Cancer Care Ontario

ONTARIO CANCER SCREENING PERFORMANCE REPORT **2016**

Ontario
Cancer Care Ontario

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MESSAGE FROM DR. LINDA RABENECK

Cancer is the leading cause of death in Ontario. One in four Ontarians 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, the Ontario Ministry of Health and Long-Term Care, in partnership with Cancer Care Ontario, operates three organized cancer screening programs: the Ontario Cervical Screening Program (OCSP), the Ontario Breast Screening Program (OBSP) and ColonCancerCheck (CCC). 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.

We previously published separate reports on the progress of each of the screening programs. However, 2016 marks the first time that performance for all three screening programs has been consolidated into one report. This is also the first report with a special focus—program coverage (screening participation and retention)—as well as a feature on Ontarians who are overdue for screening.

Program coverage was chosen as our special focus to highlight opportunities for improvement in program participation and retention. Therefore, this report is a call to action for primary care providers to encourage regular cancer screening in their eligible patients.

We will use the findings in this report to continually improve our cancer screening programs so that they best meet the needs of Ontarians. Future plans include transitioning all mammography screening sites in Ontario to the OBSP, assessing the feasibility of human papillomavirus testing as the primary cervical cancer screening method and replacing the guaiac fecal occult blood test with the fecal immunochemical test for colorectal cancer screening.

Together with our partners at the Ministry of Health and Long-Term Care, we are working to decrease the burden of cancer in Ontario through high-quality, evidence-based, organized screening programs.

Linda Rabeneck MD MPH FRCPC
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EXECUTIVE SUMMARY

The number of people newly diagnosed with cancer in Ontario has increased over the last two decades and will continue to rise, largely due to an aging population. Breast and colorectal cancer are among the most commonly diagnosed cancers in Ontario and can be prevented or detected earlier by regular screening.

Effective screening through an organized program is critical to reducing the burden of cancer in Ontario. Screening in the asymptomatic population can detect pre-cancerous changes, or cancers at an early stage when they are easier to treat. The benefits of an organized cancer screening program are fully realized when participation by target populations is high.

As Ontario's advisor on cancer prevention and care, Cancer Care Ontario designs, plans, implements and evaluates three province-wide organized screening programs: the Ontario Breast Screening Program (OBSP), the Ontario Cervical Screening Program (OCSP) and ColonCancerