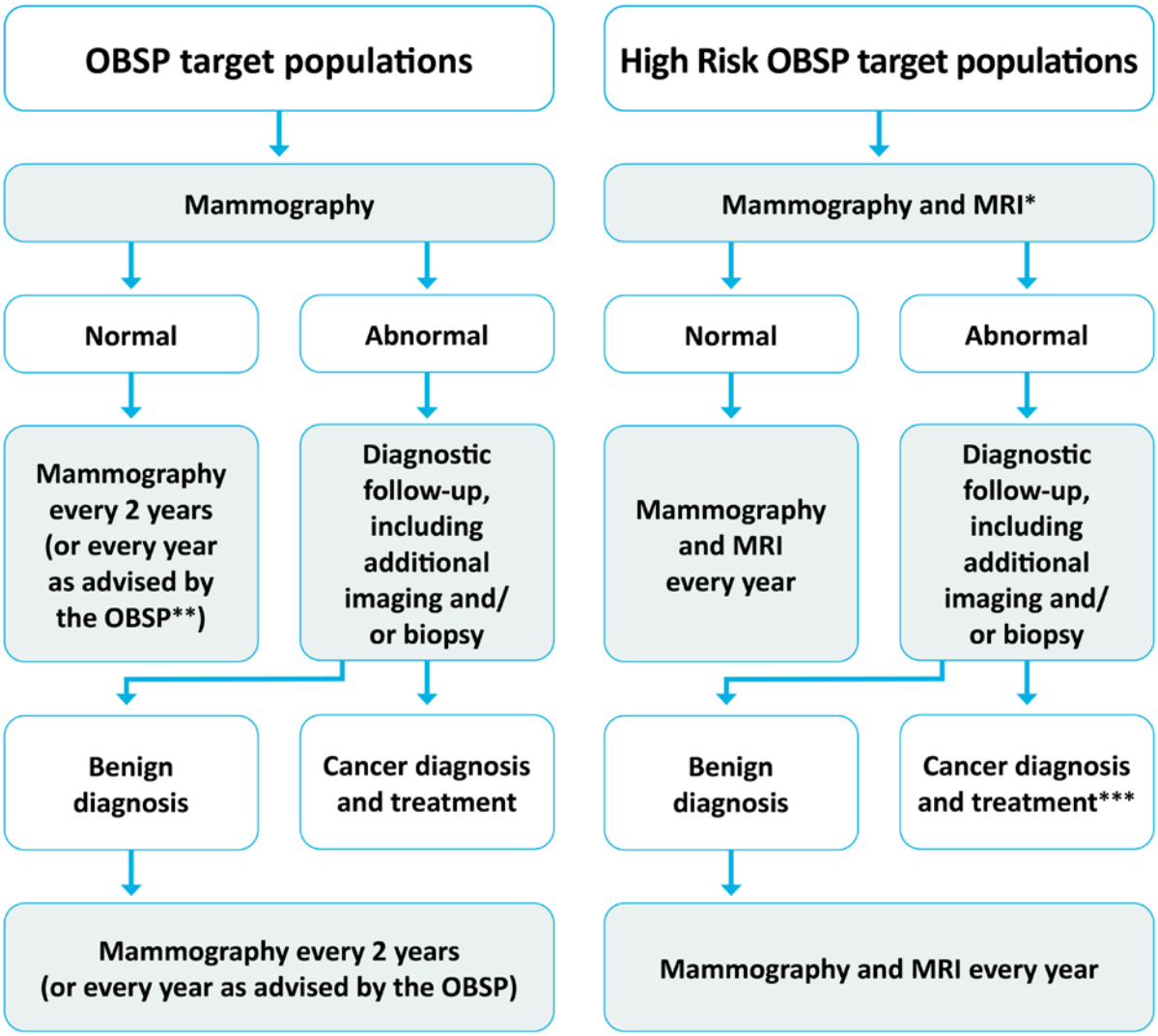
Table 3: Eligibility criteria by screening program

Screening program	Eligibility criteria
Ontario Breast Screening Program (OBSP)	Women ages 50–74 and have: • No breast cancer symptoms; • No personal history of breast cancer; • No current breast implants; • Not had a mastectomy; and • Not had a screening mammogram within the last 11 months. Women over age 74 may continue to be screened in the program with a referral for a mammogram every 2 years from their primary care provider, but they will not be automatically recalled. They are encouraged to make a personal decision about breast cancer screening in consultation with their primary care provider.

High Risk OBSP	Women ages 30–69 and:
	• Have a physician's referral;
	• Have no breast cancer symptoms;
	• Fall into one of the following risk categories:
	  • have gene changes that increase their chance of getting breast cancer (e.g., changes in the BRCA1, BRCA2, TP53, PTEN and/or CDH1 genes);
	  • have not had genetic testing, but have had genetic counselling because they have a first-degree family member with gene changes that increase their chance of getting breast cancer (e.g., changes in the BRCA1, BRCA2, TP53, PTEN and/or CDH1 genes);
	  • have a ≥25% lifetime chance of getting breast cancer based on personal and family history (confirmed at a genetics clinic using the International Breast Cancer Intervention Study [IBIS] or Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm [BOADICEA] risk assessment tools); and/or
	  • had radiation therapy to the chest before age 30 and had the radiation at least 8 years ago.
	The High Risk OBSP does not accept new participants over age 70. However, when participants already in the High Risk OBSP turn 70, the program will continue to screen them with just mammography every year until they are age 74.
	
	Participants in the High Risk OBSP over age 74 may continue to be screened in the program with a referral for a mammogram every year from their primary care provider, but they will not be automatically recalled. They are encouraged to make a personal decision about breast cancer screening in consultation with their primary care provider.

Screening program	Eligibility criteria
Ontario Cervical Screening Program (OCSP)	People who are ages 21–70* and who: • Have a cervix; and • Are or have ever been sexually active. Sexual activity includes intercourse (sex), as well as digital (using fingers) or oral (using mouth) sexual activity involving the genital area with a partner of any sex. People who are not sexually active should delay cervical screening until they become sexually active. Cervical screening can stop at age 70 if someone has been regularly screened and has had 3 or more normal cervical screening test results in the previous 10 years. *While the OCSP recommends starting cervical screening at age 21, some provinces and countries start at age 25. The OCSP supports healthcare providers who wish to initiate cytology-based screening at age 25 during the change to HPV testing. This higher age of initiation is aligned with recent evidence and recommendations from the Canadian Task Force on Preventive Health Care.
ColonCancerCheck (average risk)	People who are ages 50–74 and have: • No first-degree relative (parent, brother, sister or child) who has been diagnosed with colorectal cancer; • No personal history of pre-cancerous colorectal polyps requiring surveillance; and • No history of inflammatory bowel disease (i.e., Crohn's disease involving the colon or ulcerative colitis).
ColonCancerCheck (increased risk)	People with a family history of colorectal cancer that includes 1 or more first-degree relatives who have been diagnosed with colorectal cancer, but do not meet the criteria for hereditary colorectal cancer syndromes.** ** The definition of increased risk for colorectal cancer is currently under review.

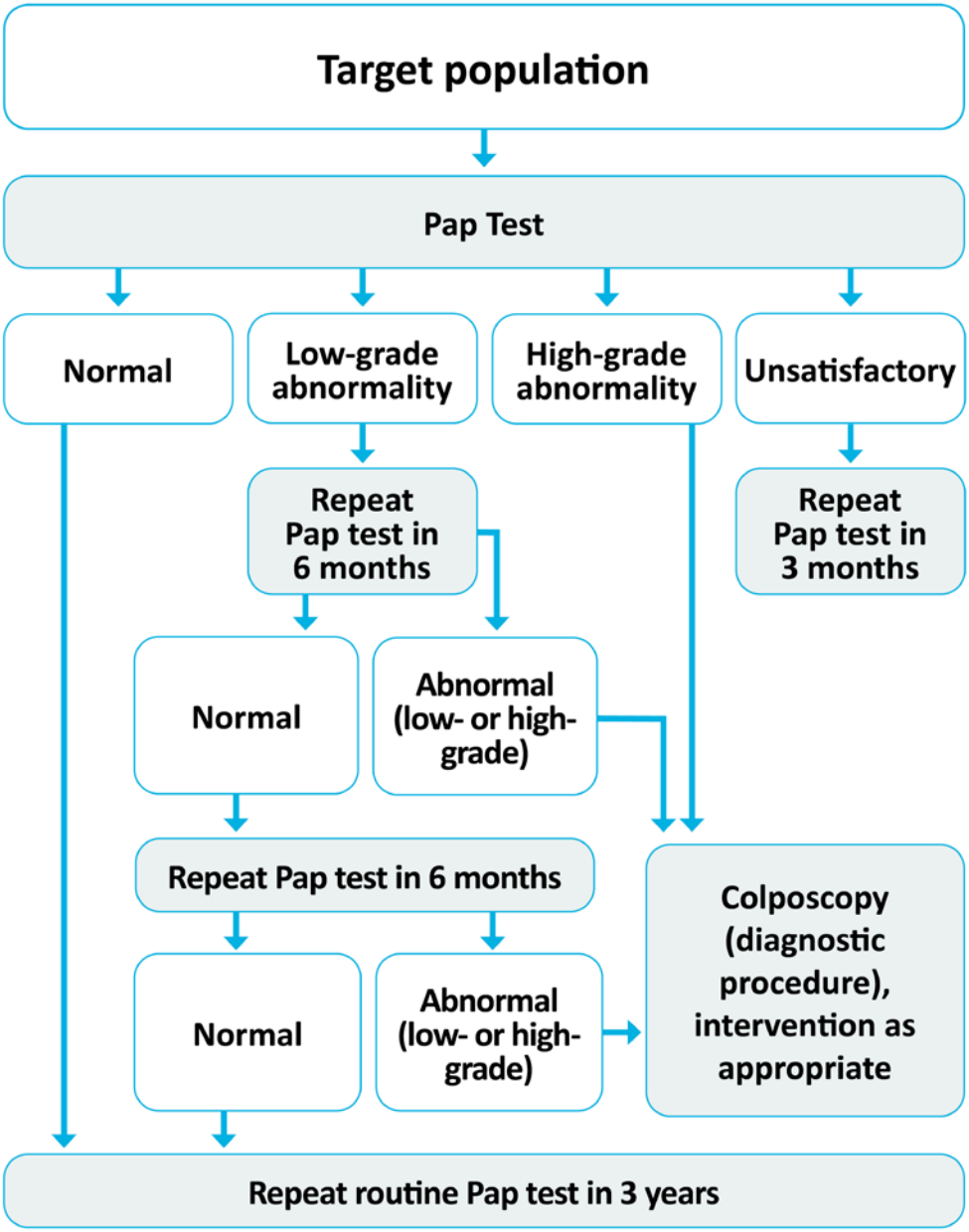
Figure 5: Ontario Breast Screening Program (OBSP) participant pathway (refer to Table 3 for target population eligibility criteria)



* If magnetic resonance imaging (MRI) is not medically appropriate, a woman is scheduled for a screening breast ultrasound.
** Reasons a woman would receive 1-year recalls include documented pathology of high-risk lesions, a personal history of ovarian cancer, two or more first-degree female relatives with breast cancer at any age, one first-degree female relative with breast cancer under age 50, 1 first-degree relative with ovarian cancer at any age, 1 male relative with breast cancer at any age, breast density ≥75 percent at the time of screening or recommended by the radiologist at the time of screening.
*** Women who are diagnosed with breast cancer while in the High Risk OBSP are eligible to return to screening once they have completed treatment and have no breast cancer symptoms.

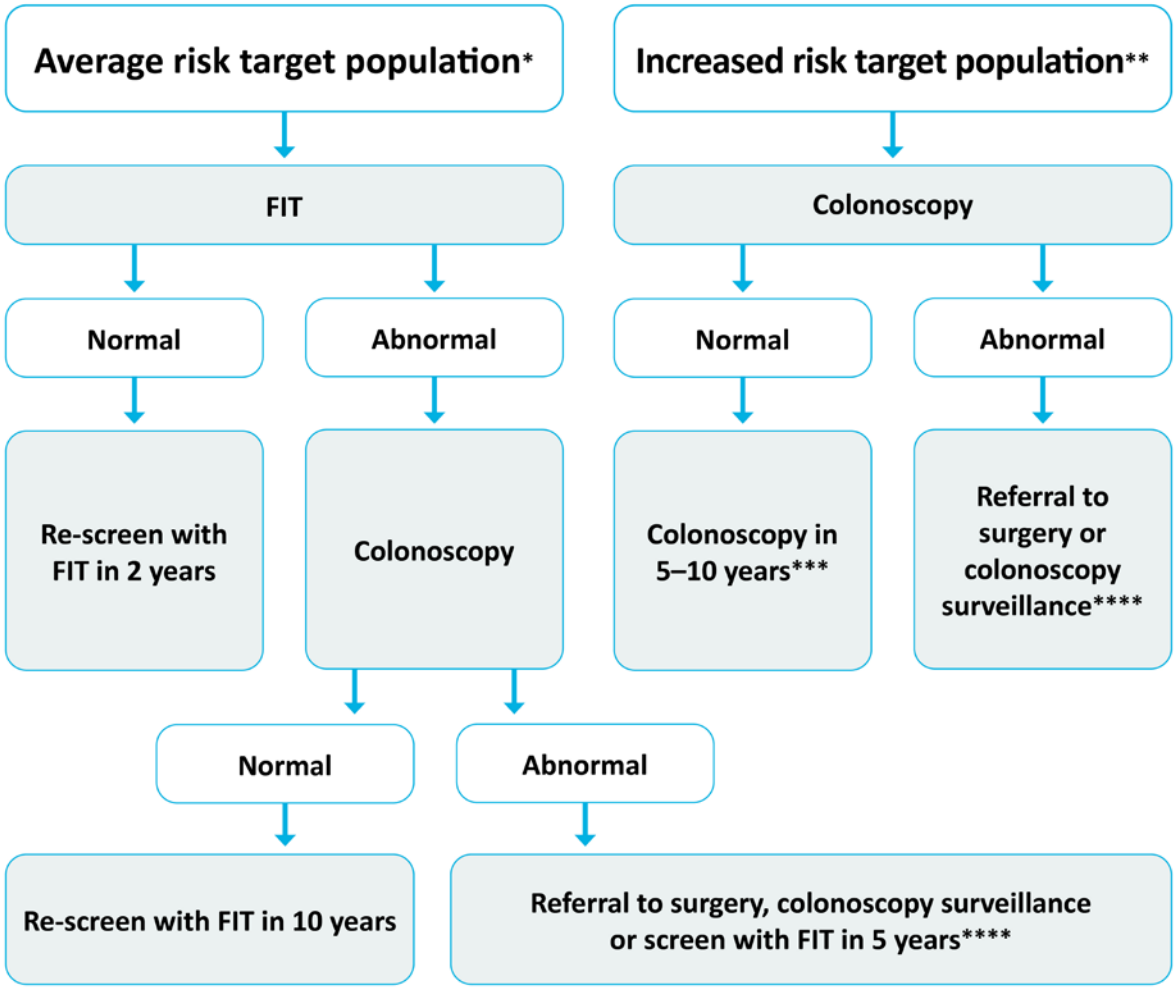
For a text version of Figure 5, refer to Appendix 3: Figure Descriptions.

Figure 6: Ontario Cervical Screening Program (OCSP) participant pathway (refer to Table 3 for target population eligibility criteria)



For a text version of Figure 6, refer to Appendix 3: Figure Descriptions.

Figure 7: ColonCancerCheck (CCC) participant pathway (refer to Table 3 for target population eligibility criteria)



*People at average risk for colorectal cancer who choose to be screened with a flexible sigmoidoscopy should be screened every 10 years.

**The screening recommendations for people at increased risk for colorectal cancer are currently under review.

***Frequency of screening depends on family history. People with a first-degree relative who was diagnosed with colorectal cancer before age 60 should be screened every 5 years, while those with a first-degree relative who was diagnosed with colorectal cancer at age 60 or older should be screened every 10 years, unless they require adenoma surveillance at shorter intervals.

****Please refer to ColonCancerCheck's Recommendations for Post-Polypectomy Surveillance at cancercareontario.ca/CCCsurveillance

For a text version of Figure 7, refer to Appendix 3: Figure Descriptions.

Limitations and Harms of Screening

Although there is a strong body of evidence supporting the benefits of cancer screening, it is important to acknowledge that screening has limitations.

Screening tests can miss some cancers or significant abnormalities that have a risk of developing into cancer (known as false-negative test results). In addition, people with abnormal screening test results may not necessarily have cancer or abnormalities that could develop into cancer (known as false-positive test results). For example, in the Ontario Breast Screening Program, approximately 18 out of every 200 women screened will have an abnormal mammogram and only one will go on to be diagnosed with cancer (15).

People with abnormal screening test results will be referred for diagnostic testing. Diagnostic tests can cause discomfort or other harms (such as bowel perforation from colonoscopy or problems with future pregnancies from colposcopy) (16–19), as well as anxiety associated with undergoing more tests and waiting for results (20,21).

Ontario Health (Cancer Care Ontario) provides information to screening participants and primary care providers that clearly outlines the benefits and limitations of cancer screening. Supporting informed participation (ensuring that people participating in cancer screening are fully informed of its benefits and limitations) is a priority for Ontario Health.

Informed Participation

Informed participation in cancer screening occurs when a person has an adequate understanding of the risks and harms to make an informed decision about getting screened (22). A potential screening participant's decision about screening should be aligned with their personal preferences and values. To achieve informed participation, information about the benefits, potential harms, and limitations of screening should be presented in a balanced way, and a participant should actively share in the decision-making with their healthcare provider or a screening navigator throughout the screening process. When someone is engaged in decision-making, they may gain a better understanding of the benefits and limitations of a screening test, have increased satisfaction throughout the screening process, comply better with screening follow-up appointments (22).

The Ontario Breast Screening Program (OBSP) and the High Risk OBSP encourage people to speak with their family doctor or nurse practitioner about breast cancer screening options. In December 2018, the Canadian Task Force on Preventive Health Care released updated *Recommendations on Screening Breast Cancer in Women Ages 40–74 Who Are Not at Increased Risk for Breast Cancer* (23). In light of the benefits and limitations of breast cancer screening, the updated recommendations emphasize helping people make an informed choice about screening based on their values and preferences. The

recommendations also encourage them to engage in shared decision-making with their healthcare provider (23).

The Lung Cancer Screening Pilot for People at High Risk has specific processes and resources that facilitate informed participation. Screening navigators provide a general overview of the benefits and risks of lung cancer screening. Potential participants have an opportunity to ask questions and after considering the benefits and risks, they are asked to verbally confirm whether they would like to proceed with screening. Tools have been created to support screening navigators and potential participants in these discussions.

Ontario Cancer Screening Performance: 2014 to 2018

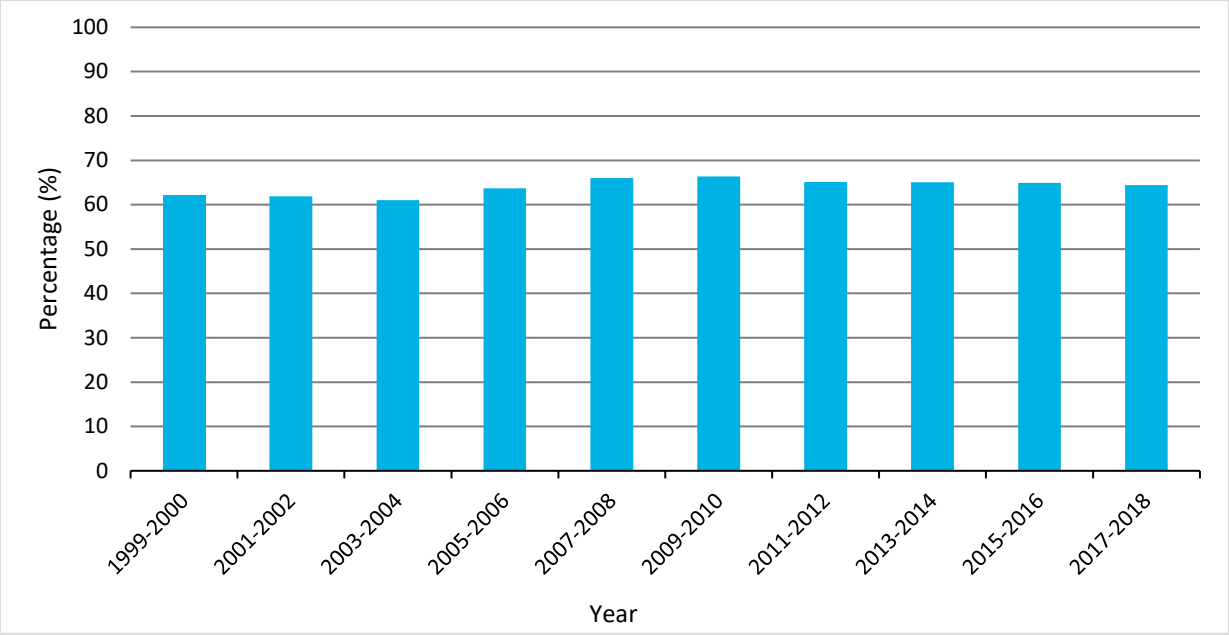
Ontario Breast Screening Program (OBSP): Average Risk

The OBSP began in the year 1990. However, program data is most reliable beginning in the year 2000 due to the creation of the Integrated Client Management System (ICMS), a provincial breast screening database developed by CCO to facilitate the operation, monitoring and evaluation of OBSP screening and assessment.

From 2000 to 2018, breast cancer screening participation ranged from 61% to 66% in 2009–2010, remaining below the European Union and Canadian targets of at least 70% (24,25). Follow up of abnormal mammogram results was consistently high from 2000 to 2018, at over 90%. Follow-up within five weeks of an abnormal mammogram result was also consistently above 90%, from 2014 to 2018, exceeding the Canadian performance target of 90% or greater (1). Follow-up within seven weeks of an abnormal mammogram result for women requiring a tissue biopsy fell short of the Canadian target of 90% or greater (1) from 2014 to 2018. The invasive breast cancer detection rate in Ontario increased to 5.6 per 1,000 for initial screens and 4.5 per 1,000 for re-screens in 2017. From 2013 to 2016, the percentage of early stage breast cancers detected improved from 61% to 65%.

Breast cancer screening participation

Figure 8: Age-adjusted percentage of Ontario screen-eligible women, 50—74 years old, who completed at least 1 mammogram within a 30-month period



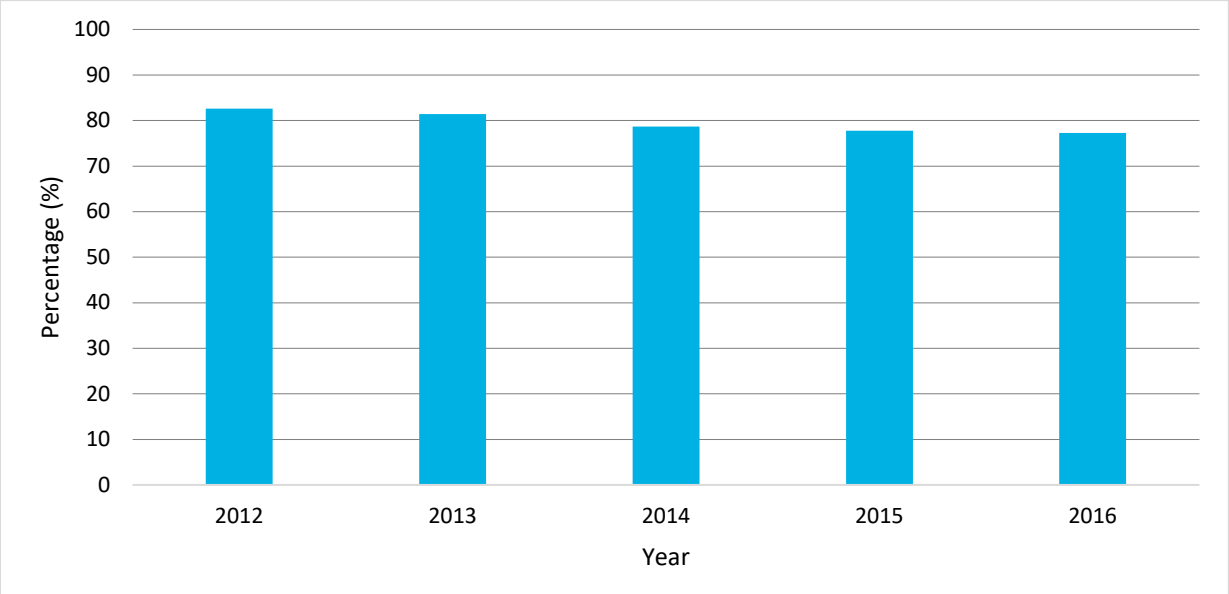
Note: OBSP data are only available beginning in the year 2000.

For data, see Table 9 in Appendix 1.

Breast cancer screening participation remained stable at 61% to 66% from 2000 to 2017—2018 (Figure 8), and remained just below the Canadian and European Union target of at least 70% (24,25).

Breast cancer screening retention

Figure 9: Percentage of Ontario screen-eligible women, 50—72 years old, who had a subsequent mammogram within 30 months of a previous program mammogram, 2012—2016

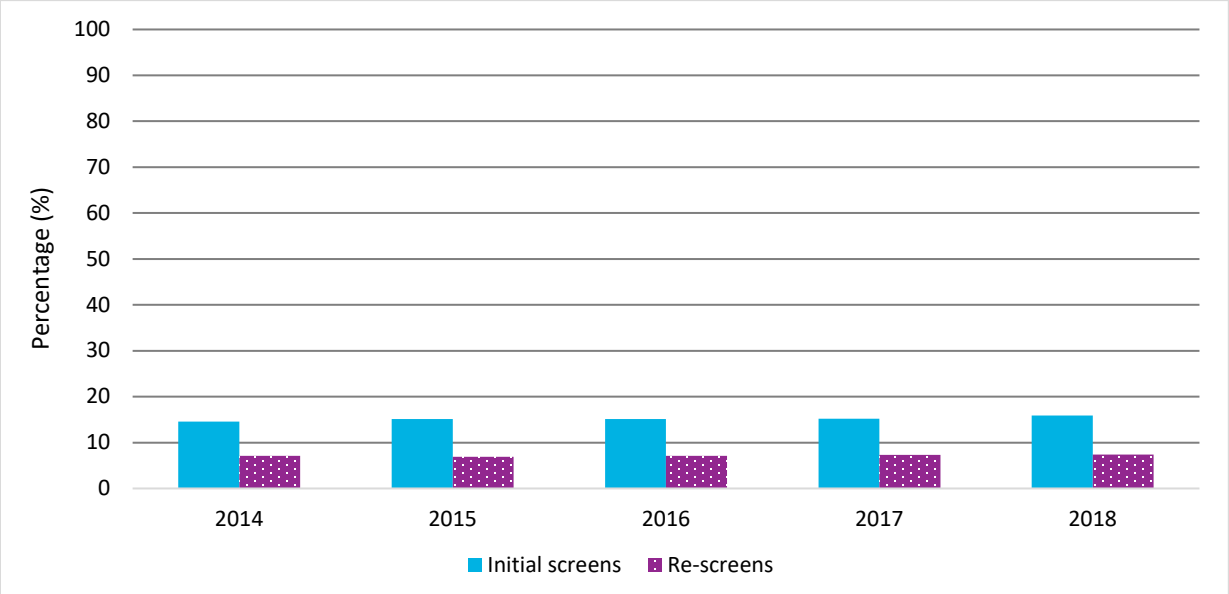


For data, see Table 10 in Appendix 1.

The full benefits of an organized screening program can only be achieved if the at-risk population gets screened regularly and according to screening guidelines. The OBSP recommends that most women ages 50 to 74 get screened with mammography every two years. The screening retention indicator uses a 30-month timeframe to allow an additional six months for participants to return for a subsequent mammogram. In 2016, 77% of participants returned for a subsequent mammogram within 30 months (Figure 9). This marked a decrease since 2012, when 83% of participants returned for a subsequent mammogram within 30 months.

Breast cancer screening abnormal call rate

Figure 10: Percentage of screen-eligible women, 50—74 years old, who were referred for further testing due to an abnormal Ontario Breast Screening Program screening mammogram result, 2014—2018



For data, see Table 11 in Appendix 1.

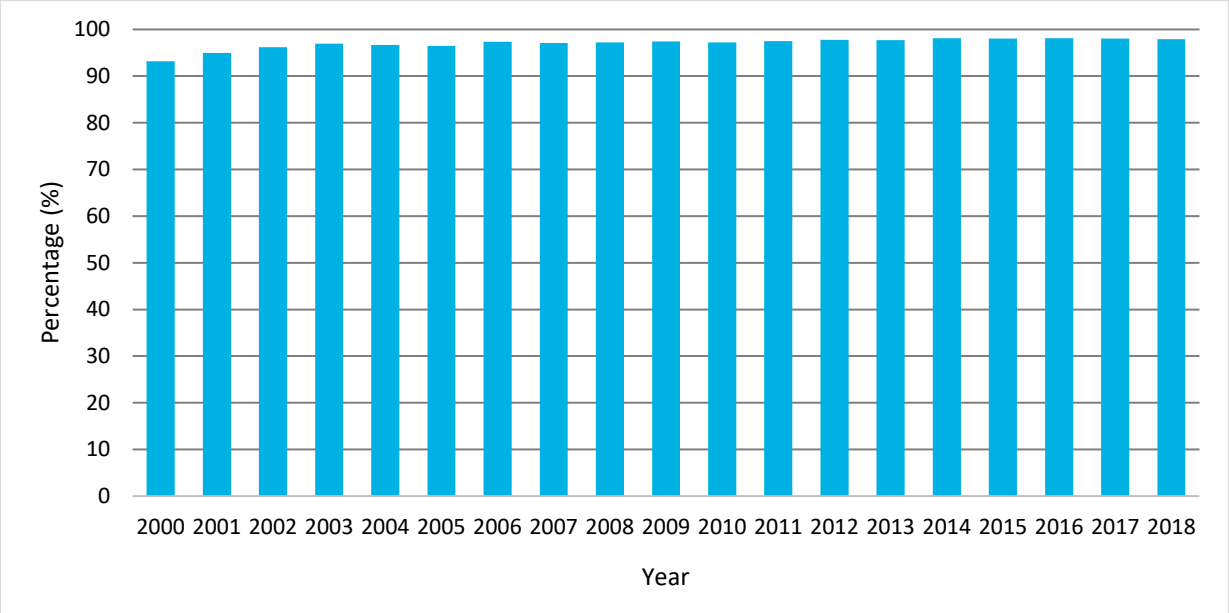
Abnormal call rate measures the proportion of participants referred for further testing due to an abnormal OBSP screening mammogram. This indicator is an important screening program performance indicator because screening programs with very low abnormal call rates may have lower cancer detection rates and higher post-screen cancer rates. Abnormal call rate influences positive predictive value (PPV),* cancer detection rate and post-screen cancer rate (26,27). Abnormal call rates tend to be higher in initial screens than in re-screens because initial screens detect mostly prevalent cancers (28).

In the OBSP, abnormal call rates for initial screens and re-screens remained steady from 2014 to 2018. The abnormal call rate for initial screens was 15% to 16% from 2014 to 2018 (Figure 10). These rates are higher than the Canadian target (acceptable level) of no more than 10% and the European Union target of no more than 7% (1,29). For re-screens, the abnormal call rate was 7% from 2014 to 2018, which exceeds the Canadian and European Union targets (acceptable level) of no more than 5% (1,29). Although the abnormal call rate for initial screens and re-screens is high, Ontario's performance has been in line with other Canadian screening programs (1).

* PPV can be expressed as: true positives/[true positives + false positives].

Breast cancer screening abnormal follow-up

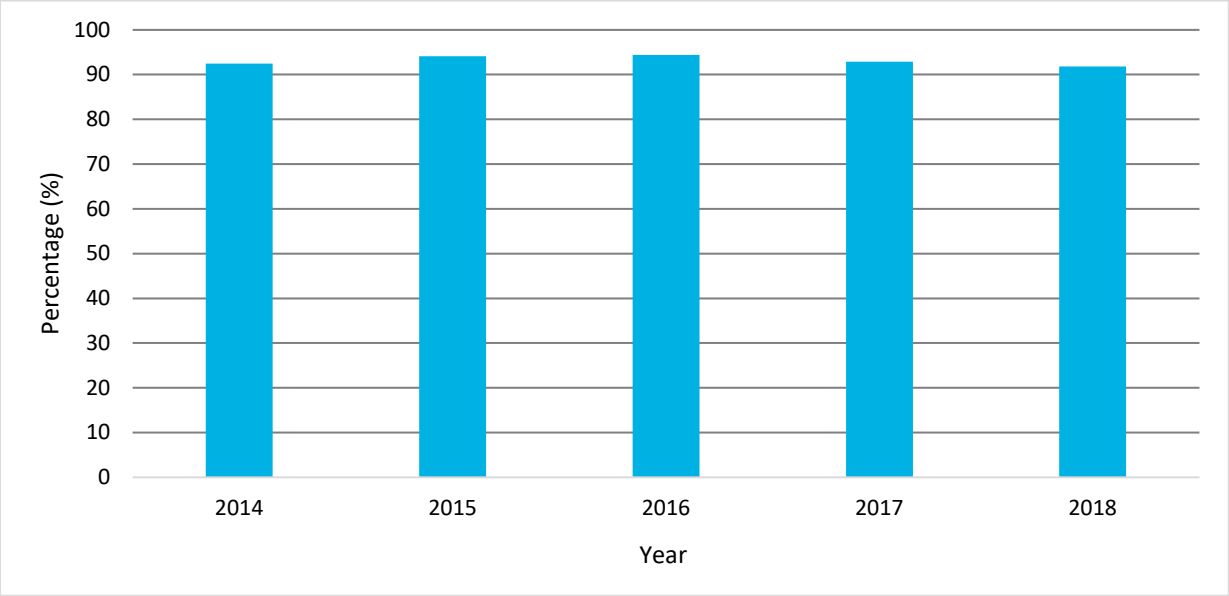
Figure 11: Percentage of Ontario screen-eligible women, 50—74 years old, with an abnormal Ontario Breast Screening Program screening mammogram who were diagnosed (benign or cancer) within 6 months of the abnormal screen date, 2000—2018



For data, see Table 12 in Appendix 1.

The percentage of screening participants who were diagnosed within six months of their abnormal mammogram increased from 95% to 97% in the early 2000s and has remained consistently high at 98% from 2012 to 2018 (Figure 11). The remaining 2% may be due to follow-up challenges, including lost contact with a participant despite repeated attempts, a participant declining further assessment or a participant receiving follow-up care in another jurisdiction. Timely follow-up of abnormal results is important because delays in follow-up and diagnosis can result in negative emotional, psychological (30,31) and clinical impacts, which may lead to a poorer prognosis (32). Breast cancer screening follow-up is a process that is undertaken by the OBSP, which involves coordinating follow-up tests and communicating results to participants.

Figure 12: Percentage of Ontario screen-eligible women, 50—74 years old, with an abnormal Ontario Breast Screening Program screening mammogram result who did not need tissue biopsy and were diagnosed (benign or cancer) within 5 weeks of the abnormal screen date, 2014—2018

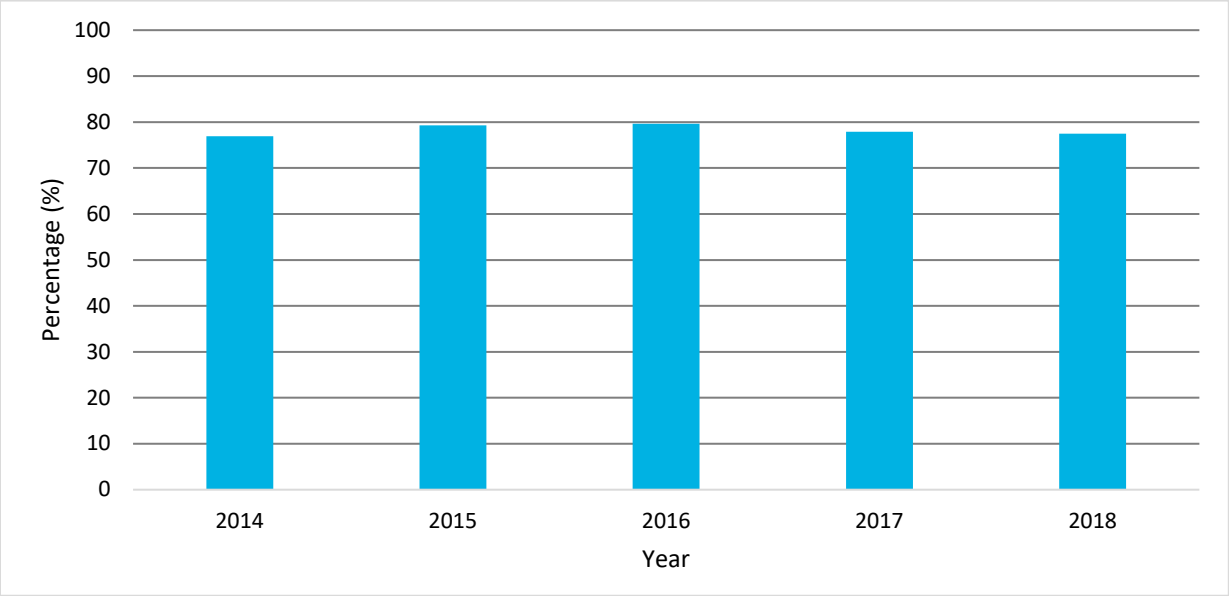


For data, see Table 13 in Appendix 1.

From 2014 to 2018, performance for the five-week diagnostic interval (without tissue biopsy) ranged from 92% to 94%, consistently exceeding the Canadian target of 90% or greater (Figure 12).

This indicator measures the percentage of Ontario screen-eligible women ages 50 to 74 with an abnormal OBSP screening mammogram result who did not need a tissue biopsy and were diagnosed within five weeks of the abnormal screen date.

Figure 13: Percentage of Ontario screen-eligible women, 50—74 years old, with an abnormal Ontario Breast Screening Program screening mammogram result who needed a tissue biopsy and were diagnosed (benign or cancer) within 7 weeks of the abnormal screen date, 2014—2018

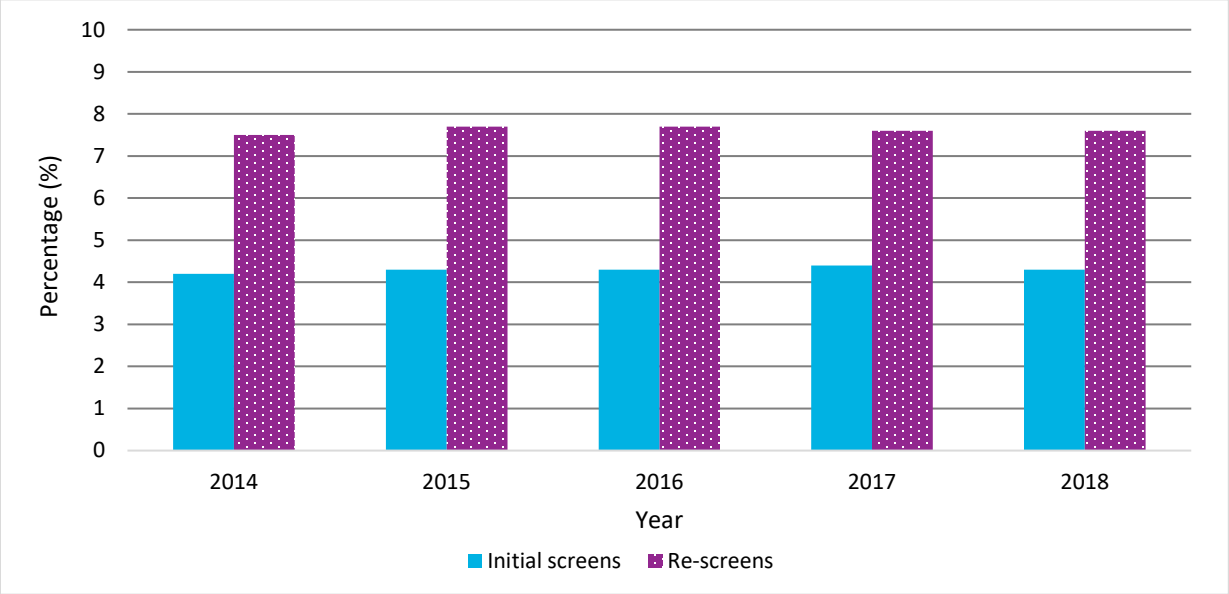


For data, see Table 14 in Appendix 1.

The seven-week diagnostic interval (with tissue biopsy) indictor (Figure 13) represents the percentage of Ontario screen-eligible women ages 50 to 74 with an abnormal OBSP screening mammogram result who needed a tissue biopsy and were diagnosed within seven weeks of their abnormal screen date. This indicator reached a high of 80% in 2016 and decreased to 76% in 2018. It continues to fall short of the national target of 90% or greater (1). Some contributing factors to this trend may be that screening participants who require a tissue biopsy for definitive diagnosis may be referred to another assessment site, which can result in increased wait times, or participants may need multiple diagnostic procedures before receiving a definitive diagnosis. Although Ontario ranks in the top three provinces in Canada for performance on this indicator, Ontario Health (Cancer Care Ontario) continues to work towards improving it (1).

Mammography positive predictive value (PPV)

Figure 14: Percentage of Ontario screen-eligible women, 50—74 years old, with an abnormal Ontario Breast Screening Program mammogram result, who were diagnosed with breast cancer (ductal carcinoma in situ or invasive) after diagnostic workup, 2014—2018



For data, see Table 15 in Appendix 1.

The positive predictive value of mammography is the probability that someone with an abnormal mammogram (a positive cancer screening test) truly has cancer.[*]

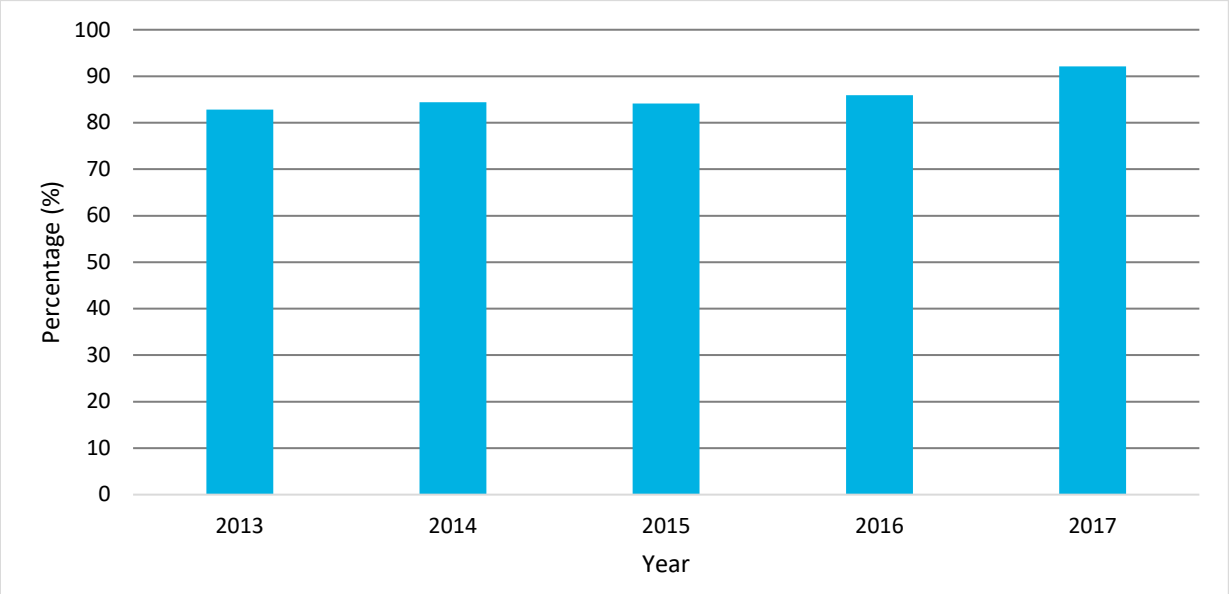
From 2014 to 2018, the PPV of initial screens remained steady at approximately 4% and the PPV of re-screens remained steady at approximately 8% (Figure 14). As per the Canadian Partnership Against Cancer there are different targets for initial screens (≥5%) and re-screens (≥6%) (1).

The PPV of a screening test depends on the underlying prevalence of disease in the population being screened. PPV increases with both age and with subsequent screens, which contributes to a higher PPV in older age groups (data not shown).

[***] PPV can be expressed as: true positives/[true positives + false positives].

Mammography sensitivity

Figure 15: Percentage of Ontario screen-eligible women, 50—74 years old, correctly diagnosed with breast cancer (ductal carcinoma in situ or invasive breast cancer), 2013—2017



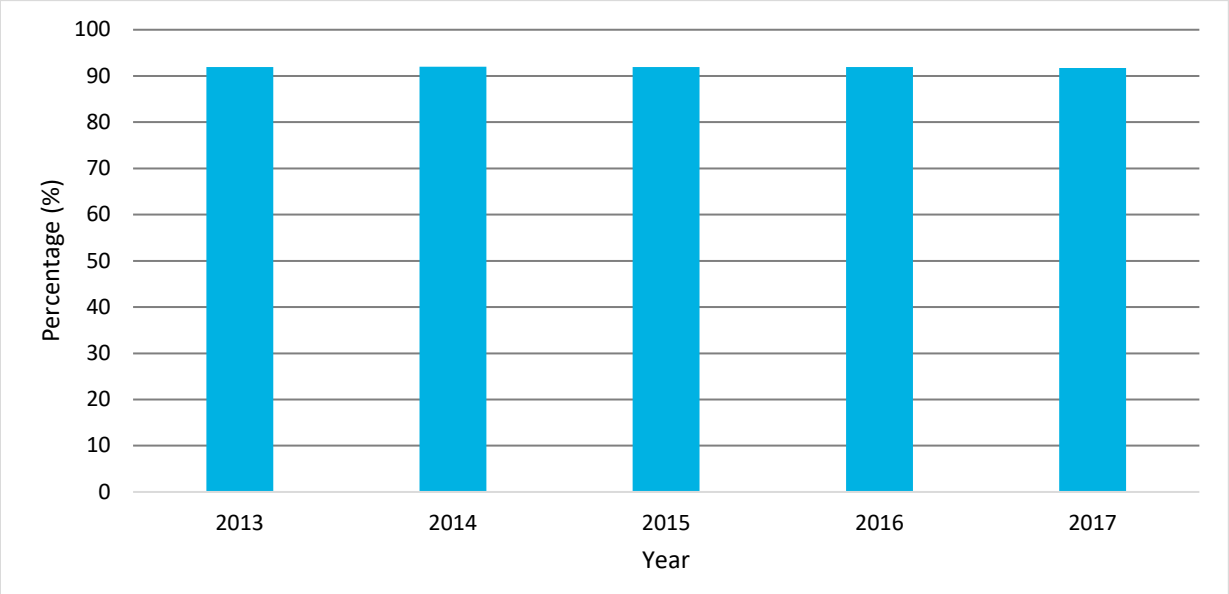
For data, see Table 16 in Appendix 1.

Sensitivity is the effectiveness of a screening test in detecting a cancer in people who truly have cancer. Sensitivity is an important measure of the efficacy of a screening test (28). Maintaining a high sensitivity, and therefore a low rate of interval cancers (cancers found between screens), is integral to the success of a screening test.

Mammography sensitivity increased from 83% in 2013 to 92% in 2017, with a pronounced increase from 2016 (86%) to 2017 (92%) (Figure 15). This increase in mammography sensitivity may reflect the increase in the rate of invasive cancer detection from 2013 to 2017 (Figure 17).

Mammography specificity

Figure 16: Percentage of Ontario screen-eligible women, 50—74 years old, without a breast cancer diagnosis who were correctly identified as having a normal Ontario Breast Screening Program screening mammogram result, 2013—2017

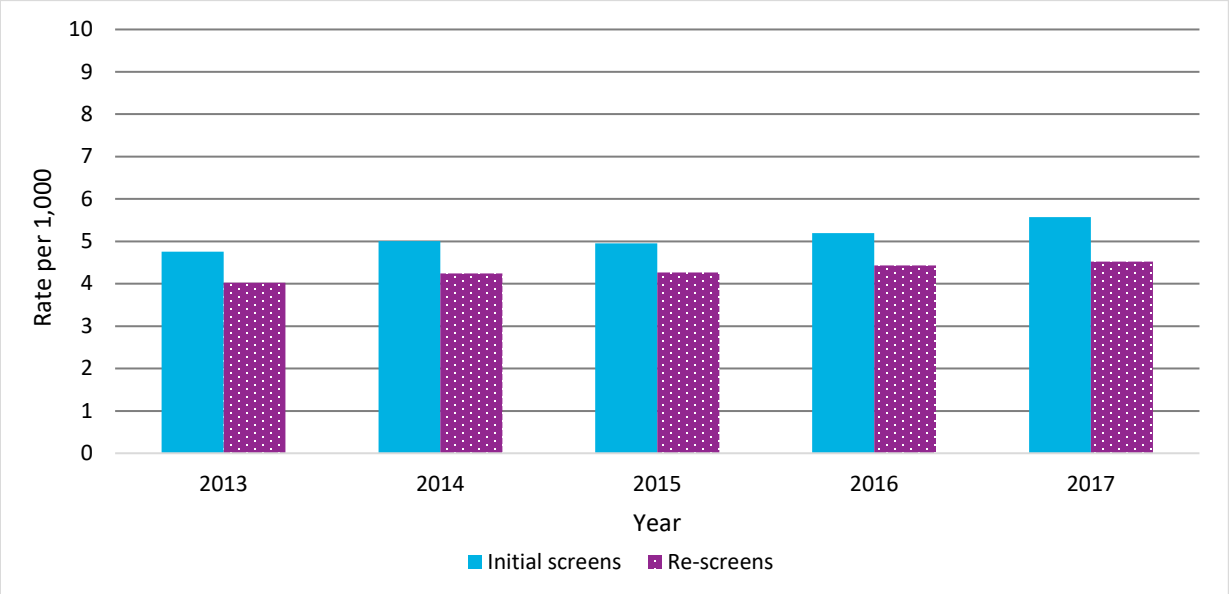


For data, see Table 17 in Appendix 1.

Mammography specificity remained stable at 92% from 2013 to 2017 (Figure 16). A high specificity reflects the ability of a cancer screening test to accurately identify people who do not have that cancer, i.e., there are fewer false-positive results.

Invasive breast cancer detection rate

Figure 17: Number of Ontario screen-eligible women, 50—74 years old, with an invasive screen-detected breast cancer per 1,000 women screened, 2013—2017



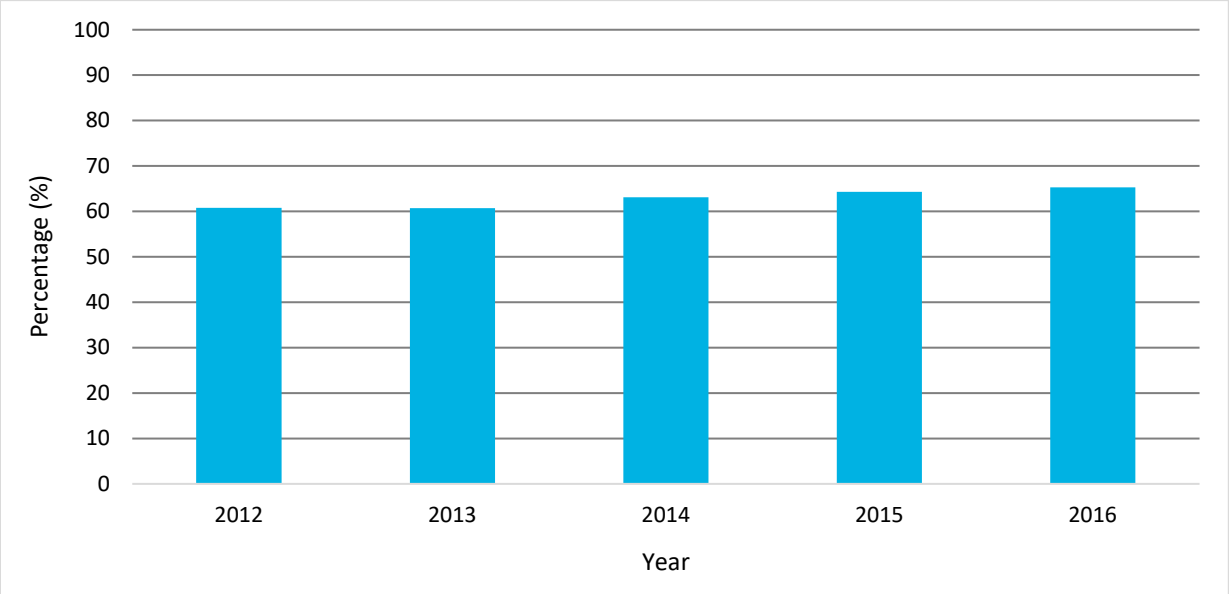
For data, see Table 18 in Appendix 1.

The invasive breast cancer detection rate increased from 4.2 per 1,000 in 2013 to 4.7 per 1,000 in 2017, averaging an increase of approximately 3% per year (Figure 17).

The invasive breast cancer detection rate for initial screens increased from 4.8 per 1,000 in 2013 to 5.6 per 1,000 in 2017. The breast cancer detection rate for re-screens was 4.0 per 1,000 in 2013 and 4.5 per 1,000 in 2017. The OBSP exceeds the Canadian targets for invasive cancer detection rate of >5 per 1,000 for initial screens and >3 per 1,000 for re-screens (1).

Early stage invasive cancer detection

Figure 18: Percentage of Ontario screen-eligible women, 50—74 years old, with an invasive Ontario Breast Screening Program screen-detected early stage (stage 1) breast cancer, 2012—2016



For data, see Table 19 in Appendix 1.

The majority of invasive breast cancers detected through the OBSP were stage I. From 2012 to 2016, the proportion of breast cancers detected at an early stage improved, increasing from 61% to 65% (Figure 18).

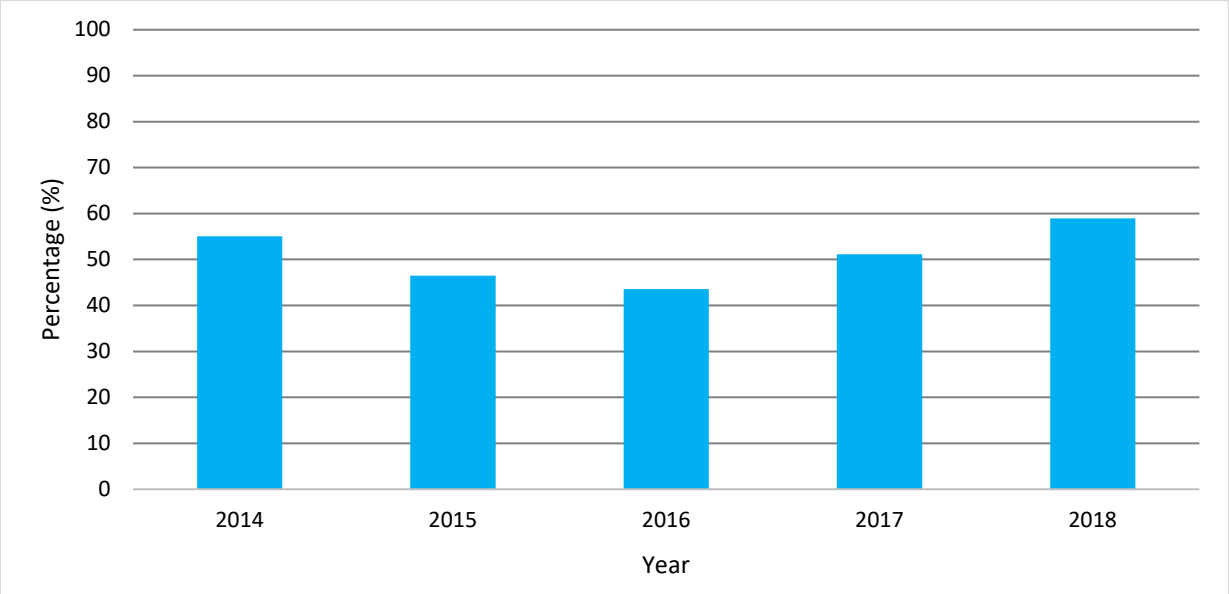
Ontario Breast Screening Program (OBSP): High Risk

The High Risk OBSP is the first population-based organized breast screening program for women at high risk of breast cancer in Canada. Retention in the High Risk OBSP increased from 70% in 2015 to 77% in 2017 after a decrease from 2013 (78%) to 2015 (70%). The overall abnormal call rate for participants in the High Risk OBSP decreased from 2013, when it was 25%, to 2018, when it was 19%. This decrease may have been driven by an increasing proportion of re-screens (rather than initial screens) in the program. Within the High Risk OBSP, the combined positive predictive value (PPV) for initial screens and re-screens increased from 6% in 2013 to 7% in 2017. The percentage of women who were screened within 90 days of confirmation of high risk status decreased from 2014 (55%) to 2016 (44%) and then increased after 2016 to a high of 59% in 2018.

In 2019, an evaluation of the High Risk OBSP validated the program's recommendations for screening high risk women ages 30 to 69 with mammography and magnetic resonance imaging (MRI) (33). The evaluation found that screening women with digital mammography and breast MRI resulted in higher breast cancer detection rates than screening with mammography alone. The evaluation also showed that results from the High Risk OBSP were consistent with findings from research settings, including observational studies that presented the benefits of screening high risk women with mammography and MRI (33). In addition, as a result of recommendations made by Cancer Care Ontario before it transitioned to Ontario Health, the High Risk OBSP received additional MRI funding from the Ministry of Health to support future growth of the program.

Women screened within 90 days of confirmation of high risk status

Figure 19: Percentage of Ontario women, 30—69 years old, screened with magnetic resonance imaging (MRI) or ultrasound within 90 days of confirmation of high risk status, 2013—2018



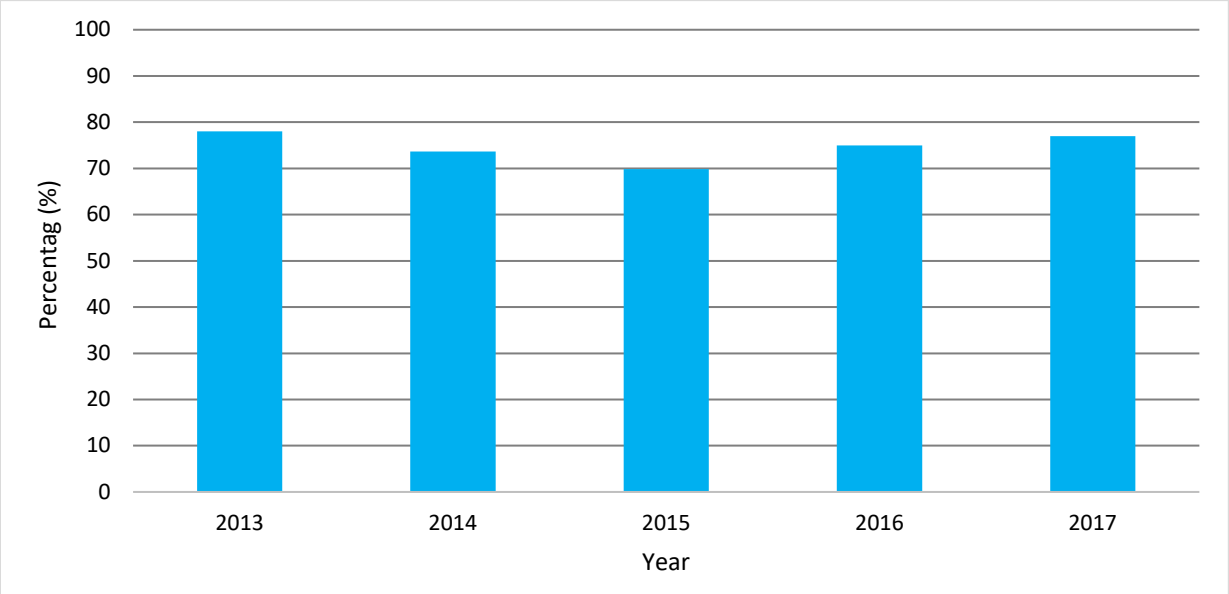
For data, see Table 20 in Appendix 1.

The percentage of women screened within 90 days of confirmation of high risk status indicator measures the percentage of participants who were screened with magnetic resonance imaging (MRI) or ultrasound within 90 days of confirming their high risk status. For participants at high risk of developing breast cancer, screening with MRI in addition to mammography is recommended because mammography alone is less sensitive than MRI and mammography combined (33).

In 2016, the percentage of women screened with MRI or ultrasound within 90 days of confirmation of their high risk status decreased to 44% (Figure 19). Before the program transitioned to Ontario Health, Cancer Care Ontario worked with the Ministry of Health to support the growth of the High Risk OBSP and the proportion of women screened within 90 days increased to 60% in 2018.

Retention in the High Risk OBSP

Figure 20: Percentage of Ontario women, 30—68 years old, who had a subsequent High Risk OBSP screen (i.e MRI or ultrasound) within 15 months of a previous High Risk OBSP screen, 2013—2017

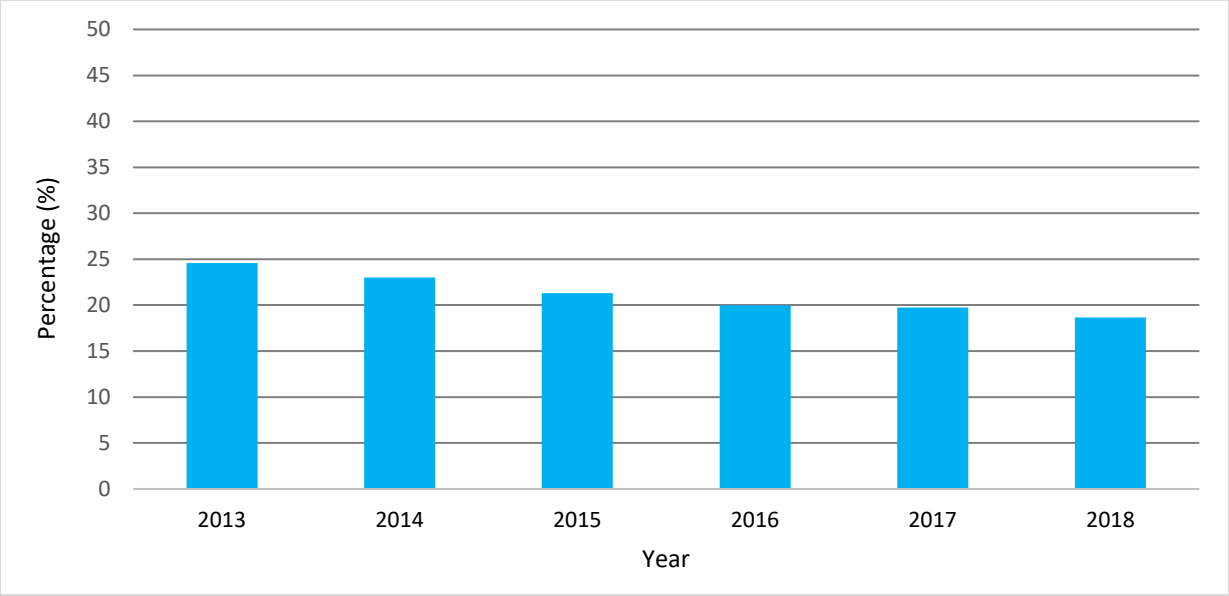


For data, see Table 21 in Appendix 1.

Retention measures the percentage of high risk screening participants ages 30 to 68 who had a subsequent MRI or ultrasound within 15 months of a previous High Risk OBSP screen. Retention decreased from 78% in 2013 to 70% in 2015 (Figure 20). Retention in the High Risk OBSP increased after 2015, reaching 77% in 2017.

High Risk OBSP abnormal call rate

Figure 21: Percentage of high risk screened women, 30—69 years old, with an abnormal screening result, 2013—2018

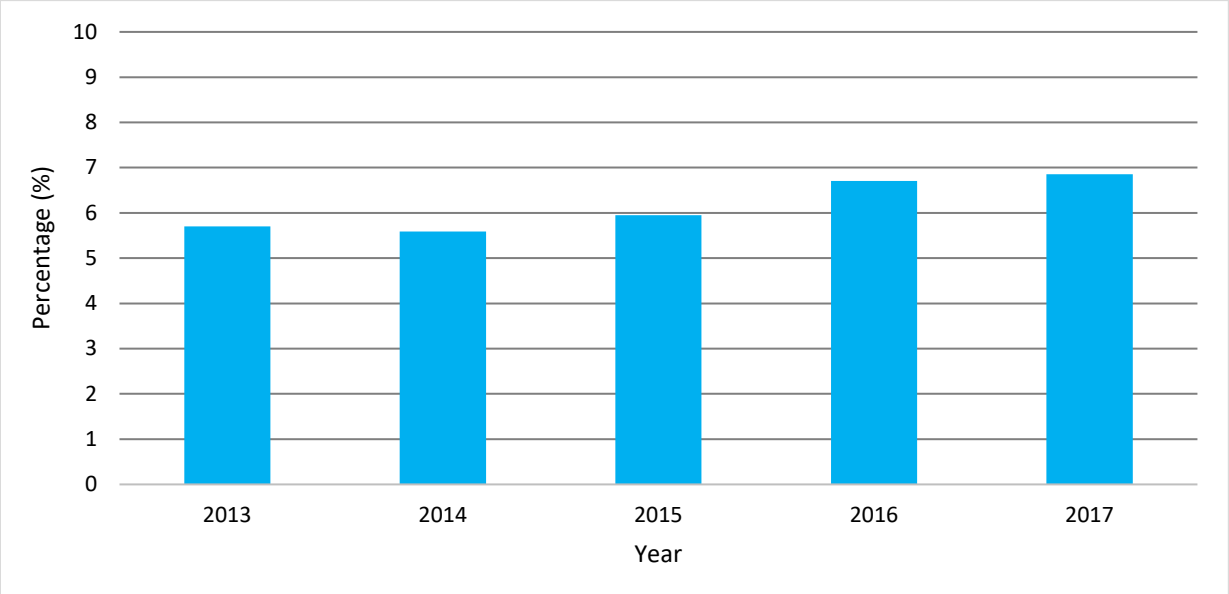


For data, see Table 22 in Appendix 1.

Compared to screening participants at average risk for breast cancer (Figure 10), participants in the High Risk OBSP have an increased abnormal call rate due to their elevated risk (Figure 21). The percentage of abnormal calls in the High Risk OBSP decreased from 25% in 2013 to 19% in 2018 (Figure 21). This decrease may be driven by a growing proportion of re-screens (compared to initial screens) in the High Risk OBSP. Abnormal call rate is higher for initial screens because radiologists do not have previous images to use for comparison.

Positive Predictive Value (PPV) for mammography and MRI in the High Risk OBSP

Figure 22: Percentage of high risk screened women, 30—69 years old, with an abnormal screening result who were diagnosed with breast cancer (ductal carcinoma in situ or invasive breast cancer) after completion of diagnostic workup, 2013—2017

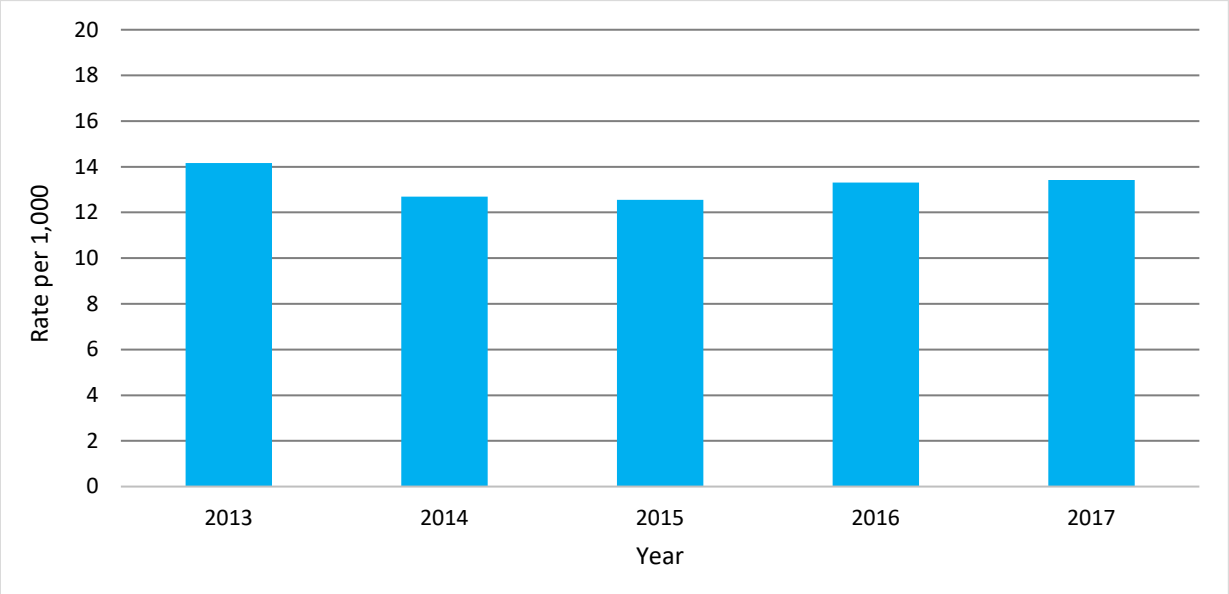


For data, see Table 23 in Appendix 1.

In 2017, the PPV for mammography and MRI in the High Risk OBSP was 6.9% (Figure 22). The PPV for combined initial screens and re-screens increased from 5.6% in 2013 to 6.9% in 2017. The PPV of a screening test depends on the underlying prevalence of disease in the population being screened. PPV increases with both age and with subsequent screens.

Cancer detection in the High Risk OBSP

Figure 23: Number of high risk screened women, 30—69 years old, with breast cancer (ductal carcinoma in situ or invasive breast cancer), per 1,000 women screened, 2013—2017



For data, see Table 24 in Appendix 1.

The invasive cancer detection rate in the High Risk OBSP decreased from 14.2 per 1,000 in 2013 to 13.4 per 1,000 in 2017 (Figure 23). The invasive cancer detection rate is higher in the High Risk OBSP than the OBSP due to the elevated risk profile of participants in the High Risk OBSP.

Ontario Cervical Screening Program (OCSP)

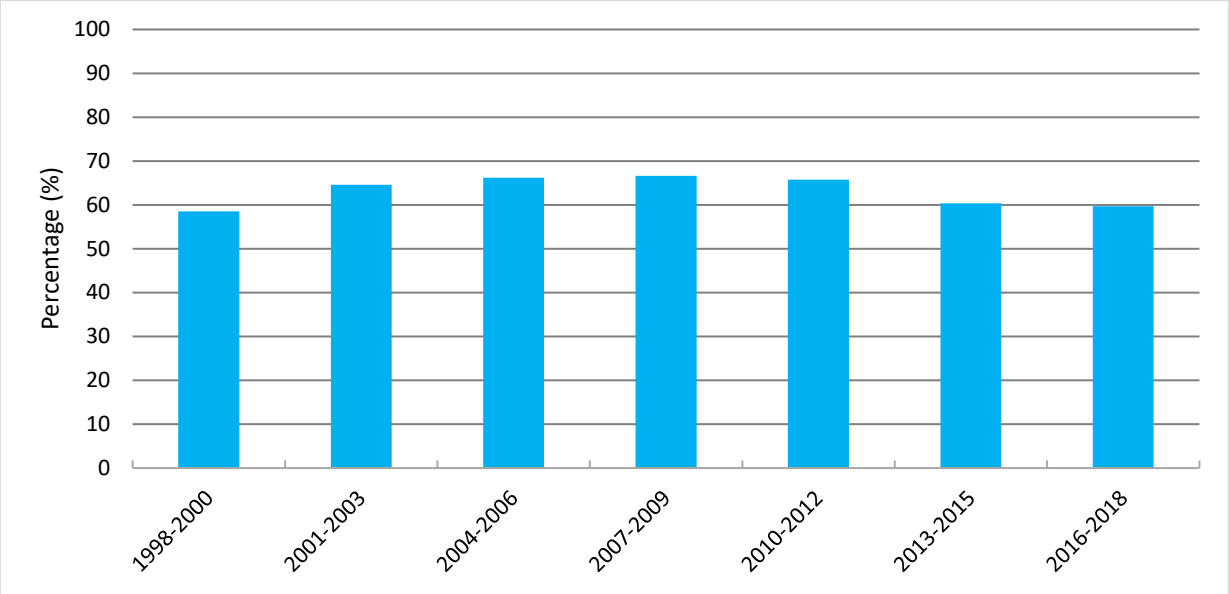
Opportunistic screening (screening in the absence of an organized cancer screening program) for cervical cancer began in Ontario in the 1960s with the introduction of the Pap test. In 1997, the Ontario Ministry of Health and Long-Term Care approved funding to Cancer Care Ontario to establish an organized cervical screening program. The OCSP was launched in 2000 and has further contributed to reductions in cervical cancer incidence and mortality that were seen after adoption of the Pap test.

In 2000, 59% of eligible women in Ontario were getting cervical screening. Participation in cervical screening peaked at 67% in 2007–2009, and remained stable at 60% from 2013—2015 to 2016—2018. Retention decreased from 2011 (71%) to 2014 (60%). Decreases in participation and retention beginning in 2013 coincided with changes to Ontario's cervical screening guidelines extending the recommended interval for Pap tests to once every three years.

Follow-up of abnormal results increased from the start of the OCSP in 2000 to 2018. By 2018, 86% of women with a high-grade abnormal Pap test result received appropriate follow-up within six months, compared to 49% in 2000. From 2013 to 2015, the detection rate for pre-cancerous lesions decreased, from 3.7 per 1,000 to 2.4 per 1,000, and then increased to 3.0 per 1,000 in 2017. The detection rate of invasive cancers remained stable at less than 0.5 per 1,000 from 2013 to 2017.

Cervical screening participation

Figure 24: Percentage of Ontario screen-eligible women, 21—69 years old, who had at least 1 Pap test within a 42-month period, 1998—2018

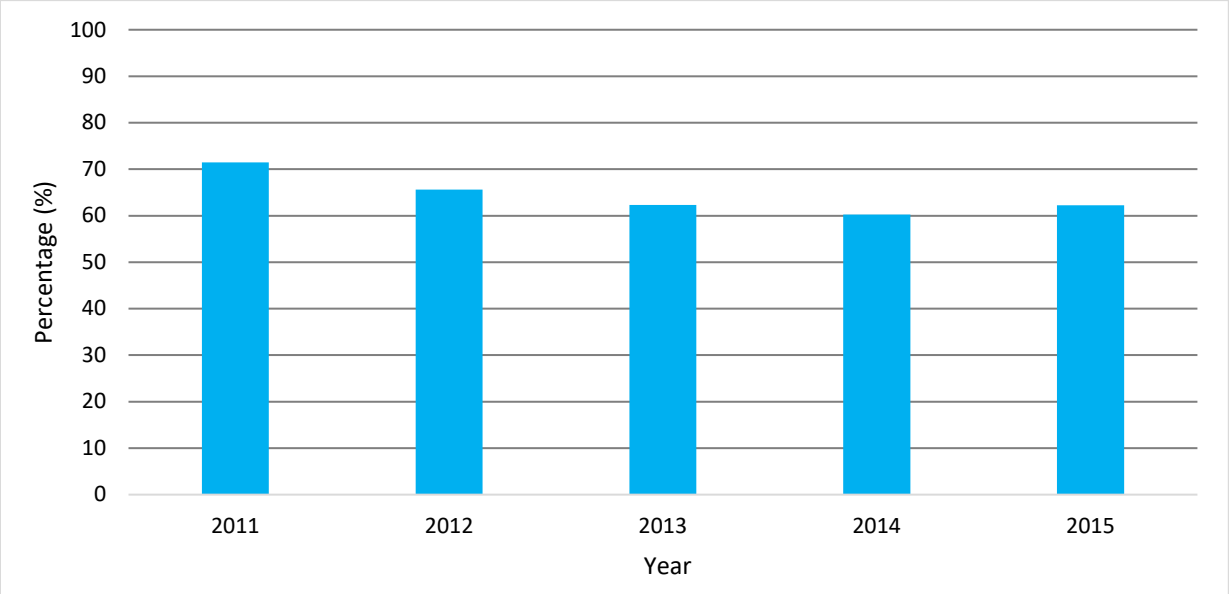


For data, see Table 25 in Appendix 1.

Participation in the OCSP has fluctuated over time, from 59% of eligible women in 1998–2000 to 67% in 2007–2009 (Figure 24). Participation remained stable at approximately 60% from 2013 to 2018. The decrease in participation from 2010—2012 and 2013—2015 coincided with the implementation of updated cervical screening guidelines in 2011 that extended the recommended interval between Pap tests from once a year to once every three years.

Cervical screening retention

Figure 25: Percentage of Ontario screen-eligible women, 21—69 years old, who had a subsequent Pap test within 42 months of a normal Pap test result, 2011—2015

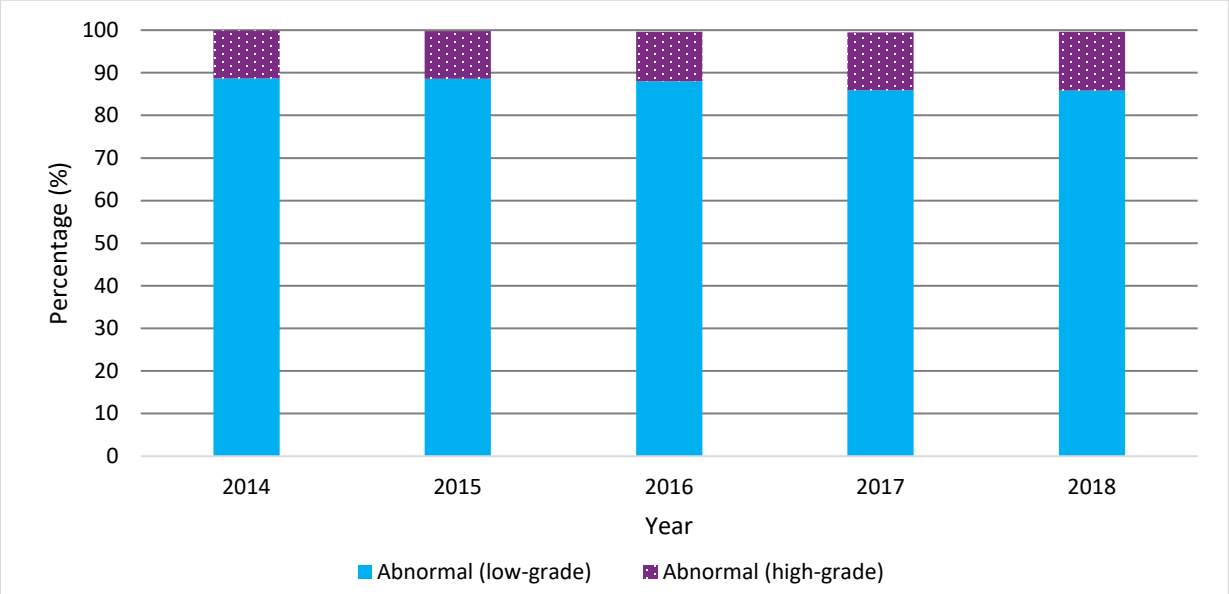


For data, see Table 26 in Appendix 1.

Cervical screening retention represents the proportion of participants returning for a screening test within 42 months (3.5 years) of a normal Pap test. Retention in the OCSP decreased from 2011 (71%) to 2014 (60%), which coincided with the updated 2011 cervical screening guidelines (Figure 25). Retention increased after 2014, with 62% of participants returning for a subsequent screening test within 42 months in 2015.

Cervical screening follow-up

Figure 26: Abnormal Pap test results distribution, 2014—2018

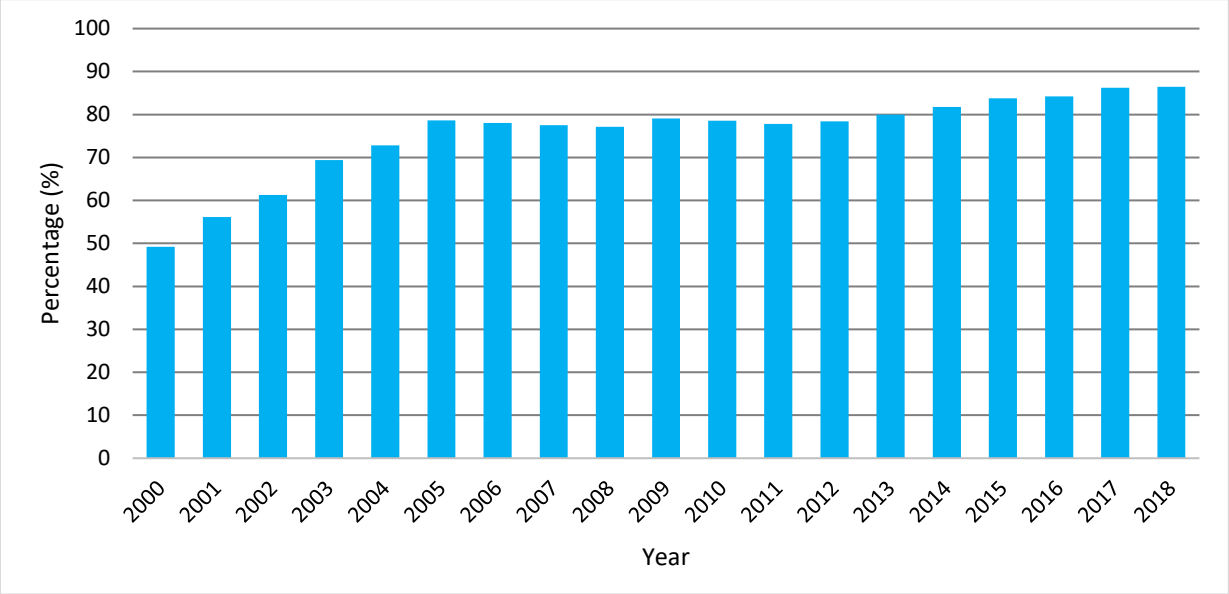


For data, see Table 27 in Appendix 1.

In 2018, out of 974,743 Pap tests with known results, 6% were abnormal. Of the abnormal test results, 86% were low-grade and 14% were high-grade. The proportion of abnormal Pap tests with low-grade results decreased from 2014 (88%) to 2018 (86%) (Figure 26), while the proportion of abnormal Pap tests with high-grade results increased from 11% in 2014 to 14% in 2018.

The number of screen-eligible women who had a Pap test increased from 2014 to 2018. However, the percentage of abnormal Pap test results remained steady each year from 2014 to 2018, ranging from 5% to 6%.

Figure 27: Percentage of Ontario screen-eligible women, 21—69 years old, with a high-grade cervical dysplasia result on a Pap test who underwent colposcopy or definitive treatment within 6 months of the high-grade abnormal result, 2000—2018

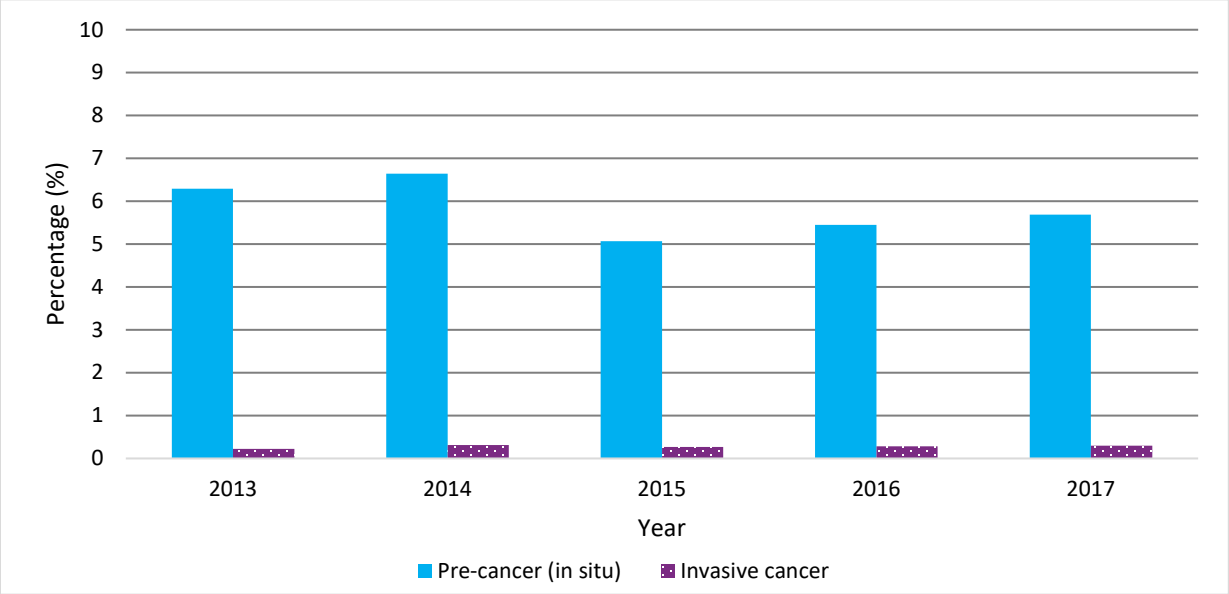


For data, see Table 28 in Appendix 1.

In 2000, 49% of participants received follow-up care within six months of a high-grade abnormal Pap test result. However, 18 years after the launch of the OCSP, follow-up had improved, with 86% of participants receiving follow-up within six months of a high-grade abnormal Pap result in 2018 (Figure 27). This increase in follow-up of abnormal results over time means that between 3,000 and 5,000 women per year received follow-up care within six months of a high-grade abnormal Pap test result.

Pap test positive predictive value (PPV)

Figure 28: Percentage of Ontario screen-eligible women, 21—69 years old, with an abnormal Pap test result who were diagnosed with an invasive cervical cancer or pre-cancer after a follow-up colposcopy or surgical procedure involving the cervix, 2013—2017



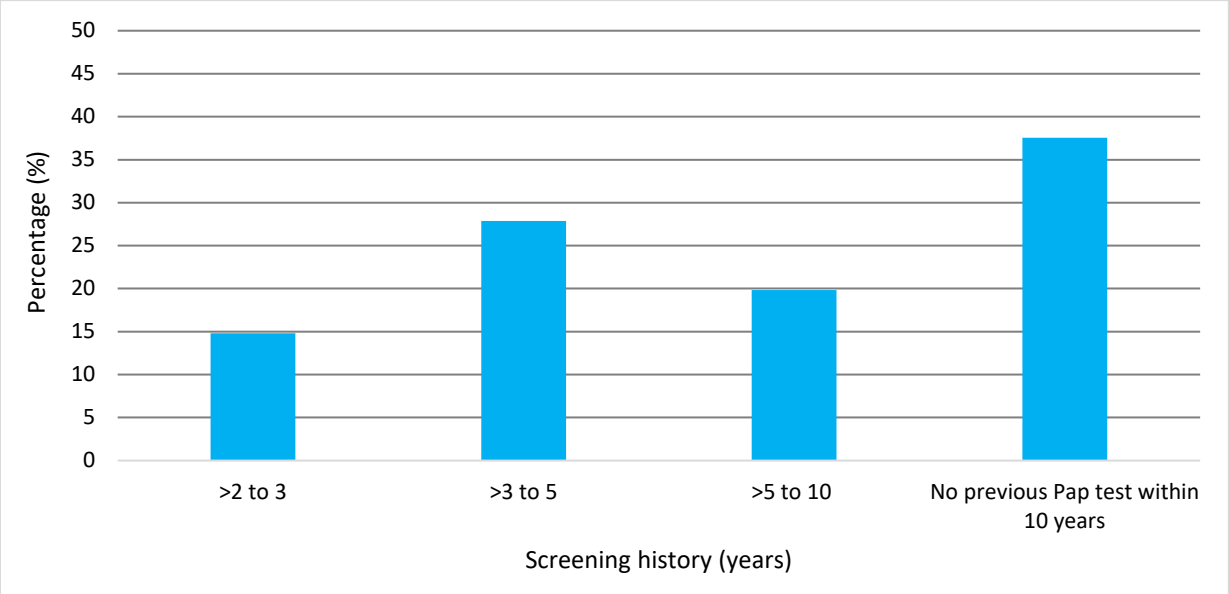
For data, see Table 29 in Appendix 1.

The positive predictive value is the probability that someone with a positive cancer screening test truly has cancer. From 2013 to 2017, 5% to 7% of screening participants with an abnormal Pap were diagnosed with a pre-cancerous lesion after a follow-up colposcopy or a surgical procedure involving the cervix (Figure 28). During the same time period, the positive predictive value of Pap tests for invasive cervical cancer remained around 0.3%.

The goal of cervical screening with the Pap test is to identify pre-cancerous lesions that may develop into cervical cancer if they are not treated. Therefore, the positive predictive value of Pap tests for carcinoma in-situ provides a more appropriate measure of the effectiveness of the Pap test than the positive predictive value of Pap tests for invasive cervical cancer.

Cervical screening history in invasive cervical cancer cases

Figure 29: Percentage of Ontario screen-eligible women, age 21 and older, who were diagnosed with invasive cervical cancer and had a history of cervical cancer screening, 2014—2018



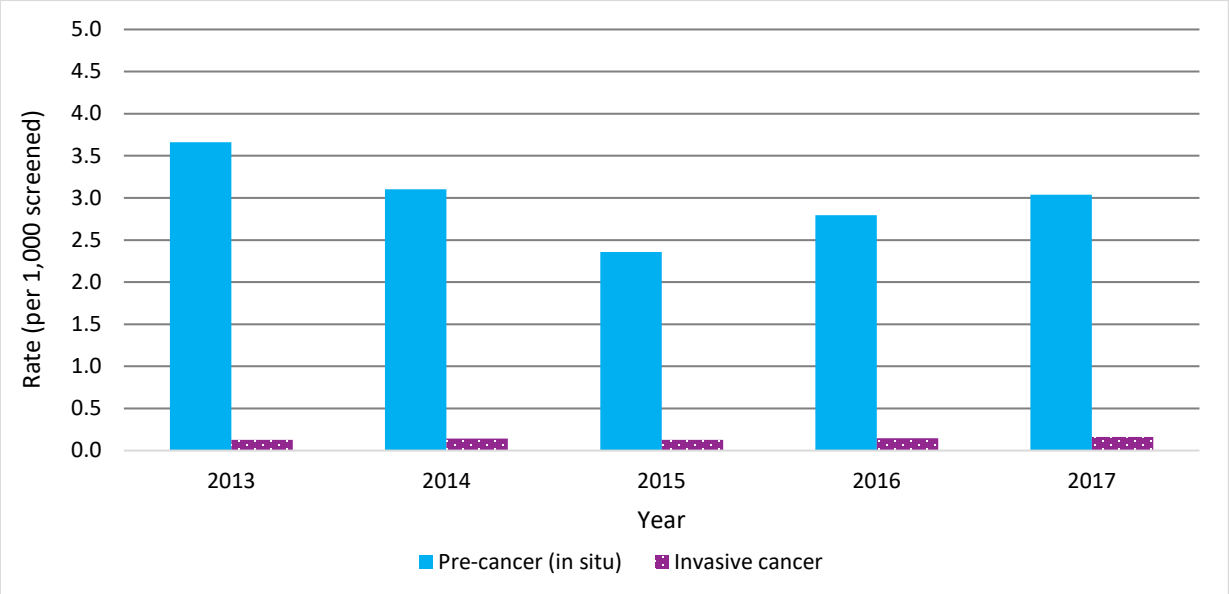
For data, see Table 30 in Appendix 1.

Most cervical cancers are found in people who have never been screened or who have been screened less often than recommended by current cervical screening guidelines (34). From 2014 to 2018, 38% of the people in Ontario who were diagnosed with invasive cervical cancer had not been screened in the 10 years before their diagnosis (Figure 29).

Of the people who were diagnosed with invasive cervical cancer, 15% had had a Pap test within two or three years of their diagnosis. There are several reasons some people might be diagnosed with cancer before they are due for re-screening. First, screening tests are not perfect and the Pap test may miss some pre-cancers. The implementation of the HPV test as the cervical screening test in Ontario will help to address this issue because the HPV test is more sensitive for certain pre-cancerous abnormalities (35) and can detect persistent high-grade abnormalities earlier than the Pap test (36,37). Second, while the Pap test can identify invasive cervical cancers, the test is not designed for this purpose – the goal of the Pap test is actually to identify early cervical cell changes. Therefore, screening with the Pap test is more likely to miss an invasive cancer than a pre-cancer (38). Third, timely follow-up of abnormal screening results is important to reduce the risk of developing an invasive cervical cancer as a result of untreated pre-cancerous abnormalities. Although the proportion of people with abnormal results who have follow-up within six months has increased, there is room for improvement.

Cervical cancer and pre-cancer (in situ) detection rate

Figure 30: Number of Ontario screen-eligible women, 21—69 years old, with a screen-detected pre-cancer or invasive cancer, per 1,000 screened using the Pap test, 2013—2017



For data, see Table 31 in Appendix 1.

The screen-detected pre-cancer rate decreased from 3.7 to 2.4 per 1,000 from 2013 to 2015 and then increased from 2.4 to 3 per 1,000 from 2015 to 2017 (Figure 30). For invasive cancers, the detection rate remained stable at less than 0.5 per 1,000 from 2013 to 2017.

The Pap test is designed to identify abnormalities that may develop into cervical cancer, which explains why the rate of screen-detected pre-cancers (screen-detected cancer in situ) is higher than the rate of screen-detected invasive cervical cancer.

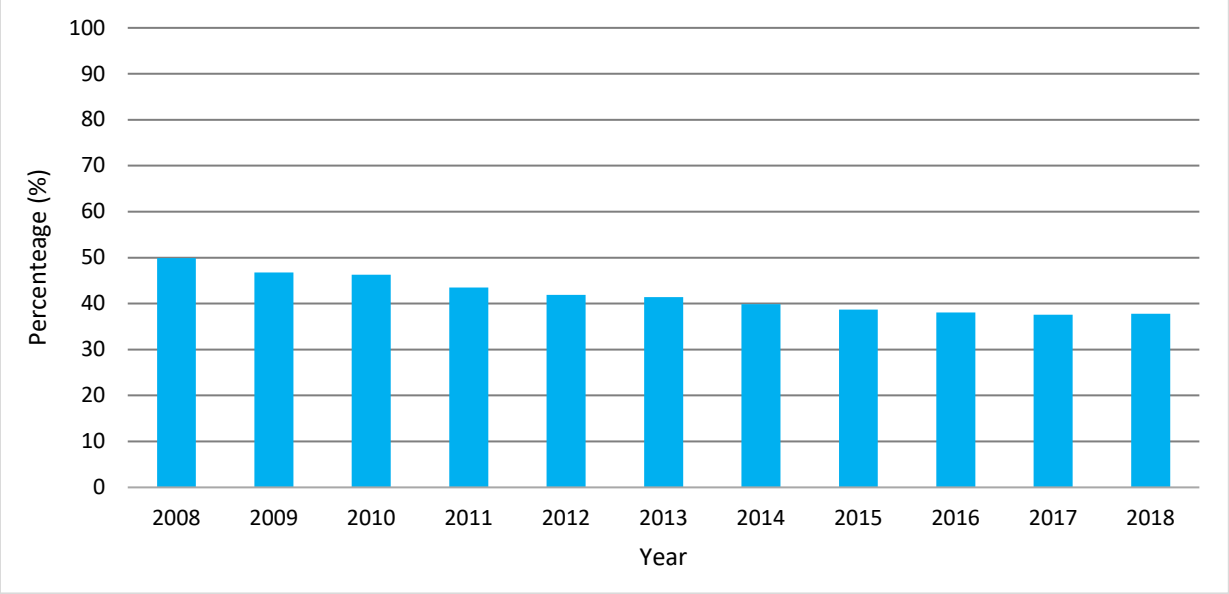
ColonCancerCheck (CCC)

Note: Some indicators reported in this section are measures of colonoscopy quality and include data for colonoscopies performed for all indications.

From ColonCancerCheck program launch in 2008 until 2018, several key program indicators substantially improved. The percentage of people overdue for colorectal cancer screening improved by 24% and the percentage of people who did not receive follow-up colonoscopy within six months of an abnormal guaiac fecal occult blood test (gFOBT) test improved by 45%. The percentage of people overdue for colorectal cancer screening stood at 38% in 2018, which exceeded the European performance target of less than or equal to 55% (2). The percentage of gFOBT-detected stage I colorectal cancers increased from 28% in 2013 to 32% in 2017.

Percentage overdue for colorectal cancer screening

Figure 31: Percentage of Ontario screen-eligible people, 50—74 years old, who were overdue for colorectal cancer screening, 2008—2018



For data, see Table 32 in Appendix 1.

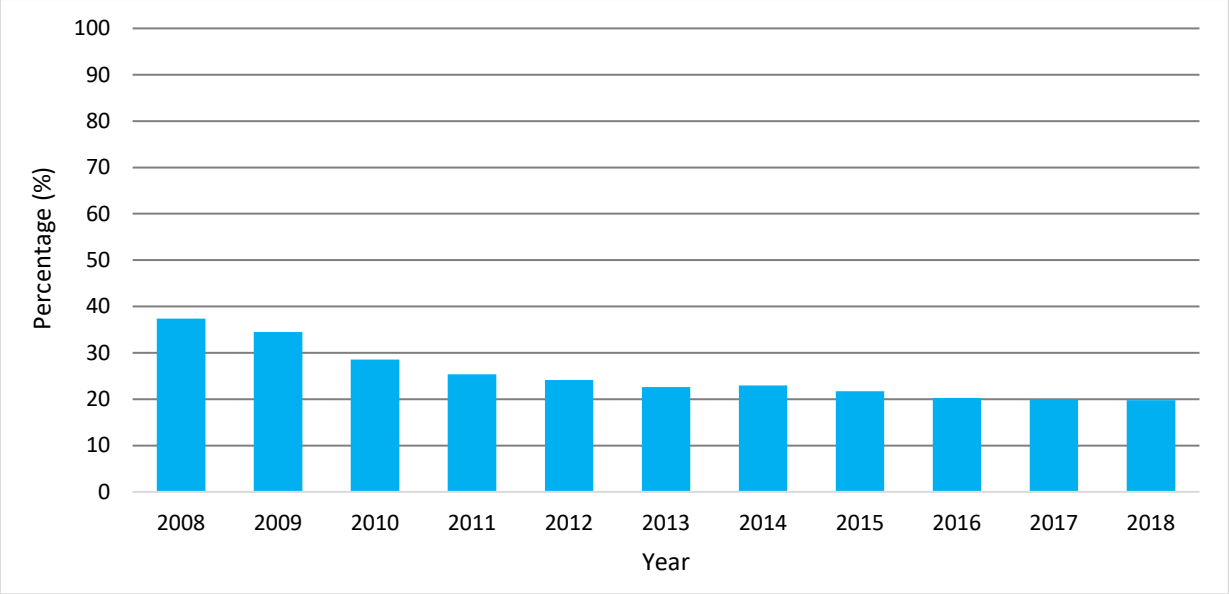
The overdue for colorectal cancer screening indicator represents the percentage of Ontario screen-eligible people, 50 to 74 years old, who had not had a gFOBT in two years, a flexible sigmoidoscopy in 10 years or a colonoscopy in 10 years. The percentage of people overdue for screening decreased

(improved), from 50% in 2008 to 38% in 2018 (Figure 31), which exceeded the European performance target of less than or equal to 55% (2).

Ontario Health (Cancer Care Ontario) now recommends screening people at average risk for colorectal cancer with the fecal immunochemical test (FIT) instead of the gFOBT. FIT was implemented in the ColonCancerCheck program in June 2019, so it is not included in the overdue for screening indicator shown in Figure 31.

No colonoscopy within 6 months of an abnormal guaiac Fecal Occult Blood Test (gFOBT) result

Figure 32: Percentage of Ontario screen-eligible people, 50—74 years old, with an abnormal gFOBT result who did not undergo colonoscopy within 6 months of their abnormal gFOBT, 2008—2018

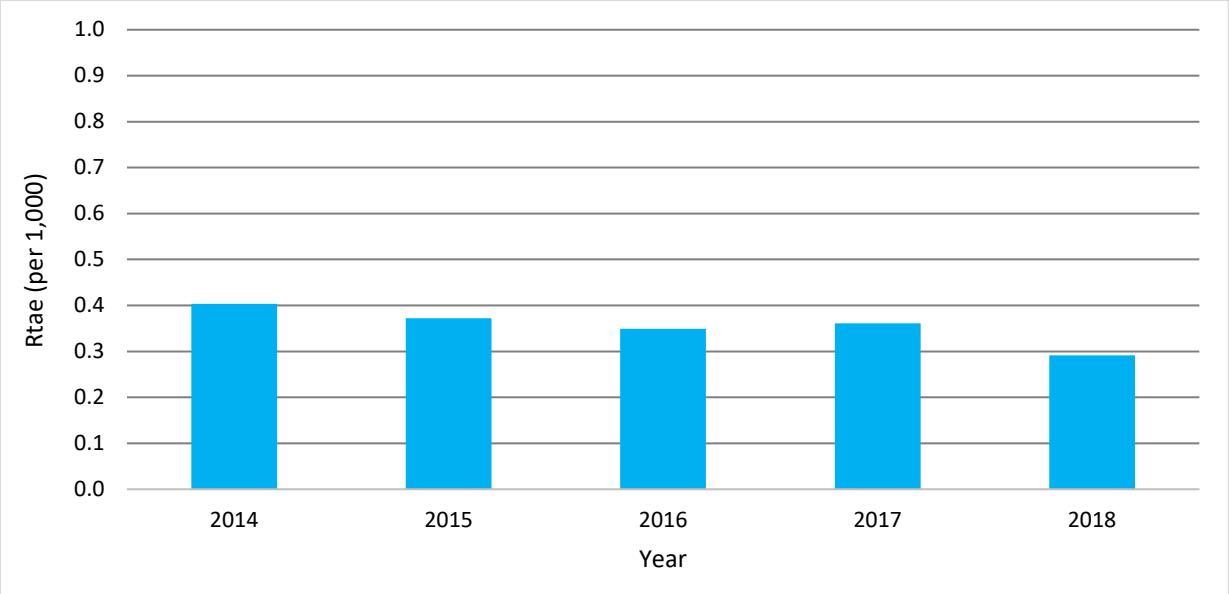


For data, see Table 33 in Appendix 1.

This indicator measures the percentage of Ontario screen-eligible people with an abnormal gFOBT result who did not undergo colonoscopy within six months of their abnormal gFOBT. In the 10 years following the 2008 launch of the ColonCancerCheck program, the proportion of people who did not receive follow-up within six months of an abnormal gFOBT result decreased (improved) from 37% in 2008 to 20% since 2016, which represents 2,000 more people who received appropriate follow-up (Figure 32).

Colonoscopy quality

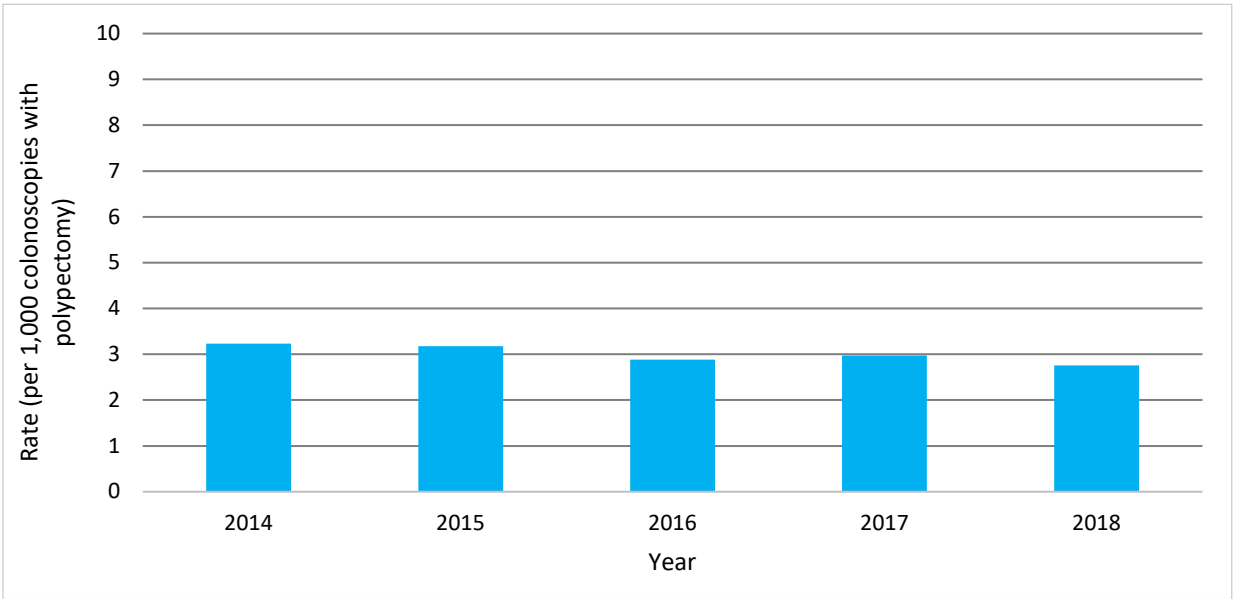
Figure 33: Rate of outpatient colonoscopies followed by hospital admissions for perforations within 7 days of colonoscopy, per 1,000 colonoscopies, 2014—2018



For data, see Table 34 in Appendix 1.

Perforation rate is an important measure of the quality of colonoscopy procedures performed in outpatient settings. This indicator includes colonoscopies performed for all reasons (i.e., not just for follow-up of abnormal screening results or to screen people at increased risk of colorectal cancer). In 2014, the outpatient perforation rate was 0.4 per 1,000 colonoscopies (Figure 33). The perforation rate decreased (improved) to 0.29 per 1,000 colonoscopies in 2018. From 2014 to 2018, the perforation rate was consistently below the national and European minimum performance target of <1 per 1,000 colonoscopies (3,4).

Figure 34: Rate of outpatient colonoscopies with polypectomy followed by hospital admissions for lower gastrointestinal bleeding within 14 days of colonoscopy, per 1,000 colonoscopies, 2014—2018

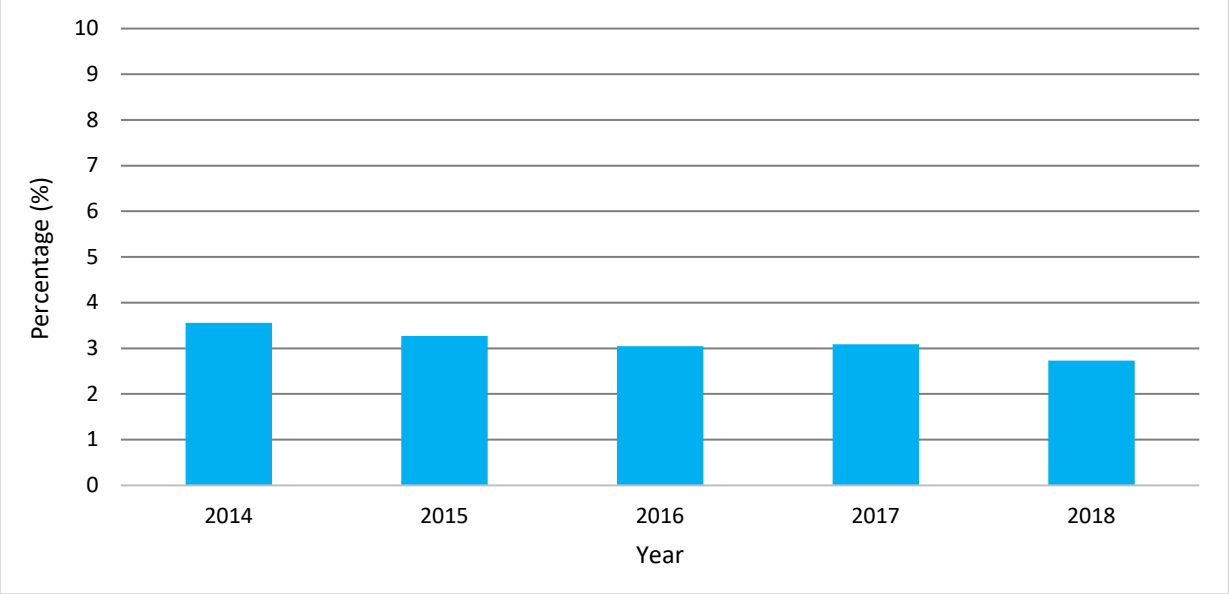


For data, see Table 35 in Appendix 1.

During a colonoscopy, the endoscopist may also perform a polypectomy. This is a procedure done to remove one or more polyps, which are abnormal growths on the lining of the colon. In the days following this procedure, some people may experience lower gastrointestinal bleeding, called post-polypectomy bleeding.

The rate of post polypectomy bleeding is another important measure of colonoscopy quality. From 2014 to 2018, the rate of post-polypectomy bleeding was relatively stable at around 3 per 1,000 colonoscopies with polypectomy (Figure 34), which is well below the provincial and United Kingdom's minimum performance target of <10 per 1,000 colonoscopies where polypectomy is performed (39,40).

Figure 35: Percentage of outpatient colonoscopies with poor bowel preparation in hospital, 2014—2018

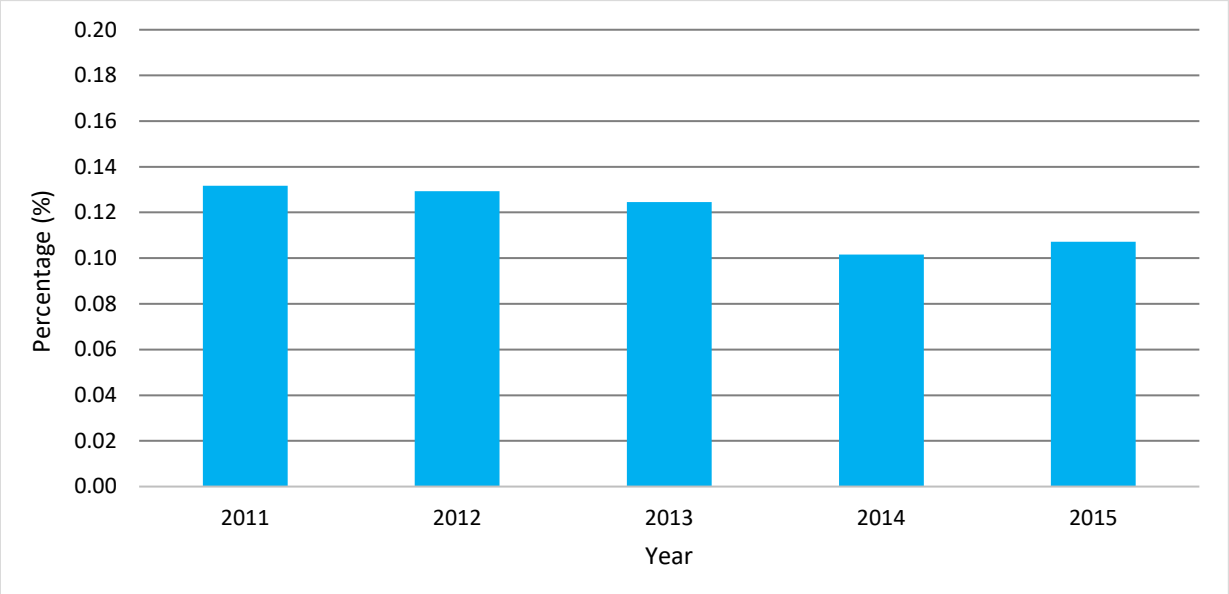


For data, see Table 36 in Appendix 1.

Bowel preparation is also a measure of colonoscopy quality. The proportion of outpatient colonoscopies with poor bowel preparation decreased (improved) from 3.6% in 2014 to 2.7% in 2018 (Figure 35). Poor bowel preparation can lead to poor performance on other quality indicators, such as patient discomfort, cecal intubation rate (a measure of the completeness of colonoscopy) and adenoma detection rate (percentage of colonoscopies that were performed by the same endoscopist and involved removing adenomas) (41).

Post colonoscopy colorectal cancer rate

Figure 36: Percentage of outpatient colonoscopies negative for colorectal cancer followed by colorectal cancer diagnosis within 6 to 36 months of colonoscopy, 2011—2015

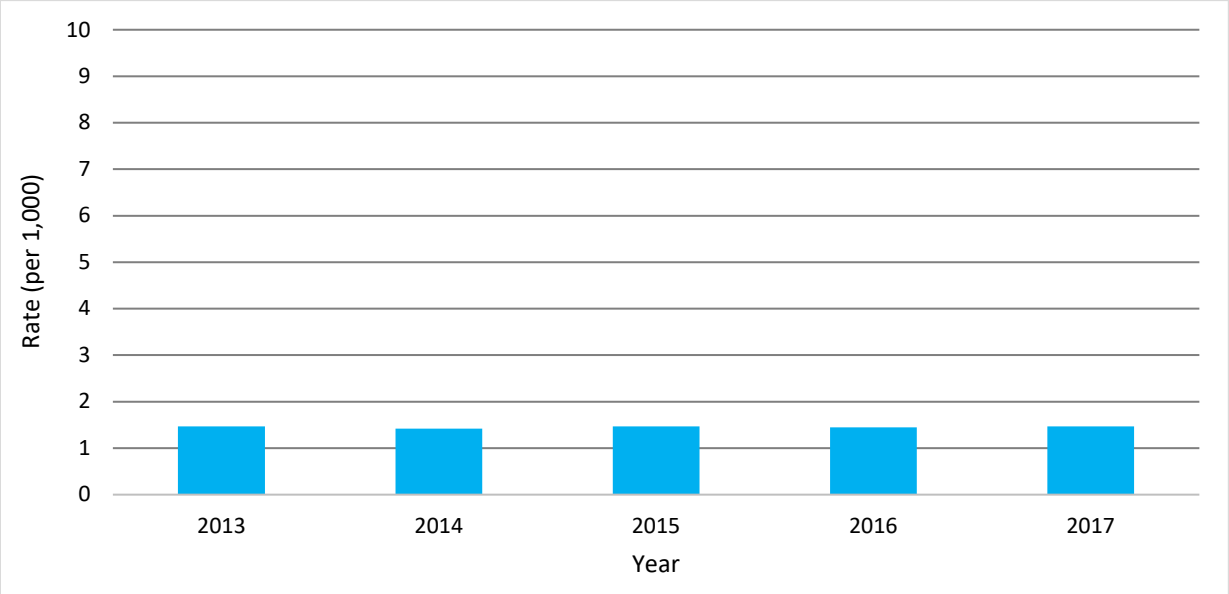


For data, see Table 37 in Appendix 1.

Post-colonoscopy colorectal cancer rate represents the percentage of new or missed cancers. This indicator is estimated by the number of colonoscopies negative for colorectal cancer followed by a colorectal cancer diagnosis within six to 36 months. The percentage of post-colonoscopy colorectal cancers decreased (improved), from 0.13% in 2011 to 0.11% in 2015 (Figure 36).

Invasive cancer detection rate for gFOBT

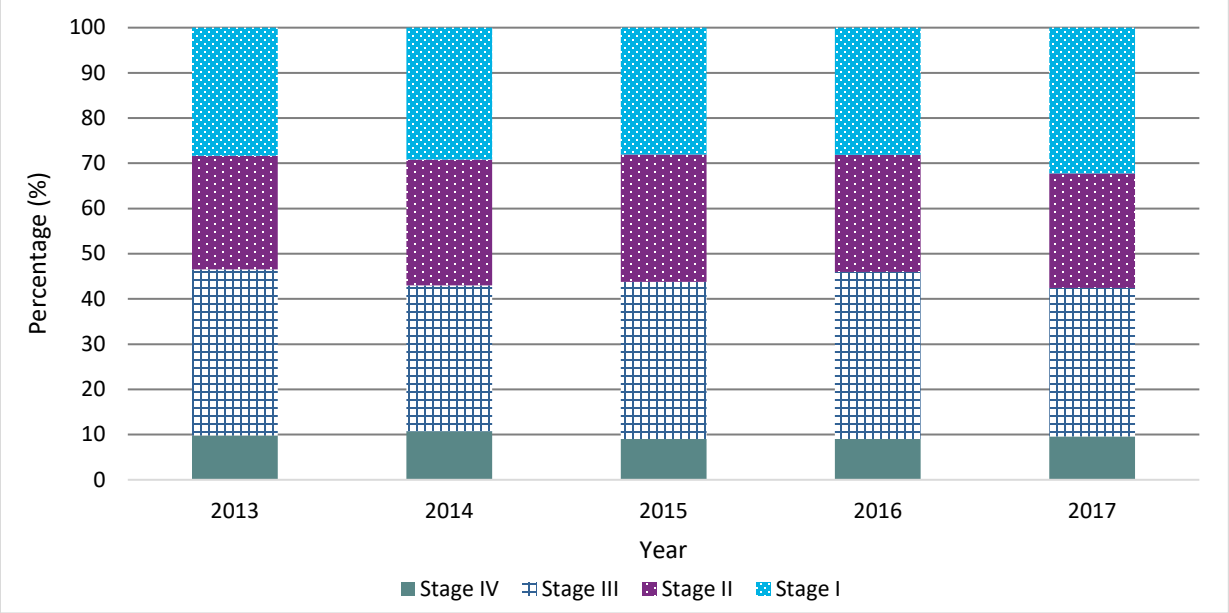
Figure 37: Number of screen-eligible people, 50—74 years old, with a detected invasive colorectal cancer per 1,000 screened using ColonCancerCheck program gFOBT, 2013—2017



For data, see Table 38 in Appendix 1.

The gFOBT invasive colorectal cancer detection rate represents the number of Ontario screen-eligible people ages 50 to 74 with a detected invasive colorectal cancer per 1,000 people screened using ColonCancerCheck program gFOBT kits. The gFOBT invasive colorectal cancer detection rate stayed consistent at approximately 1.4 to 1.5 per 1,000 gFOBTs from 2013 to 2017 (Figure 37).

Figure 38: Colorectal cancer stage distribution at diagnosis, 2013—2017



For data, see Table 39 in Appendix 1.

The percentage of gFOBT-detected stage I colorectal cancers (i.e., early-stage cancers) has increased over time, from 28% in 2013 to 32% in 2017. During the same time period, the proportion of stage I colorectal cancers detected without prior screening decreased, from 17% in 2013 to 15% in 2017 (Figure 38 and Table 4).

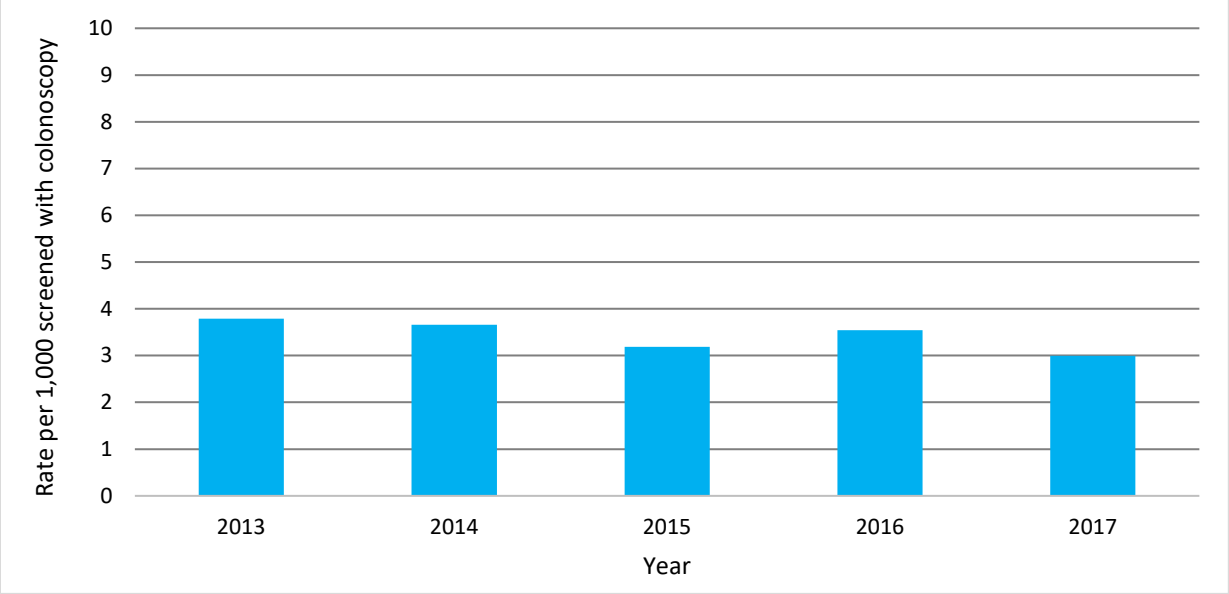
Table 4: Proportion of colorectal cancer diagnosed at an early stage (stage I), 2013—2017

Year	Percentage of gFOBT-detected stage I colorectal cancers	Percentage of stage I colorectal cancers detected without prior screening
2013	28.3	16.6
2014	29.2	16.5
2015	28.0	16.9
2016	28.2	17.1
2017	32.2	15.1

Colorectal cancers without prior screening include those people who were diagnosed with colorectal cancer and had not had a gFOBT, flexible sigmoidoscopy, or colonoscopy up to six months prior to the date of diagnosis.

Invasive cancer detection rate (family history of colorectal cancer)

Figure 39: Number of Ontario screen-eligible people, 50—74 years old, with a detected colorectal cancer per 1,000 screened with colonoscopy in those with a family history of colorectal cancer, 2013—2017



For data, see Table 40 in Appendix 1.

The invasive colorectal cancer detection rate for people with a family history of colorectal cancer represents the number of Ontario screen-eligible people, 50 to 74 years old, with a family history of the disease and a detected invasive colorectal cancer per 1,000 screened with colonoscopy. In 2013, the invasive cancer detection rate was 3.8 per 1,000 people screened with colonoscopy. The detection rate remained consistent between 2013 and 2017, between 3.0 and 3.8 per 1,000 (Figure 39).

Future Directions

Human Papillomavirus (HPV) Testing Implementation

Cervical screening programs in other jurisdictions around the world are transitioning from cytology to HPV testing. This shift is occurring because the HPV test is more sensitive than the Pap test (i.e., HPV testing more accurately identifies people who are at risk for cervical cancer). The Ontario Cervical Screening Program (OCSP) has recommended HPV testing for cervical screening and for use in colposcopy services, and is working with the Ministry of Health to implement HPV testing in Ontario.

As the recommended cervical screening test, the HPV test will better detect pre-cancers and it will more accurately inform referrals to colposcopy when combined with appropriate cytology triage testing (a subsequent test that is performed in people with positive HPV results to determine appropriate next steps). Moreover, HPV testing in colposcopy will give healthcare providers objective criteria that will help them decide whether to discharge their patients from colposcopy and inform subsequent risk-based screening intervals.

The transition to HPV testing will be a multi-year, multi-phase program implementation that will involve updates to the OCSP program, including new laboratory and test requirements, and revised screening recommendations (e.g., appropriate test, ages of initiation and cessation, and screening interval). This transition will also require updates to the OSCP's information management/information technology systems to support data collection, quality reporting for facilities and providers, and participant correspondence. In addition, a comprehensive change management and education strategy will be developed to support healthcare providers. The OCSP's provincial Colposcopy Community of Practice will be a key forum for engaging colposcopists across the province throughout the transition to HPV testing.

The Colposcopy CoP holds webinars that are accredited by the Royal College of Physicians and Surgeons of Canada. These interactive webinars allow Colposcopy CoP members to share and discuss evidence-informed best practices for colposcopy care, and have been very well-attended. In 2019, an online Colposcopy CoP Resource Hub was established. This hub is a central place where Colposcopy CoP members can find clinical tools (e.g., program screening and colposcopy recommendations, templates for discharge letters) and recordings of previous meetings.

Lung Cancer Screening for People at High Risk

Lung cancer is the leading cause of cancer death for people in Ontario (11). In 2018, approximately 7,400 people were estimated to die from lung cancer in the province, which is more than the number of people who were estimated to die from breast, colorectal and prostate cancer combined. The reason so many people die from lung cancer is that, in general, by the time it is diagnosed, the cancer has spread to other parts of the body and treatment is less successful. Now low-dose computed tomography (LDCT) offers an effective and evidence-based way to screen people. LDCT allows some lung cancers to be found early, when treatment has a better chance of working.

In June 2017, before it transitioned to Ontario Health, Cancer Care Ontario launched the Lung Cancer Screening Pilot for People at High Risk (the pilot) at specific hospitals in Ontario. The main purpose of the pilot is to assess how to implement organized lung cancer screening for people at high risk of lung cancer. The pilot sites are: The Ottawa Hospital in Ottawa (with Renfrew Victoria Hospital in Renfrew and Cornwall Community Hospital in Cornwall), Health Sciences North in Sudbury, Lakeridge Health in Oshawa and the University Health Network in Toronto.

The pilot will be evaluated to assess key components of the screening process, including recruitment, risk assessment, screening participation, retention, follow-up and diagnosis. The evaluation will also assess how many cancers were detected and at what stages, the harms resulting from unnecessary invasive diagnostic procedures and the outcomes of offering smoking cessation services. These findings will be presented in a final evaluation report in spring 2021 and will help Ontario Health (Cancer Care Ontario) plan a provincial lung cancer screening program. The pilot will transition to operations.

Colorectal Cancer Screening for People at Increased or High Risk

Increased risk screening

People with a family history of colorectal cancer that includes one or more first-degree relatives (i.e., parent, brother, sister or child) who have been diagnosed with the disease are considered to be at increased risk for colorectal cancer. Currently, the ColonCancerCheck program recommends that people who have no symptoms and are at increased risk should get screened with a colonoscopy starting at age 50, or 10 years earlier than the age their first-degree relative was diagnosed with colorectal cancer, whichever comes first. In 2018, the Canadian Association of Gastroenterology published guidelines for screening people at increased risk for colorectal cancer (42). Ontario Health (Cancer Care Ontario) will be using this new evidence and consulting an expert panel to update ColonCancerCheck's screening recommendations for people at increased risk (i.e., people with a family history of colorectal cancer).

High risk screening

Lynch syndrome also referred to as Hereditary Non-Polyposis Colorectal Cancer (HNPCC), is a genetic condition that is associated with a high lifetime risk (10% to 82%) of developing colorectal cancer (43). People with Lynch syndrome are also at risk for several other types of cancer, such as endometrial cancer (44). Approximately 2% to 5% of colorectal cancer cases diagnosed in Ontario in 2018 (230 to 580 out of 11,600 total colorectal cancer cases) can be attributed to Lynch syndrome (11,45).

People with or at risk for Lynch syndrome need to start screening for colorectal cancer earlier than the general population and should be screened with colonoscopy. The evidence indicates that screening at-risk family members could significantly reduce colorectal cancer-related mortality in this group (46). An organized screening program would help to ensure that high risk people are systematically identified and screened. Currently this type of program does not exist in Ontario.

In 2016, before it transitioned to Ontario Health, Cancer Care Ontario supported a comprehensive study on population-based Lynch syndrome testing in Ontario. This study identified barriers to implementing a screening program for Lynch syndrome, and included a cost-effectiveness analysis for systematically identifying and managing people with Lynch syndrome through reflex testing (testing that is performed on colorectal cancers to determine if the person is at risk for Lynch syndrome) (47). In addition, an evidence review was conducted in 2018 to inform the development of screening recommendations and risk reduction strategies for people with or at risk for Lynch syndrome (43).

An expert panel will be convened to provide guidance so Ontario Health (Cancer Care Ontario) can design a colorectal cancer screening program for people with or at risk for Lynch syndrome in Ontario.

Improving average risk screening participation and abnormal follow-up

After transitioning to the fecal immunochemical test (FIT) in June 2019, ColonCancerCheck continues to strive to improve the delivery of the program's screening services. Evidence from Ontario and other jurisdictions shows that directly mailing FIT kits to eligible people can improve screening participation (48–54). However, ColonCancerCheck currently requires primary care providers to order FIT kits for their patients and organize follow up with colonoscopy for those with abnormal FIT results. To help achieve the intended impact of direct mailing, which includes reducing the burden on primary care providers, the program would need to mail out FIT kits to eligible people, and arrange for follow-up colonoscopy in those with abnormal results. This means that ColonCancerCheck needs to implement centralized navigation of participants with abnormal results prior to transitioning to direct mailing of FIT kits.

Cancer Care Ontario, with support from the Ontario Institute for Cancer Research, conducted a pilot project from 2017 to 2019 that informed strategies for improving follow-up of those with abnormal

results. The first phase of this project was a qualitative study that evaluated the reasons people do not follow up with colonoscopy after an abnormal gFOBT. This phase of the study examined the perspectives of patients and physicians (55). The second phase was a study that explored using centralized navigation to improve colonoscopy follow-up (including timeliness of follow-up) for people with abnormal gFOBT results. Results from this project will be used to inform planning.

Personalized Breast Cancer Risk Assessment Study

Currently, breast screening recommendations are based primarily on age. Individualized risk assessment through a combination of genomic profiling and other breast cancer risk factors would provide more tailored screening recommendations, and improve the balance of benefits and harms in breast cancer screening. Therefore, Ontario Health (Cancer Care Ontario) researchers have partnered with researchers from other jurisdictions in Canada and internationally to conduct a large-scale project on screening for breast cancer based on individualized risk.

Researchers will study a large cohort of women ages 40 to 69 to calculate their risk level and provide them with information on making an informed choice about breast cancer screening. The team will also assess the acceptability, feasibility and outcomes of risk-based screening in existing mammography centres using a new, comprehensive risk-prediction web-based tool and a genomic profiling test. The results may change breast cancer screening practice, ensure better use of human and financial resources, and reduce the burden of breast cancer on women.

Ontario Breast Screening Program (OBSP) Expansion

To ensure that the OBSP meets the screening needs of the Ontario population, Ontario Health (Cancer Care Ontario) is conducting detailed capacity analyses to facilitate a thoughtful and evidence-based approach to program expansion. Analyses will focus on three components of capacity planning: demand, supply and access.

These analyses are being conducted at provincial and regional levels, and will allow Ontario Health (Cancer Care Ontario) to understand the demand for screening, including how many people need to be screened and require follow-up tests. The analyses will also provide information on the capacity and current supply of screening sites, breast assessment sites, personnel and imaging machines for screening. Additionally, access to screening services, such as the distance travelled to screening sites and wait times for assessment and diagnosis, will be analyzed.

The results will help to identify capacity gaps in breast cancer screening and assessment services, and inform decisions on adding new OBSP assessment sites and High Risk OBSP sites.

New Ontario Breast Screening Program (OBSP) sites

Ontario Health (Cancer Care Ontario) is working with Ontario's Regional Cancer Programs to transition facilities into the OBSP if they perform mammography screening outside of the OBSP. This transition will allow more screen-eligible people to receive breast cancer screening services through an organized cancer screening program.

A total of 58 non-OBSP screening sites transitioned into the OBSP from January 2016 to March 2020. As new sites begin offering mammography services, Ontario Health (Cancer Care Ontario) will work with Regional Cancer Programs to onboard them into the OBSP.

Appendix 1: Data Tables

Cancer Screening Performance Measures Working Group Evaluation Framework (14)

Domain	Recommended Performance Measures
Coverage	Participation Retention
Follow-up	Proportion of abnormal results Follow-up of abnormal results Diagnostic interval (time between abnormal screening test result and diagnosis)
Quality of screening	Sensitivity of screening test Positive predictive value of screening test
Detection	Pre-cancer detection rate Invasive cancer detection rate
Disease extent at diagnosis	Early stage invasive cancer detection rate

Table 5: Age-specific incidence rates per 100,000 for breast (female), colorectal and cervical cancer, Ontario, 2016

Age group (years)	Breast (female)	Colorectal	Cervical
0–39	13.6	2.4	5.2
40–59	205.4	46.9	12.6
60–79	384.5	170.7	10.1
80+	404.7	356.4	10.4

Table 6: Age-standardized incidence rates per 100,000 for breast (female), colorectal and cervical cancer, Ontario, 1981–2016

Year	Breast (female)	Colorectal	Cervical
1981	110.0	69.3	14.5
1982	110.1	71.9	13.8
1983	113.6	72.8	14.1
1984	116.1	74.9	12.6
1985	118.2	73.6	13.0
1986	114.8	70.5	12.9
1987	118.2	72.2	12.5
1988	127.7	72.2	11.9
1989	125.6	69.9	11.7
1990	124.7	70.2	12.7
1991	134.2	70.1	11.4
1992	135.9	68.2	11.4
1993	130.3	67.2	11.2
1994	129.0	68.5	10.8
1995	130.7	66.1	11.3
1996	129.7	65.4	11.2
1997	136.7	64.3	10.7
1998	136.5	67.9	8.8
1999	139.1	68.8	10.3

Year	Breast (female)	Colorectal	Cervical
2000	133.5	69.9	9.4
2001	133.7	69.3	9.0
2002	137.4	67.0	8.9
2003	128.6	65.1	9.0
2004	129.9	66.0	8.6
2005	129.6	65.4	8.2
2006	128.5	64.7	8.3
2007	130.2	64.4	8.8
2008	125.4	65.0	8.3
2009	127.7	61.9	9.0
2010	131.1	61.2	9.2
2011	130.4	60.7	8.8
2012	127.3	57.8	8.2
2013	126.7	56.3	7.4
2014	130.2	55.0	7.2
2015	127.7	54.8	8.0
2016	129.1	52.7	8.2

Table 7: Age-standardized mortality rates per 100,000 for breast (female), colorectal and cervical cancer, Ontario, 1981–2016

Year	Breast (female)	Colorectal	Cervical
1981	41.6	40.3	5.3
1982	41.4	39.0	5.4
1983	41.8	38.3	6.2
1984	43.6	38.8	5.1
1985	43.5	39.5	4.6
1986	44.5	38.3	4.2
1987	43.6	37.1	4.4
1988	42.6	38.1	4.5
1989	43.9	36.5	3.9
1990	41.3	34.9	4.5
1991	41.0	34.6	4.0
1992	40.8	34.3	3.3
1993	40.5	32.9	3.5
1994	41.5	32.9	3.3
1995	40.8	34.3	3.1
1996	39.5	32.8	3.8
1997	37.9	32.0	3.2
1998	34.5	30.9	3.2
1999	34.4	31.2	3.0
2000	35.8	31.2	2.8
2001	34.2	29.7	3.0
2002	33.5	30.6	2.3
2003	32.9	28.9	2.5
2004	32.3	28.6	2.8
2005	32.0	28.9	2.5
2006	29.2	26.5	2.7
2007	30.0	26.5	2.5
2008	28.2	26.0	2.2

Year	Breast (female)	Colorectal	Cervical
2009	27.4	25.1	2.0
2010	26.9	23.7	2.4
2011	26.8	24.2	2.2
2012	25.7	22.6	2.6
2013	24.4	21.4	2.0
2014	25.0	21.7	2.2
2015	24.2	20.7	2.2
2016	24.9	20.3	2.3

Table 8: Age-specific mortality rates per 100,000 for breast (female), colorectal and cervical cancer, Ontario, 2016

Age group (years)	Breast (female)	Colorectal	Cervical
0–39	1.5	0.6	0.5
40–59	23.2	10.0	3.4
60–79	66.3	52.4	3.9
80+	174.1	224.5	9.6

Ontario Breast Screening Program (OBSP)

Program Coverage

Table 9: Breast cancer screening participation

Age-adjusted percentage of Ontario screen-eligible women, 50–74 years old, who completed at least 1 mammogram within a 30-month period, 1991–2018

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
1991–1992	64,353	782,930	8.2 (8.1–8.2)
1993–1994	109,732	885,771	12.4 (12.3–12.4)
1995–1996	137,868	975,497	14.1 (14.1–14.2)
1997–1998	197,140	1,088,610	18.2 (18.2–18.3)
1999–2000	712,065	1,153,469	62.2 (62.1–62.3)
2001–2002	772,350	1,255,113	61.9 (61.8–62.0)
2003–2004	829,084	1,365,751	61.0 (61.0–61.1)
2005–2006	940,302	1,482,380	63.7 (63.6–63.8)
2007–2008	1,049,714	1,594,283	66.0 (65.9–66.1)
2009–2010	1,134,622	1,711,592	66.4 (66.3–66.5)
2011–2012	1,201,539	1,845,453	65.2 (65.1–65.2)
2013–2014	1,292,090	1,985,529	65.1 (65.0–65.1)
2015–2016	1,363,725	2,098,728	64.9 (64.9–65.0)
2017–2018	1,414,259	2,192,434	64.4 (64.4–64.5)

Table 10: Breast cancer screening retention

Percentage of Ontario screen-eligible women, 50–72 years old, who had a subsequent OBSP screening mammogram within 30 months of a previous program mammogram, 2012–2016

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2012	412,776	499,666	82.6 (82.5–82.7)
2013	412,485	506,462	81.4 (81.3–81.6)
2014	432,353	549,259	78.7 (78.6–78.8)
2015	438,909	564,246	77.8 (77.7–77.9)
2016	453,138	586,592	77.2 (77.1–77.4)

Follow-up of Abnormal Results

Table 11: Breast cancer screening abnormal call rate

Percentage of screen-eligible women, 50–74 years old, who were referred for further testing due to an abnormal OBSP screening mammogram result, 2014–2018

Total screens

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	49,902	580,405	8.6 (8.5–8.7)
2015	51,691	595,110	8.7 (8.6–8.8)
2016	53,700	618,683	8.7 (8.6–8.7)
2017	57,449	647,479	8.9 (8.8–8.9)
2018	59,889	668,704	9.0 (8.9–9.0)

Initial screens

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	17,035	116,329	14.6 (14.4–14.8)
2015	19,983	132,523	15.1 (14.9–15.3)
2016	18,950	125,828	15.1 (14.9–15.3)

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2017	19,903	131,299	15.2 (15.0–15.4)
2018	19,749	123,867	15.9 (15.7–16.1)

Re-screens

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	32,867	464,076	7.1 (7.0–7.2)
2015	31,708	462,587	6.9 (6.8–6.9)
2016	34,750	492,855	7.1 (7.0–7.1)
2017	37,546	516,180	7.3 (7.2–7.3)
2018	40,140	544,837	7.4 (7.3–7.4)

Table 12: Breast cancer screening 6-month abnormal follow-up

Percentage of Ontario screen-eligible women, 50–74 years old, with an abnormal OBSP screening mammogram result who were diagnosed (benign or cancer) within 6 months of the abnormal screen date, 2000–2018

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2000	9,471	10,167	93.2 (92.7–93.7)
2001	12,066	12,706	95.0 (94.6–95.3)
2002	13,524	14,055	96.2 (95.9–96.5)
2003	14,334	14,788	96.9 (96.6–97.2)
2004	16,321	16,880	96.7 (96.4–97.0)
2005	17,783	18,430	96.5 (96.2–96.8)
2006	20,837	21,407	97.3 (97.1–97.6)
2007	24,839	25,575	97.1 (96.9–97.3)
2008	29,075	29,909	97.2 (97.0–97.4)
2009	32,171	33,016	97.4 (97.3–97.6)
2010	35,837	36,852	97.2 (97.1–97.4)

2011	39,846	40,875	97.5 (97.3–97.6)
2012	43,504	44,491	97.8 (97.6–97.9)
2013	45,311	46,387	97.7 (97.5–97.8)
2014	48,979	49,916	98.1 (98.0–98.2)
2015	50,698	51,709	98.0 (97.9–98.2)
2016	52,711	53,712	98.1 (98.0–98.3)
2017	56,366	57,466	98.1 (98.0–98.2)
2018	58,659	59,898	97.9 (97.8–98.0)

Table 13: Breast cancer screening diagnostic interval: ≤ 5 weeks without tissue biopsy

Percentage of Ontario screen-eligible women, 50–74 years old, with an abnormal OBSP screening mammogram result who did not need a tissue biopsy and were diagnosed within 5 weeks of the abnormal screen date, 2014–2018

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	38,666	41,784	92.5 (92.3–92.8)
2015	40,594	43,132	94.1 (93.9–94.3)
2016	42,519	45,031	94.4 (94.2–94.6)
2017	44,797	48,240	92.9 (92.6–93.1)
2018	45,823	49,920	91.8 (91.6–92.0)

Table 14: Breast cancer screening diagnostic interval: ≤ 7 weeks with tissue biopsy

Percentage of Ontario screen-eligible women, 50–74 years old, with an abnormal OBSP screening mammogram result who needed a tissue biopsy and were diagnosed within 7 weeks of the abnormal screen date, 2014–2018

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	5,728	7,451	76.9 (75.9–77.8)
2015	6,228	7,854	79.3 (78.4–80.2)
2016	6,436	8,081	79.6 (78.8–80.5)

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2017	6,653	8,537	77.9 (77.0–78.8)
2018	7,104	9,170	77.5 (76.6–78.3)

Quality of Screening

Table 15: Mammography positive predictive value (PPV)

Percentage of Ontario screen-eligible women, 50–74 years old, with an abnormal OBSP screening mammogram result, who were diagnosed with breast cancer (DCIS or invasive) after diagnostic work-up, 2014–2018

Total screens

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	3,134	49,235	6.4 (6.1–6.6)
2015	3,249	50,986	6.4 (6.2–6.6)
2016	3,460	53,112	6.5 (6.3–6.7)
2017	3,685	56,777	6.5 (6.3–6.7)
2018	3,869	59,090	6.5 (6.3–6.7)

Initial screens

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	704	16,728	4.2 (3.9–4.5)
2015	838	19,629	4.3 (4.0–4.6)
2016	810	18,653	4.3 (4.0–4.6)
2017	870	19,561	4.4 (4.2–4.7)
2018	841	19,368	4.3 (4.1–4.6)

Re-screens

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	2,430	32,507	7.5 (7.2–7.8)
2015	2,411	31,357	7.7 (7.4–8.0)
2016	2,650	34,459	7.7 (7.4–8.0)
2017	2,815	37,216	7.6 (7.3–7.8)
2018	3,028	39,722	7.6 (7.4–7.9)

Table 16: Mammography sensitivity

Percentage of Ontario screen-eligible women, 50–74 years old, correctly diagnosed with breast cancer (DCIS or invasive) during the OBSP screening episode, 2013–2017

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2013	2,668	3,224	82.8 (81.4–84.1)
2014	3,104	3,678	84.4 (83.2–85.6)
2015	3,159	3,755	84.1 (82.9–85.3)
2016	3,376	3,932	85.9 (84.8–87.0)
2017	3,607	3,915	92.1 (91.3–93.0)

Table 17: Mammography specificity

Percentage of Ontario screen-eligible women, 50–74 years old, without a breast cancer diagnosis (DCIS or invasive), who were correctly identified as having a normal OBSP screening mammogram result, 2013–2017

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2013	488,008	531,147	91.9 (91.8–92.0)
2014	530,501	576,727	92.0 (91.9–92.1)
2015	543,419	591,355	91.9 (91.8–92.0)
2016	564,982	614,751	91.9 (91.8–92.0)
2017	590,029	643,564	91.7 (91.6–91.7)

Cancer Detection

Table 18: Invasive breast cancer detection rate

Number of Ontario screen-eligible women, 50–74 years old, with an invasive screen-detected breast cancer per 1,000 women who had an OBSP screening mammogram, 2013–2017

Total screens

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2013	2,217	533,284	4.2 (4.0–4.3)
2014	2,549	579,738	4.4 (4.2–4.6)
2015	2,628	594,405	4.4 (4.3–4.6)
2016	2,834	618,095	4.6 (4.4–4.8)
2017	3,063	646,807	4.7 (4.6–4.9)

Initial screens

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2013	453	95,232	4.8 (4.3–5.2)
2014	581	116,022	5.0 (4.6–5.4)
2015	655	132,169	5.0 (4.6–5.3)
2016	652	125,531	5.2 (4.8–5.6)
2017	730	130,957	5.6 (5.2–6.0)

Re-screens

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2013	1,764	438,052	4.0 (3.8–4.2)
2014	1,968	463,716	4.2 (4.1–4.4)
2015	1,973	462,236	4.3 (4.1–4.5)
2016	2,182	492,564	4.4 (4.2–4.6)
2017	2,333	515,850	4.5 (4.3–4.7)

Disease Extent at Diagnosis

Table 19: Early stage invasive breast cancer detection rate

Percentage of Ontario screen-eligible women, 50–74 years old, with an invasive OBSP screen-detected breast cancer detected at an early stage (stage I), 2012–2016

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2012	1,234	2,029	60.8 (58.7–63.0)
2013	1,312	2,163	60.7 (58.6–62.7)
2014	1,565	2,479	63.1 (61.2–65.0)
2015	1,660	2,583	64.3 (62.4–66.1)
2016	1,783	2,729	65.3 (63.5–67.1)

High Risk Ontario Breast Screening Program (OBSP)

Program Coverage

Table 20: Screening within 90 days of confirmation of high risk status

Percentage of Ontario women, 30–69 years old, screened with MRI or ultrasound within 90 days of confirmation of high risk status, 2014–2018

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	1,349	2,451	55.0 (53.0–57.0)
2015	999	2,148	46.5 (44.4–48.6)
2016	778	1,786	43.6 (41.2–45.9)
2017	1,004	1,963	51.1 (48.9–53.4)
2018	1,168	1,981	59.0 (56.8–61.2)

Table 21: Retention in the high risk OBSP

Percentage of Ontario women, 30–68 years old, who had a subsequent High Risk OBSP screen within 15 months of a previous High Risk OBSP screen, 2013–2017

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2013	2,866	3,672	78.1 (76.7–79.4)
2014	3,872	5,259	73.6 (72.4–74.8)
2015	4,592	6,572	69.9 (68.8–71.0)
2016	5,743	7,657	75.0 (74.0–76.0)
2017	7,157	9,294	77.0 (76.1–77.9)

Follow-up of Abnormal Results

Table 22: High risk abnormal call rate

Percentage of high risk screened women, 30–69 years old, with an abnormal screen result, 2013–2018

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2013	951	3,870	24.6 (23.2–25.9)
2014	1,274	5,535	23.0 (21.9–24.1)
2015	1,463	6,869	21.3 (20.3–22.3)
2016	1,594	7,980	20.0 (19.1–20.9)
2017	1,899	9,627	19.7 (18.9–20.5)
2018	2,033	10,901	18.6 (17.9–19.4)

Quality of Screening

Table 23: High Risk positive predictive value (PPV)

Percentage of high risk screened women with an abnormal screen result, 30–69 years old, diagnosed with breast cancer (DCIS or invasive) after completion of diagnostic work-up, 2013–2017

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2013	50	877	5.7 (4.1–7.3)
2014	70	1,252	5.6 (4.3–6.9)
2015	86	1,446	5.9 (4.7–7.2)
2016	106	1,580	6.7 (5.4–8.0)
2017	129	1,881	6.9 (5.7–8.0)

Cancer Detection

Table 24: High risk OBSP invasive cancer detection rate

Number of high risk screened women, 30–69 years old, with breast cancer (DCIS or invasive) per 1,000 women screened, 2013–2017

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2013	50	3,531	14.2 (10.1–18.2)
2014	70	5,513	12.7 (9.7–15.7)
2015	86	6,852	12.6 (9.8–15.3)
2016	106	7,966	13.3 (10.7–15.9)
2017	129	9,609	13.4 (11.1–15.8)

Ontario Cervical Screening Program (OCSP)

Program Coverage

Table 25: Cervical cancer screening participation

Percentage of Ontario screen-eligible women, 21–69 years old, who completed at least 1 Pap test in a 42-month period, 1998–2018

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
1998–2000[1]	2,092,060	3,483,714	58.5 (58.5–58.6)
2001–2003	2,447,431	3,717,271	64.6 (64.5–64.6)
2004–2006	2,662,059	3,966,771	66.2 (66.2–66.3)
2007–2009	2,740,994	4,082,635	66.6 (66.6–66.7)
2010–2012	2,782,826	4,213,546	65.8 (65.7–65.8)
2013–2015	2,642,082	4,378,353	60.4 (60.3–60.4)
2016–2018	2,728,377	4,582,892	59.7 (59.7–59.7)

[1] The OCSP began in June 2000.

Table 26: Cervical cancer screening retention

Percentage of Ontario screen-eligible women, 21–66 years old, who had a subsequent Pap test within 42 months of a normal Pap test result, 2011–2015

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2011	915,854	1,281,951	71.4 (71.4–71.5)
2012	742,732	1,132,208	65.6 (65.5–65.7)
2013	438,888	703,985	62.3 (62.2–62.5)
2014	445,910	739,822	60.3 (60.2–60.4)
2015	556,640	894,608	62.2 (62.1–62.3)

Follow-up of Abnormal Results

Table 27: Abnormal Pap test result distribution, 2014–2018

Year	Total Pap tests	Total abnormal Pap tests	Abnormal (low-grade) (%)	Abnormal (high-grade) (%)
2014	1,000,440	50,757	88.7	11.2
2015	1,195,583	59,538	88.6	11.2
2016	1,021,063	57,817	88.0	11.6
2017	981,143	57,091	85.9	13.6
2018	1,097,111	58,407	85.8	13.8

Table 28: Cervical cancer screening follow-up (high-grade Pap test)

Percentage of Ontario screen-eligible women, 21–69 years old, with a high-grade cervical dysplasia result on a Pap test who underwent colposcopy or definitive treatment within 6 months of the high-grade abnormal screen date, 2000–2018

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2000	5,042	10,243	49.2 (48.3–50.2)
2001	4,674	8,328	56.1 (55.1–57.2)
2002	4,421	7,214	61.3 (60.2–62.4)
2003	4,321	6,226	69.4 (68.2–70.6)
2004	4,557	6,258	72.8 (71.7–73.9)
2005	4,999	6,358	78.6 (77.6–79.6)
2006	5,293	6,782	78.0 (77.1–79.0)
2007	5,241	6,763	77.5 (76.5–78.5)
2008	5,238	6,792	77.1 (76.1–78.1)
2009	5,580	7,054	79.1 (78.1–80.1)
2010	5,349	6,812	78.5 (77.5–79.5)
2011	5,226	6,718	77.8 (76.8–78.8)
2012	5,082	6,481	78.4 (77.4–79.4)
2013	3,511	4,392	79.9 (78.7–81.1)

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	3,210	3,927	81.7 (80.5–83.0)
2015	3,989	4,761	83.8 (82.7–84.8)
2016	3,884	4,610	84.3 (83.2–85.3)
2017	4,732	5,487	86.2 (85.3–87.2)
2018	4,929	5,701	86.5 (85.6–87.4)

Quality of Screening

Table 29: Pap test positive predictive value (PPV)

Percentage of Ontario screen-eligible women, 21–69 years old, with an abnormal Pap test result who were diagnosed with an invasive cervical cancer or pre-cancer after a follow-up colposcopy or a surgical procedure involving the cervix, 2013–2017

Total

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2013	2,870	44,032	6.5 (6.3–6.7)
2014	2,584	37,173	7.0 (6.7–7.2)
2015	2,405	45,024	5.3 (5.1–5.6)
2016	2,418	42,206	5.7 (5.5–6.0)
2017	2,511	41,911	6.0 (5.8–6.2)

Pre-cancer

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2013	2,772	44,032	6.3 (6.1–6.5)
2014	2,469	37,173	6.6 (6.4–6.9)
2015	2,283	45,024	5.1 (4.9–5.3)
2016	2,298	42,206	5.4 (5.2–5.7)
2017	2,385	41,911	5.7 (5.5–5.9)

Invasive

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2013	98	44,032	0.2 (0.2–0.3)
2014	115	37,173	0.3 (0.3–0.4)
2015	122	45,024	0.3 (0.2–0.3)
2016	120	42,206	0.3 (0.2–0.3)
2017	126	41,911	0.3 (0.2–0.4)

Table 30: Screening history in cases of invasive cervical cancer

Percentage of Ontario screen-eligible women, age 21 years and older, who were diagnosed with an invasive cervical cancer and had a history of cervical cancer screening, 2014–2018

Time Frame (years)	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
>2 to 3	428	2,896	14.8 (13.5–16.1)
>3 to 5	807	2,896	27.9 (26.2–29.5)
>5 to 10	574	2,896	19.8 (18.4–21.3)
No previous Pap test within 10 years	1,087	2,896	37.5 (35.8–39.3)

Cancer Detection

Table 31: Cervical cancer and pre-cancer detection rate

Number of Ontario screen-eligible women 21–69 years old, with a screen-detected invasive cervical cancer or pre-cancer, per 1,000 women screened using Pap test, 2013–2017

Total

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2013	2,870	757,268	3.8 (3.7–3.9)
2014	2,584	795,407	3.2 (3.1–3.4)
2015	2,405	967,972	2.5 (2.4–2.6)

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2016	2,418	822,413	2.9 (2.8–3.1)
2017	2,511	785,226	3.2 (3.1–3.3)

Pre-cancer

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2013	2,772	757,268	3.7 (3.5–3.8)
2014	2,469	795,407	3.1 (3.0–3.2)
2015	2,283	967,972	2.4 (2.3–2.5)
2016	2,298	822,413	2.8 (2.7–2.9)
2017	2,385	785,226	3.0 (2.9–3.2)

Invasive

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2013	98	757,268	0.13 (0.10–0.16)
2014	115	795,407	0.14 (0.12–0.17)
2015	122	967,972	0.13 (0.10–0.15)
2016	120	822,413	0.15 (0.12–0.17)
2017	126	785,226	0.16 (0.13–0.19)

ColonCancerCheck (CCC)

Program Coverage

Table 32: Overdue for colorectal cancer screening

Percentage of Ontario screen-eligible individuals, 50–74 years old, who were overdue for colorectal screening, 2008–2018

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2008	1,615,643	3,226,408	49.9 (49.9–50.0)
2009	1,569,346	3,346,186	46.8 (46.7–46.8)
2010	1,610,039	3,469,459	46.3 (46.2–46.3)
2011	1,571,758	3,602,080	43.5 (43.5–43.6)
2012	1,569,556	3,737,649	41.9 (41.9–42.0)
2013	1,605,829	3,880,004	41.4 (41.3–41.4)
2014	1,594,746	4,007,166	39.9 (39.8–39.9)
2015	1,591,882	4,128,328	38.7 (38.6–38.7)
2016	1,606,860	4,245,567	38.1 (38.0–38.1)
2017	1,613,202	4,340,867	37.5 (37.5–37.6)
2018	1,651,638	4,430,064	37.8 (37.8–37.9)

Follow-up of Abnormal Results

Table 33: No colonoscopy within 6 months of an abnormal gFOBT result

Percentage of Ontario screen-eligible individuals, 50–74 years old, with an abnormal gFOBT result who did not undergo colonoscopy within 6 months of the abnormal gFOBT date, 2008–2018

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2008	3,325	8,896	37.4 (36.4–38.4)
2009	4,876	14,148	34.5 (33.7–35.3)
2010	5,060	17,717	28.6 (27.9–29.2)
2011	5,283	20,802	25.4 (24.8–26.0)

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2012	4,642	19,237	24.1 (23.5–24.7)
2013	4,323	19,108	22.6 (22.0–23.2)
2014	4,621	20,160	22.9 (22.3–23.5)
2015	4,377	20,178	21.7 (21.1–22.3)
2016	4,394	21,689	20.3 (19.7–20.8)
2017	4,473	22,554	19.8 (19.3–20.4)
2018	4,295	21,697	19.8 (19.3–20.3)

Quality of Screening

Table 34: Outpatient perforation rate

Number of outpatient colonoscopies followed by hospital admissions for perforation within 7 days of colonoscopy, per 1,000 colonoscopies, 2014–2018

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2014	180	445,753	0.40 (0.34–0.46)
2015	173	464,709	0.37 (0.32–0.43)
2016	164	469,667	0.35 (0.29–0.40)
2017	167	462,658	0.36 (0.31–0.42)
2018	137	469,649	0.29 (0.24–0.34)

Table 35: Post- polypectomy bleeding

Percentage of outpatient colonoscopies with polypectomy followed by hospital admission for lower gastrointestinal bleeding within 14 days of colonoscopy, 2014–2018

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	452	139,862	0.32 (0.29–0.35)
2015	494	155,559	0.32 (0.29–0.35)
2016	482	167,128	0.29 (0.26–0.31)

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2017	510	171,369	0.30 (0.27–0.32)
2018	493	178,881	0.28 (0.25–0.30)

Table 36: Poor bowel preparation

Percentage of outpatient colonoscopies with poor bowel preparation in hospital, 2014–2017

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2014	8,543	239,953	3.6 (3.5–3.6)
2015	8,262	252,512	3.3 (3.2–3.3)
2016	7,998	262,495	3.0 (3.0–3.1)
2017	8,982	290,924	3.1 (3.0–3.2)
2018	8,348	305,201	2.7 (2.7–2.8)

Table 37: Post-colonoscopy colorectal cancer

Percentage of outpatient colonoscopies negative for colorectal cancer followed by colorectal cancer diagnosis within 6 to 36 months of colonoscopy, 2011–2015

Year	Numerator (N)	Denominator (N)	Percentage (95% Confidence Interval)
2011	402	305,338	0.13 (0.12–0.14)
2012	402	310,864	0.13 (0.12–0.14)
2013	379	304,351	0.12 (0.11–0.14)
2014	316	311,140	0.10 (0.09–0.11)
2015	352	328,490	0.11 (0.10–0.12)

Table 38: Invasive cancer detection rate

Number of Ontario screen-eligible people, 50–74 years old, with a detected invasive colorectal cancer, per 1,000 screened using CCC program gFOBT, 2013–2017

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2013	680	462,821	1.5 (1.4–1.6)

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2014	698	491,403	1.4 (1.3–1.5)
2015	719	490,271	1.5 (1.4–1.6)
2016	723	499,699	1.4 (1.3–1.6)
2017	768	522,563	1.5 (1.4–1.6)

Table 39: Invasive cancer detection rate (family history indication)

Number of Ontario screen-eligible individuals, 50–74 years old, with a detected invasive colorectal cancer per 1,000 screened using colonoscopy for family history indication, 2013–2017

Year	Numerator (N)	Denominator (N)	Rate per 1,000 (95% Confidence Interval)
2013	94	24,801	3.8 (3.0–4.6)
2014	86	23,514	3.7 (2.9–4.5)
2015	77	24,140	3.2 (2.5–3.9)
2016	84	23,718	3.5 (2.8–4.3)
2017	71	23,682	3.0 (2.3–3.7)

Disease Extent at Diagnosis

Table 40: Colorectal cancer stage distribution at diagnosis

Colorectal cancer stage distribution at diagnosis, 2013–2017

Year	Stage I (%)	Stage II (%)	Stage III (%)	Stage IV (%)
2013	28.3	25.2	36.7	9.8
2014	29.2	27.8	32.3	10.8
2015	28.0	28.2	34.7	9.1
2016	28.2	25.9	36.9	9.0
2017	32.2	25.3	32.8	9.6

Appendix 2: Indicator Methodology

Ontario Breast Screening Program (OBSP)

Indicator	Breast cancer screening participation
Indicator Definition	Age-adjusted percentage of Ontario screen-eligible women, 50-74 years old, who completed at least one mammogram within a 30-month period
Calculations for the Indicator	(Total number of Ontario screen-eligible women, 50-74 years old, who have completed at least one mammogram in a given 30-month period/ Total number of Ontario screen-eligible women, 50-74 years old in the reporting period) x100
Denominator	Total number of Ontario screen-eligible women, 50-74 years old, in the reporting period • Ontario screen-eligible women 50-74 years old at the index date • Index date was defined as the midpoint in the reporting period, e.g. Jan 1st 2018 for 2017-2018 • The 2011 Canadian population was used as the standard population for calculating age-standardized rates Exclusions: • Women with a missing or invalid HIN, date of birth, or postal code • Women with a prior diagnosis of invasive or ductal carcinoma in-situ breast cancer before Jan 1st of the reporting period; prior diagnosis of breast cancer was defined as: ICD-O-3 codes: C50, a morphology indicative of breast invasive or ductal carcinoma in-situ cancer, microscopically confirmed with a path report • Women with a mastectomy before Jan 1st of the reporting period. Mastectomy was defined in OHIP by fee codes E505, E506, E546, R108, R109, and R117

Numerator	Total number of Ontario screen-eligible women, 50-74 years old, who have completed at least one mammogram in a given 30-month period • Identifying mammograms: OBSP mammograms for screening purposes were identified in the Integrated Client Management System (ICMS) Non-OBSP mammograms were identified using fee codes in OHIP: o X178 (screening bilateral mammogram) o X185 (diagnostic bilateral mammogram) • All mammograms in ICMS were counted, including those with partial views • Each woman was counted once regardless of the number of mammograms performed in a 30-month period; if a woman had both a program and non-program mammogram within a 30-month period, the program status was selected
Data sources	• ICMS (Integrated Client Management System) - OBSP mammograms and demographics • OHIP CHDB (Claims History Database) - Non-OBSP mammogram and mastectomy claims • OCR (Ontario Cancer Registry) - Invasive and ductal carcinoma in-situ breast cancers • RPDB (Registered Persons Database) – Demographics • Statistics Canada: 2011 Canadian population values
Data Availability and Limitations	• Historical RPDB address information is incomplete; therefore, the most recent primary address was selected for reporting, even for historical study periods • OHIP fee code X178 for screening bilateral mammography was introduced in October 2010 • OHIP fee code X185 was used for both screening and diagnostic mammography prior to October 2010; since October 2010, X185 has been used for diagnostic mammography only; however, some screening mammograms after October 2010 may still use X185 for claims • A small proportion of mammograms performed outside of OBSP as diagnostic tests could not be excluded from the analysis

Indicator	Breast cancer screening retention
Indicator Definition	Percentage of Ontario screen-eligible women, 50-72 years old, who had a subsequent OBSP screening mammogram within 30 months of a previous program mammogram
Calculations for the Indicator	(Total number of Ontario screen-eligible women, 50-72 years old, who had a subsequent OBSP screening mammogram within 30 months of a previous program mammogram/ Total number of Ontario screen-eligible women, 50-72 years old, with an OBSP screening mammogram) x 100
Denominator	Total number of Ontario screen-eligible women, 50-72 years old, with an OBSP screening mammogram in a given calendar year • Average risk women, 50-72 years old, who had an OBSP screening mammogram in a given calendar year • Mammograms were identified by OBSP mammogram records in the ICMS for screening purposes • All mammograms in ICMS were counted, including those with partial views Exclusions • Women with a missing or invalid HIN, date of birth • Women who died during the 30-month retention period and were not re-screened • Women who had breast cancer in the 30-month retention period and were not re-screened • Women who had mastectomy in the 30-month retention period and were not re-screened • Women who were re-screened during the 30-month retention period but who had a mastectomy or breast cancer diagnosis after the index date but before the re-screen date
Numerator	Total number of Ontario screen-eligible women, 50-72 years old, who had a subsequent program mammogram within 30 months of a previous program screening mammogram • Subsequent screening mammograms were identified through ICMS • All tests were considered, regardless of test result
Data sources	• ICMS (Integrated Client Management System) - OBSP mammograms, demographics, assessments and screen-detected cancer • OHIP's CHDB (Claims History Database) - Mastectomy claims • OCR (Ontario Cancer Registry) - Invasive and ductal carcinoma in-situ breast cancers

Data Availability and Limitations	• This indicator includes OBSP mammograms only • Women who have moved out of the province could not be excluded • There is a 31-month reporting lag for this indicator, as one complete month is required to allow for the data entry of the screening result and 30 months is required to follow up clients to determine the next screen date

Indicator	**Breast cancer screening abnormal call rate**
Indicator Definition	Percentage of Ontario screen-eligible women, 50-74 years old, who had an abnormal OBSP screening mammogram
Calculation	(Total number of Ontario screen-eligible women, 50-74 years old, who had an abnormal OBSP screening mammogram/ Total number of Ontario screen-eligible women, 50-74 years old, who had an OBSP screening mammogram in a given year) x 100
Denominator	Total number of Ontario screen-eligible women, 50-74 years old, who had an OBSP screening mammogram in a given year • Average risk women, 50-74 years old, who had an OBSP screening mammogram • Mammograms were identified by OBSP mammogram records in ICMS for screening purposes • All mammograms in ICMS were counted, including those with partial views Exclusions: • Women with a missing or invalid date of birth
Numerator	Total number of Ontario screen-eligible women, 50-74 years old, who had an abnormal OBSP screening mammogram • An abnormal screening mammogram was defined as an OBSP screening mammogram referred for further testing by the screening radiologist
Data Sources	• ICMS (Integrated Client Management System) - OBSP mammograms, demographics, and breast assessments
Data Availability and Limitations	• This indicator includes OBSP mammograms only • There is a one-month reporting lag for this indicator, as the sites have one month to enter the mammogram screening result (normal or abnormal) in ICMS

Indicator	Breast cancer screening 6-month abnormal follow-up
Indicator Definition	Percentage of Ontario screen-eligible women, 50-74 years old, with an abnormal OBSP screening mammogram result, who were diagnosed (benign or cancer) within 6 months of the abnormal screen date
Calculation for the Indicator	(Total number of Ontario screen-eligible women, 50-74 years old, with an abnormal OBSP screening mammogram result, who were diagnosed (benign or breast cancer) within 6 months of the abnormal screen date/ Total number of Ontario screen-eligible women, 50-74 years old, with an abnormal OBSP screening mammogram result) x 100
Denominator	Total number of Ontario screen-eligible women, 50-74 years old, with an abnormal program screening mammogram result in a given calendar year • Average risk women, ages 50 to 74, who had an abnormal OBSP mammogram in ICMS • Mammograms were identified by OBSP mammogram records in ICMS for screening purposes • Women with abnormal program screening mammograms were identified as those referred for further testing by the screening radiologist in ICMS • All mammograms in ICMS were counted, including those with partial views Exclusions • Women with a missing or invalid HIN, date of birth
Numerator	Total number of Ontario screen-eligible women, 50-74 years old, with an abnormal OBSP screening mammogram result, who were diagnosed (benign or breast cancer) within 6 months of the abnormal screen date • Date of diagnosis for benign cases was defined as date of last biopsy or procedure with benign finding • Date of diagnosis for breast cancer cases was defined as date of first FNA or tissue (core or open) biopsy procedure for breast cancer
Data sources	• ICMS (Integrated Client Management System) - OBSP mammograms, demographics, assessments and screen-detected cancer
Data Availability and Limitations	• This indicator includes OBSP mammograms only • There is an eight-month reporting lag for this indicator as the regions have up to eight months to close off assessment cases and enter the information in ICMS

Indicator	Breast cancer screening wait time to diagnosis without tissue biopsy
Indicator Definition	Percentage of Ontario screen-eligible women with an abnormal OBSP screening mammogram who were diagnosed (benign or breast cancer) without a tissue biopsy within five weeks of abnormal screen date
Calculations for the Indicator	(Total number of Ontario screen-eligible women with an abnormal OBSP screening mammogram, who were diagnosed (benign or breast cancer) within five weeks of the abnormal mammogram date/ Total number of Ontario screen-eligible women, 50-74 years old, with an abnormal OBSP screening mammogram, who did not require a tissue biopsy (core or surgical) for a definitive diagnosis) x 100
Denominator	Total number of Ontario screen-eligible women, 50-74 years old, with an abnormal OBSP screening mammogram in the reporting period, who did not require a tissue biopsy (core or surgical) for a definitive diagnosis • Average risk women, ages 50 to 74, who had an abnormal OBSP mammogram in ICMS • Mammograms were identified by OBSP mammogram records in ICMS for screening purposes • Women with abnormal program screening mammograms were identified as those referred for further testing by the screening radiologist in ICMS • All mammograms in ICMS were counted, including those with partial views Exclusions • Women without any assessment procedures • Women with a final result of “unknown/lost to follow-up” • Women with a missing or invalid HIN, date of birth
Numerator	Total number of Ontario screen-eligible women with an abnormal OBSP screening mammogram in a given calendar year who were diagnosed (benign or breast cancer) within five weeks of the abnormal mammogram date and did not require a tissue biopsy (core or surgical) for a definitive diagnosis • Date of diagnosis for benign cases was defined as date of last biopsy or procedure with benign finding • Date of diagnosis for breast cancer cases was defined as date of first FNA or tissue (core or open) biopsy procedure for breast cancer
Data Sources	• ICMS (Integrated Client Management System) - OBSP mammograms, demographics, assessments and screen-detected cancer

Data Availability and Limitations	• This indicator includes OBSP mammograms only • There is an eight-month reporting lag for this indicator, as the sites have eight months to close off assessment cases and enter the information in ICMS

Indicator	Breast cancer screening wait time to diagnosis with tissue biopsy
Indicator Definition	Percentage of Ontario screen-eligible women with an abnormal OBSP screening mammogram who were diagnosed (benign or cancer) with a tissue biopsy within seven weeks of abnormal screen date
Calculation for the Indicator	(Total number of Ontario screen-eligible women with an abnormal OBSP screening mammogram, who were diagnosed (benign or breast cancer) within seven weeks of the abnormal mammogram date / Total number of Ontario screen-eligible women, 50-74 years old, with an abnormal OBSP screening mammogram, who required a tissue biopsy (core or surgical) for a definitive diagnosis) x 100
Denominator	Total number of Ontario screen-eligible women, 50-74 years old, with an abnormal OBSP screening mammogram in the reporting period, who required a tissue biopsy (core or surgical) for a definitive diagnosis • Average risk women, 50-74 years old, who had an abnormal OBSP mammogram in ICMS • Mammograms were identified by OBSP mammogram records in ICMS for screening purposes • Women with abnormal program screening mammograms were identified as those referred for further testing by the screening radiologist in ICMS • All mammograms in ICMS were counted, including those with partial views Exclusions • Women with a missing or invalid HIN, date of birth • Women with a final result of “unknown/lost to follow-up”
Numerator	Total number of Ontario screen-eligible women with an abnormal OBSP screening mammogram in a given calendar year who were diagnosed (benign or breast cancer) within seven weeks of the abnormal mammogram date and required a tissue biopsy (core or surgical) for a definitive diagnosis • Date of diagnosis for benign cases was defined as date of last biopsy or procedure with benign finding • Date of diagnosis for breast cancer cases was defined as date of first FNA or tissue (core or open) bopsy procedure for breast cancer

Data sources	• ICMS (Integrated Client Management System) - OBSP mammograms, demographics, assessments and screen-detected cancer
Data Availability and Limitations	• This indicator includes OBSP mammograms only • There is an eight-month reporting lag for this indicator, as the sites have eight months to close off assessment cases and enter the information in ICMS

Indicator	Breast cancer screening positive predictive value
Indicator Definition	Percentage of Ontario screen-eligible women, 50-74 years old, with an abnormal OBSP screening mammogram result, who were diagnosed with breast cancer (DCIS or invasive)
Calculations for the Indicator	(Total number of screen-eligible women, 50-74 years old, with an abnormal program screening mammogram result in a given calendar year, who were diagnosed with a screen-detected breast cancer (DCIS or invasive)/ Total number of screen-eligible women, 50-74 years old, with an abnormal program screening mammogram result in a given calendar year) x 100
Denominator	Total number of screen-eligible women, 50-74 years old, with an abnormal OBSP screening mammogram result in a given calendar year • Average risk women, 50-74 years old, who had an abnormal OBSP screening mammogram result • Mammograms were identified by OBSP mammogram records in ICMS for screening purposes • Women with abnormal program screening mammograms were identified as those referred for further testing by the screening radiologist in ICMS • All mammograms in ICMS were counted, including those with partial views Exclusions: • Women with a missing or invalid HIN, date of birth • Women with a final result of “unknown/lost to follow-up”
Numerator	Total number of Ontario screen-eligible women, 50-74 years old, with an abnormal OBSP screening mammogram result, who were diagnosed with a screen-detected breast cancer (DCIS or invasive) • All breast cancers reported by OBSP sties were counted
Data Sources	• ICMS (Integrated Client Management System) - OBSP mammograms, demographics, and breast assessments

Data Availability and Limitations	• This indicator includes OBSP mammograms only. • There is an eight-month reporting lag for this indicator, as the sites have eight months to close off assessment cases and enter the information in ICMS

Indicator	**Breast cancer screening sensitivity**
Indicator Definition	Percentage of Ontario screen-eligible women, 50–74 years old, correctly diagnosed with breast cancer (DCIS or invasive) during the OBSP screening episode
Calculations for the Indicator	(Number of true-positives/ Number of true-positives and false-negatives) x 100 True-positive = Abnormal OBSP screening mammogram result, DCIS/invasive breast cancer present False-positive = Abnormal OBSP screening mammogram result, DCIS/invasive breast cancer absent False-negative = Normal OBSP screening mammogram result, DCIS/invasive breast cancer present True-negative = Normal OBSP screening mammogram result, DCIS/invasive breast cancer absent
Denominator	Total number of Ontario screen-eligible women, 50-74 years old, who had an OBSP screening mammogram, who were diagnosed with breast cancer (DCIS or invasive) within one year • Average risk women, 50-74 years old, who had an OBSP screening mammogram • Breast cancer includes screen-detected cancer and post-screen cancer. • Post-screen cancer was defined as breast cancer diagnosed before the next scheduled screening mammogram visit after a previous normal or benign screening episode. o A normal screening episode: a normal screening mammogram o A benign screening episode: an abnormal screening mammogram followed by diagnostic assessment, resulting in a final benign diagnosis. Exclusions: • Women with a missing or invalid HIN, date of birth • Women with a final result of “unknown/lost to follow-up”
Numerator	Total number of Ontario screen-eligible women, 50-74 years old, correctly diagnosed with breast cancer (DCIS or invasive) during the OBSP screening episode. • An abnormal screening mammogram was defined as an OBSP screening mammogram referred for further testing by the screening radiologist
Data Sources	• ICMS (Integrated Client Management System) - OBSP mammograms, demographics, assessments and screen-detected cancer

Data Availability and Limitations	• This indicator includes OBSP mammograms only • There is a two-year reporting lag for this indicator, as there is a two-year lag for entering cancer stage details (tumour size, nodal status, invasive vs. DCIS) in ICMS

Indicator	**Breast cancer screening specificity**
Indicator Definition	Percentage of Ontario screen-eligible women, 50-74 years old, without a breast cancer diagnosis (DCIS or invasive), who were correctly identified as having a normal OBSP screening mammogram result.
Calculations for the Indicator	(Number of true-negatives / Number of true-negatives and false-positives) x 100 True-positive = Abnormal OBSP screening mammogram result, DCIS/invasive breast cancer present False-positive = Abnormal OBSP screening mammogram result, DCIS/invasive breast cancer absent False-negative = Normal OBSP screening mammogram result, DCIS/invasive breast cancer present True-negative = Normal OBSP screening mammogram result, DCIS/invasive breast cancer absent
Denominator	Total number of Ontario screen-eligible women, 50-74 years old, who had an OBSP screening mammogram, who were not diagnosed with breast cancer (DCIS or invasive) within one year • Average risk women, 50-74 years old, who had an OBSP screening mammogram • Breast cancer includes screen-detected cancer and post-screen cancer. • Post-screen cancer was defined as breast cancer diagnosed before the next scheduled screening mammogram visit after a previous normal or benign screening episode. o A normal screening episode: a normal screening mammogram o A benign screening episode: an abnormal screening mammogram followed by diagnostic assessment, resulting in a final benign diagnosis. Exclusions • Women with a missing or invalid HIN, date of birth • Women with a final result of “unknown/lost to follow-up”
Numerator	Total number of Ontario screen-eligible women, 50-74 years old, without a breast cancer diagnosis (DCIS or invasive), who were correctly identified as having a normal OBSP screening mammogram result. • A normal screening mammogram result was defined as an OBSP screening mammogram that was not referred for further testing by the screening radiologist in

	ICMS.
Data Sources	• ICMS (Integrated Client Management System) - OBSP mammograms, demographics, assessments and screen-detected cancer
Data Availability and Limitations	• This indicator includes OBSP mammograms only • There is a two-year reporting lag for this indicator, as there is a two-year lag for entering cancer stage details (tumour size, nodal status, invasive vs. DCIS) in ICMS

Indicator	**Invasive breast cancer detection rate**
Indicator Definition	Number of Ontario screen-eligible women, 50-74 years old, with an invasive screen-detected breast cancer per 1,000 women who had an OBSP screening mammogram
Calculations for the Indicator	(Total number of Ontario screen-eligible women, 50-74 years old, who had an OBSP screening mammogram, with a screen-detected invasive breast cancer diagnosis/ Total number of Ontario screen-eligible women, 50-74 years old who had an OBSP screening mammogram) x 100
Denominator	Total number of Ontario screen-eligible women, 50-74 years old who had an OBSP screening mammogram • Average risk women, 50-74 years old, who had an OBSP screening mammogram Exclusions • Women with a missing or invalid HIN, date of birth • Women with a final result of "unknown/lost to follow-up"
Numerator	Total number of Ontario screen-eligible women, 50-74 years old, who had an OBSP screening mammogram, with a screen-detected invasive breast cancer diagnosis
Data Sources	• ICMS (Integrated Client Management System) - OBSP mammograms, demographics, assessments and screen-detected cancer
Data Availability and Limitations	• This indicator includes OBSP mammograms only. • There is a two-year reporting lag for this indicator, as there is a two-year lag for entering cancer stage details (tumour size, nodal status, invasive vs. DCIS) in ICMS

Indicator	**Early stage invasive breast cancer detection rate**
Indicator Definition	Percentage of Ontario screen-eligible women, 50-74 years old, with an invasive OBSP screen-detected breast cancer detected at an early stage (stage I)

Calculations for the Indicator	(Total number of Ontario screen-eligible women, 50-74 years old, who had an OBSP screening mammogram, with an early stage (Stage I) screen-detected invasive breast cancer / Total number of Ontario screen-eligible women, 50-74 years old, who had an OBSP screening mammogram, with a screen-detected invasive breast cancer) x 100
Denominator	Total number of Ontario screen-eligible women, 50-74 years old, who had an OBSP screening mammogram, with a screen-detected invasive breast cancer • Average risk women who had an OBSP screening mammogram, 50-74 years old, with a screen-detected invasive breast cancer • Invasive breast cancer was defined based on the behavior code (5th digit of morphology code). Exclusions • Women with a missing or invalid HIN, date of birth • Invasive cancer with a missing cancer stage data.
Numerator	Total number of Ontario screen-eligible women, 50-74 years old, who had an OBSP screening mammogram, with an early stage (Stage I) screen-detected invasive breast cancer
Data Sources	• ICMS (Integrated Client Management System) - OBSP mammograms, demographics, assessments and screen-detected cancer
Data Availability and Limitations	• This indicator includes OBSP mammograms only. • There is a two-year reporting lag for this indicator, as there is a two-year lag for entering cancer stage details (tumour size, nodal status, invasive vs. DCIS) in ICMS

High Risk Ontario Breast Screening Program (OBSP)

Indicator	Women screened within 90 days of High Risk confirmation (High Risk OBSP)
Indicator Definition	Percentage of Ontario women, 30-69 years old, screened with MRI or Ultrasound within 90 days of confirmation of high risk status
Calculations for the Indicator	(Total number of women, 30-69 years old, who were screened with MRI or Ultrasound within 90 days of confirmation of high risk status/ Total number of women, 30-69 years old, confirmed to be at high risk and screened with MRI or Ultrasound within one year after the confirmation) x 100

Denominator	Total number of women, 30-69 years old, confirmed to be at high risk • Women, 30 to 69 years old, confirmed to be at high risk • Age is based on the High Risk OBSP screening date • Confirmation date of high risk status for women referred by a physician (Category A) is defined as the most recent date between the registration date and the update date. For women referred to genetic assessment (Category B), it is defined as the most recent date among the registration date, referral date, genetic assessment date, generic assessment entered date and the update date. Generic assessment entered date or update date is selected only if it is before the OBSP high risk screening date. Exclusions • Women with a missing or invalid HIN, date of birth • Women who declined to participate in High Risk OBSP screening or have no screens. • Women with negative duration (confirmation date after screen date) • Women with a positive duration but interval greater than 365 days
Numerator	Total number of women, 30-69 years old, screened with MRI or ultrasound within 90 days of confirmation of high risk status • Women, 30 to 69 years old, confirmed to be at high risk and screened with MRI or ultrasound within 90 days of confirmation of high risk status date
Data sources	• ICMS (Integrated Client Management System) - OBSP screens, demographics, assessments and screen-detected cancer
Data availability and limitations	• OBSP high risk data are available from July 1, 2011 • There is a four-month reporting lag for this indicator. Up to three months are required to allow follow-up of women for the screening to occur after confirmation of high risk status. Another month is required for the data entry of the screening result • Women can be referred to genetic assessment at age 29 but cannot be screened in the OBSP high risk program until age 30 (or 10 weeks short of their 30th birthday). • If the same woman was referred more than once to the OBSP high risk program within a year, the latest registration date is used
Indicator	**Breast cancer screening retention (High Risk OBSP)**
Indicator Definition	Percentage of High Risk OBSP women, 30-68 years old, who had a subsequent High Risk OBSP screen within 15 months of a previous High Risk OBSP screen

Calculations for the Indicator	(Total number of women, 30-68 years old, who had a subsequent High Risk OBSP screen within 15 months of a previous High Risk OBSP screen/ Total number of women, 30-68 years old, who had a High Risk OBSP screen in the reporting period) x 100
Denominator	Total number of women, 30 to 68 years old, screened with an High Risk OBSP MRI or Ultrasound • Women, 30 to 68 years old at the index date, confirmed to be at high risk and had at least an High Risk OBSP MRI or Ultrasound in the reporting period • Index date is the earliest screening modality date (OBSP mammogram, OBSP MRI/Ultrasound) within an OBSP high risk screening episode • Date of the high risk non-OBSP MRI or mammogram associated with the complementary High Risk OBSP screening test will not be used to calculate the index date or the next screen date • For women who had two High Risk OBSP screening episodes within the same reporting period, both screening episodes are counted as women can be re-screened as early as 11 months following the previous screen date Exclusions: • Women with missing or invalid HIN, date of birth • Women who are currently in decline or deferral OBSP operational status and were not re-screened within 15 months • Women who died or had a total bilateral mastectomy during the 15-month follow-up period and were not re-screened • Total bilateral mastectomy is defined as >=2 total mastectomy OHIP fee codes or a single total mastectomy OHIP fee code with >=2 number of services on the same women o Total mastectomy OHIP fee codes: R108A (Simple total mastectomy), R117A (simple total mastectomy with subcutaneous with nipple preservation), E505A (simple total mastectomy with limited axillary node sample), and R109A (Mastectomy- Radical or Modified Radical). • For women with a high risk mammogram and MRI screening episode OR mammogram and ultrasound screening episode, woman not re-screened within 15 months and not recalled to screening by the OBSP site following her index screen date were excluded
Numerator	Total number of women, 30 to 68 years old, with an OBSP high-risk screen, who had a subsequent High Risk OBSP screen within 15 months of a previous High Risk OBSP screen • Women, 30 to 68 years old, who had a subsequent high risk screen (MRI or Ultrasound) within 15 months • For women age 68, re-screens with a High Risk OBSP mammogram only were included

Data sources	• ICMS (Integrated Client Management System) - OBSP screens, demographics, assessments and screen-detected cancer • OHIP CHDB (Claims History Database) – Mastectomy claims
Data availability and limitations	• High Risk OBSP data are available from July 1, 2011 • There is a 16-month reporting lag for this indicator as 15 months are required to allow for follow-up of women for the second screening episode to occur and another complete month is required for the data entry of the screening result of the second screening episode into the ICMS

Indicator	**Abnormal call rate (High Risk OBSP)**
Indicator Definition	Percentage of High Risk screened women, 30-69 years old, with an abnormal screen result
Calculations for the Indicator	(Total number of High Risk women, 30-69 years old, referred for further testing because of an abnormal screen result/ Total number of women, 30-69 years old, who had a High Risk OBSP screen) x 100
Denominator	Total number of women, 30-69 years old, who had a High Risk OBSP screen • Women, 30-69 years old, confirmed to be at high risk, who had a High Risk OBSP screen and have a screen result entered • Women screened with at least an MRI (or ultrasound) • Women who had an ultrasound instead of an MRI (i.e., MRI is contraindicated) • Includes partial screens where there was a normal complementary non-OBSP screening test performed within the previous seven months • Each High Risk OBSP screening episode was counted; if a woman had multiple OBSP high risk screening episodes in a given year, all High Risk OBSP screening episodes were included • Age is determined by the earliest screening modality within each High Risk OBSP screening episode (mammogram date or MRI/ultrasound) Exclusions • Women with a missing or invalid HIN, date of birth • Mammogram only screens (i.e. with no previous MRI or subsequent MRI within seven months)
Numerator	Total number of high risk screened women, 30-69 years old, referred for further testing because of an abnormal screen result • Women, 30-69 years old, confirmed to be at high risk, who had an abnormal screen result • An abnormal screen result was defined as at least one of the high risk screen tests (mammogram and/or MRI or ultrasound) referred for further testing by the

	screening radiologist in ICMS
Data sources	• ICMS (Integrated Client Management System) - OBSP screens, demographics, assessments and screen-detected cancer
Data Availability & Limitations	• High Risk OBSP data are available from July 1, 2011 • Women can be referred to genetic assessment at age 29 but cannot be screened in the High Risk OBSP until age 30 (or 10 weeks short of their 30th birthday). • There are separate screening records for the same screening episode per woman screened (e.g., one mammogram record and a separate MRI record); the seven month rule is used to determine whether two screening tests belong to the same screening episode • There is at least an 8 month reporting lag for this indicator as the regions/sites have up to and including 1 month to enter the screen result (normal or abnormal) for each screening test within the OBSP high risk screening episode and the two high risk screening tests can be up to 7 months apart

Indicator	**Positive predictive value (High Risk OBSP)**
Indicator Definition	Percentage of high risk screened women with abnormal screen result, 30-69 years old, diagnosed with breast cancer (DCIS or invasive) after completion of diagnostic workup
Calculations for the indicator	(Total number of high risk screened women, 30-69 years old, with a screen-detected breast cancer (DCIS or invasive) following an abnormal screen result and completion of diagnostic workup/ Total number of high risk screened women, 30-69 years old, referred for further testing because of an abnormal screen result) x 100

Denominator	Total number of high risk screened women, 30-69 years old, referred for further testing because of an abnormal screen result • Women, 30-69 years old, confirmed to be at high risk, who had an abnormal screen result • An abnormal screen result was defined as at least one of the high risk screen tests (mammogram and/or MRI or ultrasound) referred for further testing by the screening radiologist in ICMS • Women screened with at least an MRI (or ultrasound) • Women who had an ultrasound instead of an MRI (i.e., MRI is contraindicated) • Each abnormal High Risk OBSP screening episode was counted; if a woman had multiple abnormal High Risk OBSP screening episodes in a given year, all abnormal OBSP high risk screening episodes were included • Includes partial screens where there was a normal complementary non-OBSP screening test performed within the previous seven months of the OBSP screening test • Age is determined by the earliest screening modality within each High Risk OBSP screening episode (mammogram date or MRI/ultrasound) Exclusions • Women with a missing or invalid HIN, date of birth • Women with a final result of "unknown/lost to follow-up" • Mammogram only screens (i.e., with no previous MRI or subsequent MRI within seven months)
Numerator	Total number of high risk screened women, 30-69 years old, with a screen-detected breast cancer (DCIS or invasive) following an abnormal screen result and completion of diagnostic workup.
Data sources	• ICMS (Integrated Client Management System) - OBSP screens, demographics, assessments and screen-detected cancer
Data Availability & Limitations	• High Risk OBSP data are available from July 1, 2011 • Women can be referred to genetic assessment at age 29 but cannot be screened in the High Risk OBSP until age 30 (or 10 weeks short of their 30th birthday). • There are separate screening records for the same screening episode per woman screened (e.g., one mammogram record and a separate MRI record); the seven month rule is used to determine whether two screening tests belong to the same screening episode • There is an eight-month reporting lag for this indicator as regions/sites have up to eight months following the abnormal screen date to enter all of the assessment information and final diagnosis into the ICMS

Indicator	**Breast cancer detection rate (High Risk OBSP)**
Indicator Definition	Number of high risk screened women, 30-69 years old, with breast cancer (ductal carcinoma in situ [DCIS] or invasive) per 1,000 women screened
Calculations for the Indicator	(Total number of high risk screened women, 30-69 years old, with a screen-detected breast cancer (DCIS or invasive) following an abnormal screen result and completion of diagnostic workup/ Total number of women, 30-69 years old, who had a High Risk OBSP screen) x 100
Denominator	Total number of women, 30-69 years old, who had a High Risk OBSP screen • Women, 30-69 years old, confirmed to be at high risk, who had a High Risk OBSP screen and have a screen result entered • Women screened with at least an MRI (or ultrasound) • Women who had an ultrasound instead of an MRI (i.e., MRI is contraindicated) • Each High Risk OBSP screening episode was counted; if a woman had multiple High Risk OBSP screening episodes in a given year, all High Risk OBSP screening episodes were included • Includes partial screens where there was a normal complementary non-OBSP screening test performed within the previous seven months of the OBSP screening test • Age is determined by the earliest screening modality within each High Risk OBSP screening episode (mammogram date or MRI/ultrasound) Exclusions • Women with a missing or invalid HIN, date of birth • Women with a final result of "unknown/lost to follow-up" • Mammogram only screens (i.e. with no previous MRI or subsequent MRI within seven months)
Numerator	Total number of high risk screened women, 30-69 years old, with a screen-detected breast cancer (DCIS or invasive) following an abnormal screen result and completion of diagnostic workup.
Data sources	• ICMS (Integrated Client Management System) - OBSP screens, demographics, assessments and screen-detected cancer

Data Availability and Limitations	• High Risk OBSP data are available from July 1, 2011 • Women can be referred to genetic assessment at age 29 but cannot be screened in the High Risk OBSP until age 30 (or 10 weeks short of their 30th birthday). • There are separate screening records for the same screening episode per woman screened (e.g., one mammogram record and a separate MRI record); the seven month rule is used to determine whether two screening tests belong to the same screening episode • There is an eight-month reporting lag for this indicator as regions/sites have up to eight months following the abnormal screen date to enter all of the assessment information and final diagnosis into the ICMS

Ontario Cervical Screening Program (OCSP)

Indicator	**Cervical screening (Pap test) participation**
Indicator Definition	Age-adjusted percentage of Ontario screen-eligible women, 21-69 years old, who completed at least one Pap test in a 42-month period
Calculations for the Indicator	(Total number of Ontario screen-eligible women, 21-69 years old, who have completed at least one Pap test in a 42-month period/ Total number of Ontario screen-eligible women, 21-69 years old in the reporting period) x 100
Denominator	Total number of Ontario screen-eligible women, 21-69 years old, in the reporting period • Ontario screen-eligible women ages 21-69 at the index date • Index date was defined as the midpoint of a reporting period, e.g. July 1st 2015 for 2014-2016 • The 2011 Canadian population was used as the standard population for calculating age-standardized rates • The RPDB address closest to the index date was used to assign postal code Exclusions • Women with a missing or invalid HIN, date of birth, or postal code • Women diagnosed with an invasive cervical cancer prior to January 1st of the reporting period, e.g. January 1st 2014 for 2014-2016; prior diagnosis of cervical cancer was defined as: ICD-O-3 codes C53, a morphology indicative of cervical cancer, microscopically confirmed with a path report • Women who had a colposcopy and/or treatment within 2 years prior to January 1st of the reporting period • Colposcopy and/or treatment were identified through OHIP, using the following fee codes:

	Colposcopy o Z731 - Initial investigation of abnormal cytology of vulva and/or vagina or cervix under colposcopic technique with or without biopsy(ies) and/or endocervical curetting o Z787 - Follow-up colposcopy with biopsy(ies) with or without endocervical curetting o Z730 - Follow-up colposcopy without biopsy with or without endocervical curetting Treatment o Z732 - Cryotherapy o Z724 - Electro o Z766 - Electrosurgical Excision Procedure (LEEP) o S744 - Cervix - cone biopsy - any technique, with or without D&C o Z729 - Cryoconization, electroconization or CO2 laser therapy with or without curettage for premalignant lesion (dysplasia or carcinoma in-situ), out-patient procedure • Women with a hysterectomy prior to January 1st of the reporting period • Women with a hysterectomy were identified through OHIP, using the following fee codes: o E862A – When hysterectomy is performed laparoscopically, or with laparoscopic assistance o P042A – Obstetrics – labour – delivery – caesarean section including hysterectomy o Q140A – Exclusion code for enrolled female patients aged 35-70 with hysterectomy o S710A – Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy o S727A – Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy o S757A – Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal o S758A – Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior and posterior vaginal repair and including enterocoele and/or vault prolapse repair when rendered o S759A - Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior or posterior vaginal repair and including enterocoele and/or vault prolapse repair when rendered o S762A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection o S763A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection o S765A – Amputation of cervix o S766A- Cervix uteri - Exc - cervical stump – abdominal o S767A- Cervix uteri - exc - Cervical stump – vaginal o S816A - Hysterectomy - with or without adnexa (unless otherwise specified) - vaginal

Numerator	Total number of Ontario screen-eligible women, 21-69 years old, who have completed at least one Pap test in a 42-month period • Identifying Pap tests: Pap tests were identified through CytoBase Pap tests were also identified using fee codes through OHIP: o E430A: add-on to a003, a004, a005, a006 when pap performed outside hospital o G365A: Periodic-pap smear o E431A: When Papanicolaou smear is performed outside of hospital, to G394. o G394A: Additional for follow-up of abnormal or inadequate smears o L713A: Lab.med.-anat path,hist,cyt-cytol-gynaecological specimen o L733A: Cervicovaginal specimen (monolayer cell methodology) o L812A: Cervical vaginal specimens including all types of cellular abnormality, assessment of flora, and/or cytohormonal evaluation o Q678A: Gynaecology – pap smear – periodic – nurse practitioners • All Pap tests in CytoBase were counted, including those with inadequate specimens • Each woman was counted once regardless of the number of Pap tests performed in a 42-month time frame
Data sources	• CytoBase - Pap tests • OHIP's CHDB (Claims History Database) – Pap tests, colposcopy procedures, treatment procedure claims, hysterectomy claims • OCR (Ontario Cancer Registry) - Resolved invasive cervical cancers • RPDB (Registered Persons Database) - Demographics
Data Availability and Limitations	• Pap test results are available in CytoBase only • CytoBase includes only Pap tests analyzed in three community-based laboratories in Ontario; Pap tests analyzed in Ontario hospitals and Community Health Centres are not captured in CytoBase • It is difficult to determine whether a Pap test in CytoBase and/or OHIP was done for screening or diagnostic purposes, and therefore, some Pap tests included in these analyses may have been performed for diagnostic purposes

Indicator	**Cervical screening (Pap test) retention**
Indicator Definition	Percentage of Ontario screen-eligible women, 21-66 years old, who had a subsequent Pap test within 42-months of a normal Pap test result

Calculations for the Indicator	(Total number of Ontario screen-eligible women, 21-66 years old, who had a subsequent Pap test within 42 months of a previous normal Pap test result / Total number of Ontario screen-eligible women, 21-66 years old, who had a normal Pap test in a given year) x 100
Denominator	Total number of Ontario screen-eligible women, 21-66 years old, who had a normal Pap test in a given year • Ontario screen-eligible women 21-66 years old at the index date, who had a normal Pap test result in a given year • Index date was defined as the last normal Pap test date per person by date of specimen collection in CytoBase in a given year • The RPDB address closest to the index date was used to assign postal code • Normal Pap tests were defined through CytoBase (CytoBase codes 4.1, 4.2, 4.3.1, 4.3.2, 4.3 for version 2, and CytoBase codes 4.1, 4.2, 4.3 for version 1) • Each woman was counted once in a given year regardless of the number of Pap tests performed Exclusions: • Women with a missing or invalid HIN, date of birth, or postal code • Women diagnosed with an invasive cervical cancer before the subsequent Pap date or during the follow-up interval if there was no subsequent Pap test • Diagnosis of cervical cancer was defined as: ICD-O-3 codes C53, a morphology indicative of cervical cancer, microscopically confirmed with a path report • Women with a hysterectomy before the subsequent Pap date or during the follow-up interval if there was no subsequent Pap test • Women with a hysterectomy were identified through OHIP, using the following fee codes: o E862A – When hysterectomy is performed laparoscopically, or with laparoscopic assistance o P042A – Obstetrics – labour – delivery – caesarean section including hysterectomy o Q140A – Exclusion code for enrolled female patients aged 35-70 with hysterectomy o S710A – Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy o S727A – Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy o S757A – Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal o S758A – Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior and posterior vaginal repair and including enterocoele and/or vault prolapse repair when rendered o S759A - Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior or posterior vaginal repair and including

	enterocoele and/or vault prolapse repair when rendered o S762A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection o S763A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection o S765A – Amputation of cervix o S766A- Cervix uteri - exc - cervical stump – abdominal o S767A- Cervix uteri - exc - cervical stump – vaginal o S816A - Hysterectomy - with or without adnexa (unless otherwise specified) - vaginal
Numerator	Total number of Ontario screen-eligible women, 21-66 years old, who had a subsequent Pap test within 42 months of a previous normal Pap test result • Subsequent Pap tests were identified through CytoBase • All tests were considered, regardless of test result
Data Sources	• CytoBase - Pap tests • OHIP CHDB (Claims History Database) – Hysterectomy claims • OCR (Ontario Cancer Registry) - Resolved invasive cervical cancers • RPDB (Registered Persons Database) - Demographics
Data Availability and Limitations	• Only CytoBase data were used for these analyses as there were no results for OHIP data • CytoBase includes only Pap tests analyzed in community-based laboratories in Ontario; Pap tests analyzed in Ontario hospitals and Community Health Centres are not captured in CytoBase • It is difficult to determine whether a Pap test was done for screening or diagnostic purposes, and therefore, some Pap tests included in these analyses may have been performed for diagnostic purposes • Some women with a scheduled Pap test (follow-up) may be included in this cohort

Indicator	**Pap test abnormal rate**
Indicator Definition	Percentage of Ontario screen-eligible women, 21-69 years old, with an abnormal Pap test result
Calculations for the indicator	(Total number of Ontario screen-eligible women, 21-69 years old, with an abnormal Pap test result/ Total number of Ontario screen-eligible women, 21-69 years old, who had a Pap test) x 100
Denominator	Total number of Ontario screen-eligible women, 21-69 years old, who had a Pap test in

	the reporting period • Women, ages 21-69 at the index date, who had a Pap test in Cytobase • Index date was defined as the date of specimen collection in CytoBase. If a woman had multiple Pap tests in a given year, the date of the most severe test was taken as the index date • Each woman was counted once per given year regardless of the number of tests performed • The RPDB address closest to the index date was used to assign postal code Exclusions • Women with a missing or invalid HIN, date of birth or postal code • Women diagnosed with an invasive cervical cancer prior to the index date; diagnosis of cervical cancer was defined as: ICD-O-3 codes C53, a morphology indicative of cervical cancer, microscopically confirmed with a path report • Women with an unsatisfactory Pap test result • Women with a hysterectomy before the index date • Women with a hysterectomy were identified through OHIP, using the following fee codes: o E862A – When hysterectomy is performed laparoscopically, or with laparoscopic assistance o P042A – Obstetrics – labour – delivery – caesarean section including hysterectomy o Q140A – Exclusion code for enrolled female patients aged 35-70 with hysterectomy o S710A – Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy o S727A – Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy o S757A – Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal o S758A – Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior and posterior vaginal repair and including enterocoele and/or vault prolapse repair when rendered o S759A - Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior or posterior vaginal repair and including enterocoele and/or vault prolapse repair when rendered o S762A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection o S763A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection o S765A – Amputation of cervix o S766A- Cervix uteri - Exc - cervical stump – abdominal o S767A- Cervix uteri - exc - Cervical stump – vaginal o S816A - Hysterectomy - with or without adnexa (unless otherwise specified) -

	vaginal
Numerator	Total number of Ontario screen-eligible women, 21-69 years old, with an abnormal Pap test result • Women with an abnormal Pap test result in CytoBase • An abnormal Pap test was defined using the Bethesda codes from CytoBase. Abnormal Pap tests include Pap tests with results of ASC, ASC-H, AGC, Adeno in-situ, LSIL, HSIL, Carcinoma, Squamous cell carcinoma, Adenocarcinoma, Other malignancy.
Data Sources	• Cytobase – Pap tests • OHIP's CHDB (Claims History Database) – Hysterectomy • OCR (Ontario Cancer Registry) - Resolved invasive cervical cancers • RPDB (Registered Persons Database) - Demographics
Data Availability and Limitations	• Pap test results are available in CytoBase only • CytoBase includes only Pap tests analyzed in community-based laboratories in Ontario; Pap tests analyzed in Ontario hospitals and Community Health Centres are not captured in CytoBase • It is difficult to determine whether a Pap test in CytoBase and/or OHIP was done for screening or diagnostic purposes, and therefore, some Pap tests included in these analyses may have been performed for diagnostic purposes

Indicator	**Cervical screening follow-up (high-grade Pap tests)**
Indicator Definition	Percentage of Ontario screen-eligible women with a high-grade cervical dysplasia on a Pap test, 21-69 years old, who underwent colposcopy or definitive treatment within six months of the high-grade abnormal screen date
Calculations for the Indicator	(Total number of Ontario screen-eligible women, 21-69 years old, with a high-grade cervical abnormality on a Pap test, who underwent colposcopy or definitive treatment within 6 months of the high-grade abnormal screen date/ Total number of Ontario screen-eligible women, 21-69 years old, with a high-grade cervical abnormality on a Pap test in a given year) x 100
Denominator	Total number of Ontario Screen-eligible women, 21-69 years old at the index date, who had a high-grade cervical abnormality on a Pap test • Index date was defined as the date of the most recent high-grade cervical abnormality per person by date of specimen collection in CytoBase in each calendar year

	High-grade cervical dysplasia was defined as (Version 2): ASC-H (4.4.5); AGC (4.5.1, 4.5.2, 4.5.3, 4.5.4, 4.5.5, 4.5.7, 4.5.9, 4.5.10, 4.5.11, 4.5.12, 4.5.13); Adeno in-situ (4.5.8, 4.6); HSIL (4.8). • Each woman was counted once in a given year regardless of the number of tests performed • The RPDB address closest to the index date was used to assign postal code Exclusions: • Women with a missing or invalid HIN, date of birth, or postal code • Women who died during the follow-up period • Women diagnosed with an invasive cervical cancer before the index date; prior diagnosis of cervical cancer was defined as: ICD-O-3 codes C53, a morphology indicative of cervical cancer, microscopically confirmed with a path report • If a woman had a colposcopy within +/- 7 days of the Pap test, the Pap test was assumed to be completed concurrently with colposcopy and not a Pap test that was followed up by colposcopy. This Pap test should not be defined as an index Pap test and therefore was removed. • Women with a hysterectomy before the index Pap date • Women with a hysterectomy were identified through OHIP, using the following fee codes: o E862A – When hysterectomy is performed laparoscopically, or with laparoscopic assistance o P042A – Obstetrics – labour – delivery – caesarean section including hysterectomy o Q140A – Exclusion code for enrolled female patients aged 35-70 with hysterectomy o S710A – Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy o S727A – Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy o S757A – Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal o S758A – Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior and posterior vaginal repair and including enterocoele and/or vault prolapse repair when rendered o S759A - Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior or posterior vaginal repair and including enterocoele and/or vault prolapse repair when rendered o S762A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection o S763A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection o S765A – Amputation of cervix o S766A- Cervix uteri - Exc - cervical stump – abdominal o S767A- Cervix uteri - exc - Cervical stump – vaginal o S816A - Hysterectomy - with or without adnexa (unless otherwise

	specified) – vaginal
Numerator	Total number of women with a high-grade cervical abnormality on Pap test who underwent colposcopy or definitive treatment within six months of the high-grade abnormal Pap test • Colposcopy was defined using the following fee codes in OHIP: o Z731 - Initial investigation of abnormal cytology of vulva and/or vagina or cervix under colposcopic technique with or without biopsy(ies) and/or endocervical curetting o Z787 - Follow-up colposcopy with biopsy(ies) with or without endocervical curetting o Z730 – Follow-up colposcopy without biopsy with or without endocervical curetting • If no record was found for a subsequent colposcopy after the high-grade cervical abnormality Pap test, other definitive procedures were included; these procedures were identified through OHIP claims as: o Z732-Cryotherapy o Z724-Electro o Z766-Electrosurgical Excision Procedure (LEEP) o S744-Cervix - cone biopsy - any technique, with or without D&C o Z729-Cryoconization, electroconization or CO2 laser therapy with or without curettage for premalignant lesion (dysplasia or carcinoma in-situ), out-patient procedure • If no record was found for a colposcopy or one of the procedures listed above, the woman was still assumed to be followed up provided a hysterectomy was performed within six months of the high-grade abnormal Pap test • If a woman had multiple colposcopies or multiple procedures, the earliest colposcopy or procedure was selected
Data Sources	• CytoBase - Pap tests • OHIP CHDB (Claims History Database) – Previous Pap tests, colposcopies, definitive procedure claims, hysterectomy claims • OCR (Ontario Cancer Registry) - Resolved invasive cervical cancers • RPDB (Registered Persons Database) - Demographics
Data Availability and Limitations	• Pap test results are available in CytoBase only • CytoBase includes only Pap tests analyzed in community-based laboratories in Ontario; Pap tests analyzed in Ontario hospitals and Community Health Centres are not captured in CytoBase • It is difficult to determine whether a Pap test in CytoBase and/or OHIP was done for screening or diagnostic purposes, and therefore, some Pap tests included in these analyses may have been performed for diagnostic purposes

Indicator	**Pap test positive predictive value**
Indicator Definition	Percentage of Ontario screen-eligible women ages 21–69 with an abnormal Pap test result who were diagnosed with pre-cancer or invasive cervical cancer after a follow-up colposcopy or a surgical procedure involving the cervix
Calculations for the Indicator	(Total number of women with invasive cervical cancer or pre-cancer/ Total number of women who had an abnormal Pap test followed by a colposcopy or a surgical procedure in the reporting period) x 100
Denominator	Total number of screen-eligible Ontario women, 21-69 years old, who had an abnormal Pap test result followed by a colposcopy or a surgical procedure involving the cervix within 6 months of the abnormal Pap test. • Women, 21-69 years old, who had a Pap test with an abnormal result followed by colposcopy or surgical procedure involving the cervix within 6 months of the Pap test, in each time period • An abnormal Pap test was defined using the Bethesda codes from Cytobase. Abnormal Pap tests include Pap tests with results of ASC, ASC-H, AGC, Adeno in-situ, LSIL, HSIL, Carcinoma, Squamous cell carcinoma, Adenocarcinoma, and other malignancy • Abnormal Pap test was followed by a colposcopy or a cervical surgical procedure such as: cervical biopsy, endocervical biopsy, LEEP, cone biopsy or hysterectomy within 6 months of the Pap test • Colposcopy was defined using the following fee codes in OHIP: o Z731 - Initial investigation of abnormal cytology of vulva and/or vagina or cervix under colposcopic technique with or without biopsy(ies) and/or endocervical curetting o Z787 - Follow-up colposcopy with biopsy(ies) with or without endocervical curetting o Z730 – Follow-up colposcopy without biopsy with or without endocervical curetting • Cervical surgical procedures were identified using the following fee codes in OHIP: o Z732: Cryotherapy o Z724: Electro o Z766: Electrosurgical Excision Procedure (LEEP) o S744: Cervix - cone biopsy - any technique, with or without D&C o Z729: Cryoconization, electroconization or CO2 laser therapy with or without curettage for premalignant lesion (dysplasia or carcinoma in situ), out-patient procedure Exclusions • Women with a missing or invalid HIN, date of birth, or postal code • Women diagnosed with an invasive cervical cancer before the Pap test date;

	diagnosis of cervical cancer was defined as: ICD-O-3 codes C53, a morphology indicative of cervical cancer, microscopically confirmed with a path report • Women with a hysterectomy before the Pap test date • Women with a hysterectomy were identified through OHIP, using the following fee codes: o E862A – When hysterectomy is performed laparoscopically, or with laparoscopic assistance o P042A – Obstetrics – labour – delivery – caesarean section including hysterectomy o Q140A – Exclusion code for enrolled female patients aged 35-70 with hysterectomy o S710A – Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy o S727A – Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy o S757A – Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal o S758A – Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior and posterior vaginal repair and including enterocoele and/or vault prolapse repair when rendered o S759A - Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior or posterior vaginal repair and including enterocoele and/or vault prolapse repair when rendered o S762A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection o S763A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection o S765A – Amputation of cervix o S766A- Cervix uteri - Exc - cervical stump – abdominal o S767A- Cervix uteri - exc - Cervical stump – vaginal o S816A - Hysterectomy - with or without adnexa (unless otherwise specified) – vaginal • Women with a normal, unsatisfactory, endometrial or other abnormalities that are not indicative of cervical abnormalities
Numerator	Total number of screen-eligible women with an abnormal Pap test result, 21-69 years old, who were diagnosed with pre-cancer or invasive cervical cancer after a follow up colposcopy or a surgical procedure involving the cervix • Women with invasive cervical cancer o Defined as ICD-O-3 code C53 with a behaviour code=3, a morphology indicative of cervical cancer, microscopically confirmed with a path report • Women with pre-cancer o Defined as ICD-O-3 code C53 with a behaviour code=2 and NAACCR_MOC_CD=1 (Histology, Autopsy, Pathology, Biopsy) • Pre-cancers or invasive cervical cancers were counted if date of pre-cancer or cancer diagnosis in OCR occurred between 7 days before and up to 3 months after colposcopy or within ± 7 days of the surgical procedure

Data Sources	• Cytobase – Pap tests • OHIP's CHDB (Claims History Database) – Colposcopy and surgical procedures involving the cervix • OCR (Ontario Cancer Registry) - Resolved invasive cervical cancers • RPDB (Registered Persons Database) - Demographics
Data Availability & Limitations	• Pap test results are available in CytoBase only • CytoBase includes only Pap tests analyzed in community-based laboratories in Ontario; Pap tests analyzed in Ontario hospitals and Community Health Centres are not captured in CytoBase • It is difficult to determine whether a Pap test in CytoBase and/or OHIP was done for screening or diagnostic purposes, and therefore, some Pap tests included in these analyses may have been performed for diagnostic purposes

Indicator	**Screening History in cases of invasive cervical cancer**
Indicator Definition	Distribution of cervical cancer screening history among Ontario women, age 21 and over, diagnosed with invasive cervical cancer
Calculation for the Indicator	(Total number of women with invasive cervical cancer whose prior cervical screening history is within a specific timeframe/ Total number of Ontario women age 21 and over, diagnosed with invasive cervical cancer in the reporting period) x 100
Denominator	Total number of Ontario women age 21 and over, diagnosed with invasive cervical cancer in the reporting period • Diagnosis of cervical cancer was defined as: ICD-O-3 codes C53, a morphology indicative of cervical cancer, microscopically confirmed with a path report • The RPDB address closest to the index date was used to assign postal code Exclusions • Women with a missing or invalid HIN, date of birth or postal code
Numerator	Total number of women with invasive cervical cancer whose prior cervical screening history is within a specific timeframe • Pap tests screening history was stratified into the below categories. Each category is mutually exclusive. o >2 to 3 years o >3 years to 5 years o >5 years to 10 years

	○ No previous Pap test within 10 years • If a woman had a Pap test >2-3 years and >3-5 years and >5-10 years, the most recent test was counted (i.e. >2 to 3 years screening history category). • Identifying Pap tests: Pap tests were identified through CytoBase Pap tests were also identified using fee codes through OHIP: ○ E430A: add-on to a003, a004, a005, a006 when pap performed outside hospital ○ G365A: Periodic-pap smear ○ E431A: When Papanicolaou smear is performed outside of hospital, to G394. ○ G394A: Additional for follow-up of abnormal or inadequate smears ○ L713A: Lab.med.-anat path,hist,cyt-cytol-gynaecological specimen ○ L733A: Cervicovaginal specimen (monolayer cell methodology) ○ L812A: Cervical vaginal specimens including all types of cellular abnormality, assessment of flora, and/or cytohormonal evaluation ○ Q678A: Gynaecology – pap smear – periodic – nurse practitioners • All Pap tests in CytoBase were counted, including those with inadequate specimens Exclusions • Pap tests completed within 2 years prior to cancer diagnosis date were excluded based on the assumption that these Pap tests may have been done for diagnostic purposes
Data Sources	• CytoBase – Pap tests • OHIP's CHDB (Claims History Database) – Pap tests • OCR (Ontario Cancer Registry) - Resolved invasive cervical cancers • RPDB (Registered Persons Database) – Demographics • PCCF+ - Residence and socio-demographic information
Data Availability and Limitations	• Pap test results are available in CytoBase only • CytoBase includes only Pap tests analyzed in community-based laboratories in Ontario; Pap tests analyzed in Ontario hospitals and Community Health Centres are not captured in CytoBase

Indicator	**Pap test cancer detection rate**
Indicator Definition	Number of Ontario screen-eligible women, 21-69 years old, with a screen-detected invasive cervical cancer or pre-cancer per 1,000 screened using a Pap test

Calculations for the Indicator	(Total number of Ontario screen-eligible women, 21-69 years old, with a screen-detected invasive cervical cancer or pre-cancer/ Total number of Ontario screen-eligible women, 21-69 years old, screened with a Pap test in the reporting period) x 100
Denominator	Total number of Ontario screen-eligible women, 21-69 years old, screened with a Pap test in the reporting period • Women ages 21-69 at the index date • Index date was defined as the date of specimen collection in CytoBase in a given year • Each woman was counted once in a given year regardless of the number of tests performed • If a woman had multiple tests in a given year, the specimen date of the most severe test was chosen as the index date Exclusions • Women with a missing or invalid HIN, date of birth, postal code • Women diagnosed with an invasive cervical cancer before the index date; diagnosis of cervical cancer was defined as: ICD-O-3 codes C53, a morphology indicative of cervical cancer, microscopically confirmed with a path report • Women with a hysterectomy before the index Pap date • Women with a hysterectomy were identified through OHIP, using the following fee codes: o E862A – When hysterectomy is performed laparoscopically, or with laparoscopic assistance o P042A – Obstetrics – labour – delivery – caesarean section including hysterectomy o Q140A – Exclusion code for enrolled female patients aged 35-70 with hysterectomy o S710A – Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy o S727A – Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy o S757A – Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal o S758A – Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior and posterior vaginal repair and including enterocoele and/or vault prolapse repair when rendered o S759A - Hysterectomy - with or without adnexa (unless otherwise specified) – with anterior or posterior vaginal repair and including enterocoele and/or vault prolapse repair when rendered o S762A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection o S763A - Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection

	o S765A – Amputation of cervix o S766A- Cervix uteri - Exc - cervical stump – abdominal o S767A- Cervix uteri - exc - Cervical stump – vaginal o S816A - Hysterectomy - with or without adnexa (unless otherwise specified) – vaginal • Women with an unsatisfactory, endometrial or other abnormalities that are not indicative of cervical abnormalities. • If a woman had a colposcopy within +/- 7 days of the Pap test, the Pap test was assumed to be completed concurrently with colposcopy and not a Pap test that was followed up by colposcopy. This Pap test should not be defined as an index Pap test and therefore was removed.
Numerator	Total number of Ontario screen-eligible women with an abnormal Pap test result, 21-69 years old, who were diagnosed with pre-cancer or invasive cervical cancer after a follow up colposcopy or a surgical procedure involving the cervix • Women with invasive cervical cancer o Defined as ICD-O-3 code C53 with a behaviour code=3 • Women with pre-cancer o Defined as ICD-O-3 code C53 with a behaviour code=2 and NAACCR_MOC_CD=1 (Histology, Autopsy, Pathology, Biopsy) • Pre-cancers or invasive cervical cancers were counted if o Abnormal Pap test was followed by a colposcopy or a cervical surgical procedure such as LEEP, cone biopsy or hysterectomy within 6 months o Date of pre-cancer or cancer diagnosis in OCR occurred between 7 days before and up to 3 months after colposcopy or within ± 7 days of the surgical procedure o An abnormal Pap test was defined using the Bethesda codes from Cytobase. Abnormal Pap tests include Pap tests with results of ASC, ASC-H, AGC, Adeno in-situ, LSIL, HSIL, Carcinoma, Squamous cell carcinoma, Adenocarcinoma, and other malignancy. • Colposcopy was defined using the following fee codes in OHIP: o Z731 - Initial investigation of abnormal cytology of vulva and/or vagina or cervix under colposcopic technique with or without biopsy(ies) and/or endocervical curetting o Z787 - Follow-up colposcopy with biopsy(ies) with or without endocervical curetting o Z730 – Follow-up colposcopy without biopsy with or without endocervical curetting • Cervical surgical procedures were identified using the following fee codes in OHIP: o Z732: Cryotherapy o Z724: Electro o Z766: Electrosurgical Excision Procedure (LEEP) o S744: Cervix - cone biopsy - any technique, with or without D&C o Z729: Cryoconization, electroconization or CO2 laser therapy with or without curettage for premalignant lesion (dysplasia or carcinoma in situ), out-patient procedure

Data Sources	• CytoBase - Pap tests • OHIP's CHDB (Claims History Database) – Pap tests, colposcopies, definitive procedure claims, hysterectomy claims • OCR (Ontario Cancer Registry) - Resolved invasive cervical cancers • RPDB (Registered Persons Database) - Demographics
Data Availability and Limitations	• Pap test results are available in CytoBase only • CytoBase includes only Pap tests analyzed in community-based laboratories in Ontario; Pap tests analyzed in Ontario hospitals and Community Health Centres are not captured in CytoBase • It is difficult to determine whether a Pap test in CytoBase and/or OHIP was done for screening or diagnostic purposes, and therefore, some Pap tests included in these analyses may have been performed for diagnostic purposes

ColonCancerCheck (CCC)

Indicator	**Overdue for colorectal cancer screening**
Indicator Definition	Percentage of Ontario screen-eligible individuals, 50-74 years old, who were overdue for colorectal screening in each calendar year
Calculations for the Indicator	(Total number of Ontario screen-eligible individuals, 50–74 years old, who were overdue for colorectal screening by the end of the calendar year/ Total number of Ontario screen-eligible individuals, 50–74 years old) x 100
Denominator	**Definition** Total number of Ontario screen-eligible individuals, 50–74 years old in each calendar year • Ontario residents ages 50–74 at the index date • Index date was defined as Jan 1 of a given year Exclusions: • Individuals with a missing or invalid HIN, date of birth, or postal code • Individuals with an invasive colorectal cancer prior to Jan 1 of the calendar year of interest; prior diagnosis of colorectal cancer was defined as: ICD-O-3 codes C18.0, C18.2-C18.9, C19.9, C20.9, a morphology indicative of colorectal cancer, microscopically confirmed with a path report • Individuals with a total colectomy prior to Jan 1 of the calendar year

	• Total colectomy was defined in OHIP by fee codes S169A, S170A, S172A
Numerator	Total number of Ontario screen-eligible individuals, 50–74 years old, who were overdue for colorectal screening by the end of the calendar year • Individuals were considered overdue for colorectal screening if they: (1) did not have a gFOBT within the last two years (Jan 1 of the previous year to Dec 31st of the calendar year of interest) AND (2) did not have a colonoscopy in the last ten years (Jan 1 nine years prior to the calendar year of interest to Dec 31st of the calendar year of interest) AND (3) did not have a flexible sigmoidoscopy in the last ten years (Jan 1 nine years prior to the calendar year of interest to Dec 31st of the calendar year of interest) For example: at the end of 2018, an individual would be considered overdue for colorectal screening if he or she did not have a gFOBT test in 2017-2018, or flexible sigmoidoscopy in 2009-2018, or a colonoscopy in 2009-2018 • Identifying FOBTs: Program CCC FOBT was identified in LRT or OHIP (L179A ColonCancerCheck Fecal Occult Blood Testing) Non-program FOBT was identified using fee codes in OHIP (L181A Lab Med - Biochem - Occult Blood) • Colonoscopies was defined as a record in CIRT, GI Endo DSP or in OHIP defined by OHIP fee codes Z555A, Z491A-Z499A • Flexible sigmoidoscopies were identified using fee code Z580A in OHIP • Multiple claims with the same Health Insurance Number (HIN) and service date were assumed for a single procedure • Each individual was counted once regardless of the number of tests performed
Data Sources	• OHIP CHDB (Claims History Database) – Total colectomy claims, non-CCC and CCC FOBT, colonoscopy, flexible sigmoidoscopy • CIRT (Colonoscopy Interim Reporting Tool) – CCC program colonoscopy records • GI Endo DSP (Gastrointestinal Endoscopy Data Submission Portal) – Hospital colonoscopy records • LRT (Laboratory Reporting Tool) – CCC FOBTs • OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers • RPDB (Registered Persons Database) – Demographics

Data Availability and Limitations	• Historical RPDB address information is incomplete; therefore, the most recent primary address was selected for reporting, even for historical study periods • gFOBTs tested in hospital labs could not be captured • A small proportion of gFOBTs performed as diagnostic tests could not be excluded from the analysis

Indicator	**Abnormal gFOBT with no follow-up within six months**
Indicator **Definition**	Percentage of Ontario screen-eligible individuals with an abnormal gFOBT result who did not undergo colonoscopy within 6 months of the abnormal gFOBT result
Calculations for the Indicator	(Total number of Ontario screen-eligible individuals, 50–74 years old, who did not undergo colonoscopy within 6 months of the abnormal gFOBT result/ Total number of Ontario screen-eligible individuals, 50-74 years old, with an abnormal CCC program gFOBT result in the reporting period) x 100
Denominator	Total number of Ontario screen-eligible individuals, 50-74 years old, with an abnormal CCC program gFOBT result in the reporting period • Individuals, age 50–74 at the index date, who had an abnormal program gFOBT result in LRT in the reporting period • Index date was defined as the first abnormal gFOBT result date per person in the reporting period • Abnormal gFOBT result date was the lab report date in LRT • gFOBTs were identified by CCC program FOBT records in LRT • Abnormal FOBT results were defined as at least one positive flap out of three flaps Exclusions • Individuals with a missing or invalid HIN, date of birth, sex or postal code • Individuals with an invasive colorectal cancer before the gFOBT result date; prior diagnosis of colorectal cancer was defined as: ICD-O-3 codes C18.0, C18.2-C18.9, C19.9, C20.9, a morphology indicative of colorectal cancer, microscopically confirmed with a path report • Individuals with a total colectomy before the gFOBT result date; total colectomy was identified using OHIP fee code S169A, S170A and S172A • Abnormal gFOBTs with follow-up colonoscopies performed in an inpatient setting

Numerator	Total number of Ontario screen-eligible individuals, 50–74 years old, with an abnormal program gFOBT result in the reporting period, who did not undergo colonoscopy within 6 months of the abnormal gFOBT result Inclusions • Individuals with an abnormal program gFOBT result who did not have a follow-up colonoscopy within 6 months of the abnormal gFOBT result o Follow-up colonoscopies are defined as those performed between 2-183 days after an abnormal gFOBT • Colonoscopy was defined as a record in CIRT/GI Endo DSP or in OHIP by the fee codes Z555A, Z491A-Z499A
Data Sources	• OHIP's CHDB (Claims History Database) – Colonoscopy claims • CIRT (Colonoscopy Interim Reporting Tool) – CCC program colonoscopy records • GI Endo DSP (Data Submission Portal) - Hospital colonoscopy • LRT (Laboratory Reporting Tool) – CCC gFOBTs • OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers • RPDB (Registered Persons Database) – Demographics
Data Availability and Limitations	• Historical RPDB address information is incomplete; therefore, the most recent primary address was selected for reporting, even for historical study periods

Indicator	**Inadequate bowel preparation**
Indicator Definition	Percentage of hospital outpatient colonoscopies with poor bowel preparation
Calculations for the Indicator	(Total number of outpatient colonoscopies with poor bowel preparation/ Total number of outpatient colonoscopies performed during the reporting period) x 100
Denominator	Total number of outpatient colonoscopies performed during the reporting period • Individuals, age 18 and older, who had an outpatient colonoscopy • Only outpatient colonoscopies are included Exclusions • Individuals with a missing or invalid HIN, date of birth • Individuals with a total colectomy prior to colonoscopy; total colectomy was identified using OHIP fee code S169A, S170A and S172A
Numerator	Total number of outpatient colonoscopies with poor bowel preparation
Data Sources	• CIRT (Colonoscopy Interim Reporting Tool) – CCC program colonoscopy records • GI Endo DSP (Data Submission Portal) - Hospital colonoscopy records

Data Availability and Limitations	• This indicator includes hospital colonoscopy data only

Indicator	**Outpatient perforation**
Indicator Definition	Number of outpatient colonoscopies followed by hospital admissions for perforation within 7 days of colonoscopy, per 1,000 colonoscopies
Calculations for the Indicator	(Total number of outpatient colonoscopies followed by hospital admissions for perforation within 7 days of colonoscopy/ Total number of outpatient colonoscopies performed in the reporting period) x 1,000
Denominator	Total number of outpatient colonoscopies performed in the reporting period • Individuals, age 18 and older who had at least one colonoscopy in the reporting period • Colonoscopy was defined as a record in OHIP by fee codes: Z codes (Z555A, Z491A-Z499A) • Outpatient colonoscopies only, defined by linking OHIP claims to CIHI NACRS records Exclusions • Individuals with a missing or invalid HIN, date of birth • Individuals with a total colectomy before the index date; total colectomy was identified using OHIP fee code S169A, S170A and S172A • Endoscopists whose billing number could not be associated with a CPSO number
Numerator	Total number of outpatient colonoscopies followed by hospital admissions for perforation within 7 days of colonoscopy • Colonoscopy perforation was defined when a patient was admitted to hospital with T812, K631, K650, K658, K659, S36510, S36511, S36991 as one of the diagnosis codes, and associated with diagnosis type 1, 6, W, X, Y, or M within 7 days of the colonoscopy, AND with any of the following conditions: o Patients with a diagnosis code Y604 (Unintentional cut, puncture, perforation or haemorrhage during endoscopic examination) o Patients with no other procedures done o Patients with procedures performed during the hospitalization that would likely be done to support perforation (e.g., surgery). The definition excludes patients with colorectal cancer undergoing surgery that could be used to treat colorectal cancer

	Exclusions • Patients with a second colonoscopy during admission • Patients with splenectomy and control of bleeding outside of the colon, or cancer of GI tract • Patients with procedure codes suggesting hospital admission was for reasons other than to treat perforation
Data Sources	• OHIP's CHDB (Claims History Database) – Colonoscopy claims • CIHI DAD/NACRS – Inpatient/outpatient colonoscopy and hospital location • CIHI DAD – Perforation related hospital admissions and colorectal cancer diagnoses • RPDB (Registered Persons Database) – Demographics • CPDB (Corporate Provider Database) – Provider OHIP billing number mapping to CPSO number • OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers
Data Availability and Limitations	• Emergency department visits and same-day surgeries were included in the same NACRS file that has been used to identify inpatient or outpatient colonoscopies

Indicator	**Post-polypectomy bleeding**
Indicator **Definition**	Percentage of outpatient colonoscopies with polypectomy followed by hospital admissions for lower gastrointestinal bleeding within 14 days of colonoscopy
Calculations for the Indicator	(Total number of outpatient colonoscopies with polypectomy followed by hospital admissions for lower gastrointestinal bleeding within 14 days of colonoscopy/ Total number of outpatient colonoscopies where ≥1 polyp(s) were removed among Ontario individuals, age 50 or older) x 100
Denominator	Total number of outpatient colonoscopies where ≥1 polyp(s) were removed in the reporting period • Individuals, age 50 and older who had at least one colonoscopy where ≥1 polyp(s) was removed in the reporting period. • Colonoscopy was defined as a record in OHIP by fee code: Z codes (Z555A, Z491A-Z499A), except Z555A+/-E740A alone and Z496A+/-E740A alone • Polypectomy was defined as a record in OHIP by fee code Z571A, Z570A or E685A. Polypectomy must be performed on the same day as colonoscopy for the same patient • Outpatient colonoscopies only, defined by linking OHIP claims to CIHI-NACRS records Exclusions

	• Individuals with a missing or invalid HIN, date of birth • Individuals with a total colectomy before the index date; total colectomy was identified using OHIP fee code S169A, S170A and S172A • Endoscopists whose billing number could not be associated with a CPSO number
Numerator	Total number of outpatient colonoscopies with polypectomy followed by hospital admissions for lower gastrointestinal bleeding within 14 days of colonoscopy • Polypectomy associated bleeding was defined when a patient was admitted to hospital with T810, K625, D62, K921, K922, R58 as one of the diagnosis codes, and associated with diagnosis type 1, 6, W, X, Y, or M, OR with K626, K633 as the most responsible diagnosis code and accompanied by any of the diagnosis code Y838, Y839, Y848, Y849, Y604, Y608, Y609 within 14 days of the colonoscopy, AND with any of the following conditions: o Patients with at least one of the diagnosis codes Y604, Y608, Y609, Y838, Y839, Y848, Y849 o Patients with no procedures done o Patients with procedures performed during the hospitalization that would likely be done to treat bleeding (e.g. surgery). The definition excludes patients with colorectal cancer undergoing surgery that could be used to treat colorectal cancer. Exclusions • Patients with splenectomy and control of bleeding outside of the colon, or cancer of GI tract • Patients with procedure codes suggesting hospital admission was for reasons other than to treat bleeding
Data Sources	• OHIP's CHDB (Claims History Database) – Colonoscopy claims • CIHI DAD/NACRS – Inpatient/outpatient colonoscopy and hospital location • CIHI DAD – Bleeding related hospital admissions and colorectal cancer diagnoses • RPDB (Registered Persons Database) – Patient demographics • CPDB (Corporate Provider Database) – Provider OHIP billing number mapping to CPSO number • OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers
Data Availability and Limitations	• Emergency department visits and same-day surgeries are included in the same NACRS file used to identify inpatient or outpatient colonoscopies

Indicator	**Post-colonoscopy colorectal cancer**
Indicator Definition	Percentage of outpatient colonoscopies negative for CRC (colorectal cancer) followed by CRC diagnosis within 6 to 36 months of colonoscopy

Calculations for the Indicator	(Total number of outpatient colonoscopies negative for CRC followed by CRC diagnosis within 6 to 36 months of colonoscopy/ Total number of outpatient colonoscopies negative for CRC in the reporting period) x 100
Denominator	Total number of outpatient colonoscopies negative for CRC in the reporting period • Individuals, age 50 and older who had at least one outpatient colonoscopy in the reporting period • ”Negative for colorectal cancer” was defined as no CRC record in the Ontario Cancer Registry (OCR) within six months of colonoscopy • Colonoscopy was defined as a record in OHIP by fee codes: Z codes (Z555A, Z491A-Z499A), except Z555A+/-E740A alone and Z496A+/-E740A alone • Outpatient colonoscopies only, defined by linking OHIP claims to CIHI’s DAD and NACRS records Exclusions: • Individuals with a missing or invalid HIN, date of birth or postal code • Individuals with an invasive colorectal cancer prior to colonoscopy; colorectal cancer was defined as: ICD-O-3 codes C18.0, C18.2-C18.9, C19.9, C20.9, a morphology indicative of colorectal cancer, microscopically confirmed with a path report • Individuals with a total colectomy prior to colonoscopy; total colectomy was defined in OHIP by fee codes S169A, S170A, and S172A • Individuals who died without a diagnosis of CRC or moved out of province in the follow-up period • Individuals with CRC diagnosed within six months of colonoscopy
Numerator	Total number of outpatient colonoscopies negative for CRC followed by CRC diagnosis within 6 to 36 months of colonoscopy • Post-colonoscopy CRC was defined as individuals with CRC diagnosed within 6 to 36 months of their colonoscopy
Data Sources	• OHIP CHDB (Claims History Database) – Colonoscopy and colectomy claims • CIHI DAD/NACRS – inpatient/outpatient colonoscopy and hospital location • RPDB (Registered Persons Database) - Demographics • OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers
Data Availability and Limitations	N/A

Indicator	**Early stage invasive colorectal cancer detection**
Indicator Definition	Percentage of invasive screen-detected colorectal cancers detected at an early stage (stage I)
Calculations for the Indicator	(Total number of Ontario screen-eligible individuals, 50-74 years old, with an early stage (stage I) screen-detected invasive colorectal cancer/ Total number of Ontario screen-eligible individuals, 50-74 years old, with a screen-detected invasive colorectal cancer) x 100
Denominator	Total number of Ontario screen-eligible individuals, 50-74 years old, with a screen-detected invasive colorectal cancer • Only colorectal cancers detected as a result of screening for a CCC program indication (abnormal gFOBT or family history colonoscopy) were counted. • Invasive colorectal cancer was identified in OCR as: ICD-O-3 codes C18.0, C18.2-C18.9, C19.9, C20.9, a morphology indicative of colorectal cancer, microscopically confirmed with a path report • Colorectal cancers were defined as "screen-detected" if the individual had: o An abnormal gFOBT followed by large bowel endoscopy or colonic surgical resection within 183 days, and o Date of colorectal cancer in OCR occurred up to 190 days after the abnormal FOBT result o Date of colorectal cancer in OCR occurred between 7 days before and up to 91 days after family history colonoscopy • Large bowel endoscopy was defined as a record in CIRT, GI Endo DSP or in OHIP defined by OHIP fee codes Z555A, Z491A-Z499A and Z580A • Colonic surgical resections were defined in CIHI as resection with or without stoma, bypass or local excisions of colon and rectum, using the relevant Canadian Classification of Health Interventions (CCI) codes developed by the Canadian Institute for Health Information (CIHI). The codes used are listed in the Technical Appendix to Cancer Surgery in Ontario: ICES Atlas 2008. The Technical Appendix is located at - http://www.ices.on.ca/file/Technical%20appendix%20full%20FINAL.pdf. Admission date was used as proxy of surgical date if surgical date was missing in CIHI database Exclusions: • Individuals with a missing or invalid HIN, date of birth • Individuals with invasive cancers with unknown stage or cases were unstageable
Numerator	Total number of Ontario screen-eligible individuals, 50-74 years old, who were screened for a CCC program indication (abnormal gFOBT or family history colonoscopy), with an early stage (stage I) screen-detected invasive colorectal cancer
Data Sources	• OHIP's CHDB (Claims History Database) – Large bowel endoscopy and colectomy claims • CIHI DAD and NACRS – Colorectal related surgery records

	• CIRT (Colonoscopy Interim Reporting Tool) – CCC program colonoscopy records • GI Endo DSP (Gastrointestinal Endoscopy Data Submission Portal) – Hospital colonoscopy records • LRT (Laboratory Reporting Tool) –CCC gFOBTs • OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers • RPDB (Registered Persons Database) - Demographics
Data Availability and Limitations	• Result information on program-branded kits is available to CCO through LRT, from community labs only • This indicator does not include OHIP billings for Ontarians screened outside of the CCC organized program as OHIP does not provide results of the test

Indicator	**FOBT CRC detection rate**
Indicator Definition	Number of Ontario screen-eligible individuals, 50–74 years old, with a detected invasive colorectal cancer per 1,000 screened using CCC program gFOBTs
Calculations for the Indicator	(Total number of Ontario screen-eligible individuals, 50-74 years old, with a detected invasive colorectal cancer/ Total number of Ontario screen-eligible individuals, 50-74 years old, screened using a CCC program gFOBT) x100
Denominator	Total number of Ontario screen-eligible individuals, 50-74 years old, screened using a CCC program gFOBT • Individuals, ages 50-74, who were screened using a CCC program gFOBT • Index date was defined as the first screen date per person by gFOBT kit receipt date • Individuals who had completed both a gFOBT and a family history colonoscopy were considered screened with a gFOBT • Each individual was counted once regardless of the number of tests performed Exclusions • Individuals with a missing or invalid HIN, date of birth, or postal code • Individuals with rejected or indeterminate FOBT results • Individuals with a previous invasive colorectal cancer before the index date o Invasive colorectal cancer was defined as: ICD-O-3 codes C18.0, C18.2-C18.9, C19.9, C20.9, a morphology indicative of colorectal cancer, microscopically confirmed with a path report • Individuals with a previous total colectomy before the index date o Total colectomy was identified in OHIP by fee codes S169A, S170A, S172A

Numerator	Total number of Ontario screen-eligible individuals, 50-74 years old, with a detected invasive colorectal cancer among those screened using CCC program gFOBTs • Only colorectal cancers detected as a result of screening for a CCC program indication (abnormal gFOBT) were counted. • Invasive colorectal cancer was identified in OCR as: ICD-O-3 codes C18.0, C18.2-C18.9, C19.9, C20.9, a morphology indicative of colorectal cancer, microscopically confirmed with a path report • Colorectal cancers were defined as "screen-detected" if the individual had: o An abnormal gFOBT followed by large bowel endoscopy or colonic surgical resection within 183 days, and o Date of colorectal cancer in OCR occurred up to 190 days after the abnormal gFOBT result • Large bowel endoscopy was defined as a record in CIRT, GI Endo DSP or in OHIP defined by OHIP fee codes Z555A, Z491A-Z499A and Z580A • Colonic surgical resections were defined in CIHI as resection with or without stoma, bypass or local excisions of colon and rectum, using the relevant Canadian Classification of Health Interventions (CCI) codes developed by the Canadian Institute for Health Information (CIHI). The codes used are listed in the Technical Appendix to Cancer Surgery in Ontario: ICES Atlas 2008. The Technical Appendix is located at - http://www.ices.on.ca/file/Technical%20appendix%20full%20FINAL.pdf. Admission date was used as proxy of surgical date if surgical date was missing in CIHI database
Data sources	• OHIP's CHDB (Claims History Database) – Large bowel endoscopy and colectomy claims • CIHI DAD and NACRS – Colorectal related surgery records • CIRT (Colonoscopy Interim Reporting Tool) – CCC program colonoscopy records • GI Endo DSP (Gastrointestinal Endoscopy Data Submission Portal) – Hospital colonoscopy records • LRT (Laboratory Reporting Tool) –CCC gFOBTs • OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers • RPDB (Registered Persons Database) - Demographics
Data Availability and Limitations	• Result information on program-branded kits is available to CCO through LRT, for community labs only • This indicator does not include OHIP billings for Ontarians screened outside of the CCC organized program as OHIP does not provide results of the test • A small proportion of gFOBTs performed as diagnostic tests could not be excluded from the analysis • Historical RPDB address information is incomplete; therefore, the most recent primary address was selected for reporting, even for historical study periods

Indicator	**Family history colonoscopy CRC detection rate**
Indicator Definition	Number of Ontario screen-eligible individuals, 50–74 years old, with a detected invasive colorectal cancer per 1,000 screened using colonoscopy for family history (FH) indication
Calculations for the Indicator	(Total number of Ontario screen-eligible individuals, 50–74 years old, with a detected invasive colorectal cancer among those screened for family history colonoscopy/ Total number of Ontario screen-eligible individuals, 50–74 years old, screened for family history colonoscopy) x 1,000
Denominator	Total number of Ontario screen-eligible individuals screened, 50–74 years old, screened with colonoscopy for family history • Individuals who were screened for program indications (ages 50–74 for FH colonoscopy at the index date) in reporting period • Index date was defined as the first FH colonoscopy date screen date per person • Each individual was counted once regardless of the number of tests performed • Individuals who had completed both a gFOBT and a FH colonoscopy were counted in the gFOBT group Exclusions • Individuals with a missing or invalid HIN, date of birth or postal code • Individuals who were screened using a CCC program gFOBT. These individuals were considered to be screened with FOBT and not the FH colonoscopy. They are included in the gFOBT CRC detection rate calculation • Individuals with a previous invasive colorectal cancer before the index date, except for those diagnosed with colorectal cancer 7 days before FH colonoscopy o Invasive colorectal cancer was defined as: ICD-O-3 codes C18.0, C18.2-C18.9, C19.9, C20.9, a morphology indicative of colorectal cancer, microscopically confirmed with a path report • Individuals with a previous total colectomy before the index date o Total colectomy was identified in OHIP by fee codes S169A, S170A, S172A
Numerator	Total number of Ontario screen-eligible individuals, 50-74 years old, with a detected invasive colorectal cancer among those screened for family history colonoscopy • Only colorectal cancers detected as a result of screening for a FH colonoscopy were counted. • Invasive colorectal cancer was identified in OCR as: ICD-O-3 codes C18.0, C18.2-C18.9, C19.9, C20.9, a morphology indicative of colorectal cancer, microscopically confirmed with a path report • Colorectal cancers were defined as “screen-detected” if the individual had: o Date of colorectal cancer in OCR occurred between 7 days before and up to 91 days after FH colonoscopy

Data Sources	• OHIP (Claims History OHIP's CHDB (Claims History Database) – Large bowel endoscopy and colectomy claims • CIRT (Colonoscopy Interim Reporting Tool) – CCC program FH colonoscopy records • GI Endo DSP (Gastrointestinal Endoscopy Data Submission Portal) – Hospital colonoscopy records • LRT (Laboratory Reporting Tool) – CCC gFOBTs • OCR (Ontario Cancer Registry) – Resolved invasive colorectal cancers • RPDB (Registered Personal Database) – Demographics
Data Availability and Limitations	• This indicator does not include OHIP billings for Ontarians screened outside of the CCC organized program as OHIP does not provide results of the test

Appendix 3: Figure Descriptions

Figure 40: Ontario Breast Screening Program (OBSP) participant pathway (refer to Table 3 for target population eligibility criteria)

Description: The figure is two side-by-side flow charts, each with nine labeled boxes linked by arrows. The flow charts are unidirectional. At each step, arrows point forward to one or two boxes. Here the flow charts are described as lists in which the possible next steps are listed beneath each numbered box label.

Flow chart one of two:

1. OBSP target populations
    a. Forward to Mammography
2. Mammography
    a. Forward to Normal; or
    b. Forward to Abnormal
3. Normal
    a. Forward to Mammography every 2 years (or every year as advised by the OBSP**)
4. Abnormal
    a. Forward to Diagnostic follow-up, including additional imaging and/or biopsy
5. Mammography every 2 years (or every year as advised by the OBSP**)
6. Diagnostic follow-up, including additional imaging and/or biopsy
    a. Forward to Benign diagnosis; or
    b. Forward to Cancer diagnosis and treatment
7. Benign diagnosis
    a. Forward to Mammography every 2 years (or every year as advised by the OBSP)
8. Cancer diagnosis and treatment
9. Mammography every 2 years (or every year as advised by the OBSP)

Flow chart two of two:

1. High Risk OBSP target populations
    a. Forward to Mammography and MRI*
2. Mammography and MRI*
    a. Forward to Normal; or
    b. Forward to Abnormal
3. Normal
    a. Forward to Mammography and MRI every year
4. Abnormal
    a. Forward to Diagnostic follow-up, including additional imaging and/or biopsy
5. Mammography and MRI every year
6. Diagnostic follow-up, including additional imaging and/or biopsy

    a. Forward to Benign diagnosis; or
    b. Forward to Cancer diagnosis and treatment***
7. Benign diagnosis
    a. Forward to Mammography and MRI every year
8. Cancer diagnosis and treatment***
9. Mammography and MRI every year

Return to Figure 5.

Figure 41: Ontario Cervical Screening Program (OCSP) participant pathway (refer to Table 3 for target population eligibility criteria)

Description: The figure is a flow chart, with sixteen labeled boxes linked by arrows. The flow chart is unidirectional. At each step, arrows point forward to one or two boxes. Here the flow chart is described as lists in which the possible next steps are listed beneath each numbered box label.

1. Target population
    a. Forward to Pap test
2. Pap test
    a. Forward to Normal; or
    b. Forward to Low-grade abnormality; or
    c. Forward to High-grade abnormality; or
    d. Forward to Unsatisfactory
3. Normal
    a. Forward to Repeat routine Pap test in 3 years
4. Low-grade abnormality
    a. Forward to Repeat Pap test in 6 months
5. High-grade abnormality
    a. Forward to Colposcopy (diagnostic procedure), intervention as appropriate
6. Unsatisfactory
    a. Forward to Repeat Pap test in 3 months
7. Repeat Pap test in 6 months
    a. Forward to Normal; or
    b. Forward to Abnormal (low- or high-grade)
8. Repeat Pap test in 3 months
9. Normal
    a. Forward to Repeat Pap test in 6 months
10. Abnormal (low- or high-grade)
    a. Forward to Colposcopy (diagnostic procedure), intervention as appropriate
11. Repeat Pap test in 6 months
    a. Forward to Normal; or
    b. Forward to Abnormal (low- or high-grade)

12. Normal
    a. Forward to Repeat routine Pap test in 3 years
13. Abnormal (low- or high-grade)
    a. Forward to Colposcopy (diagnostic procedure), intervention as appropriate
14. Repeat routine Pap test in 3 years
15. Colposcopy (diagnostic procedure), intervention as appropriate
    a. Forward to follow-up
16. Follow-up

Return to Figure 6.

Figure 42: ColonCancerCheck (CCC) participant pathway (refer to Table 3 for target population eligibility criteria)

Description: The figure is two side-by-side flow charts. The first flow chart has ten labeled boxes linked by arrows. The second flow chart has six labeled boxes linked by arrows. The flow charts are unidirectional. At each step, arrows point forward to one or two boxes. Here the flow charts are described as lists in which the possible next steps are listed beneath each numbered box label.

Flow chart one of two:

1. Average risk target population*
    a. Forward to FIT
2. FIT
    a. Forward to Normal; or
    b. Forward to Abnormal
3. Normal
    a. Forward to Re-screen with FIT in 2 years
4. Abnormal
    a. Forward to Colonoscopy
5. Re-screen with FIT in 2 years
6. Colonoscopy
    a. Forward to Normal; or
    b. Forward to Abnormal
7. Normal
    a. Forward to Re-screen with FIT in 10 years
8. Abnormal
    a. Forward to Referral to surgery, colonoscopy surveillance or screen with FIT in 5 years****
9. Re-screen with FIT in 10 years
10. Referral to surgery, colonoscopy surveillance or screen with FIT in 5 years****

Flow chart two of two:

1. Increased risk target population**
    a. Forward to Colonoscopy
2. Colonoscopy
    a. Forward to Normal; or
    b. Forward to Abnormal
3. Normal
    a. Forward to Colonoscopy in 5–10 years***
4. Abnormal
    a. Forward to Referral to surgery or colonoscopy surveillance****
5. Colonoscopy in 5–10 years***
6. Referral to surgery or colonoscopy surveillance****

Return to Figure 7.

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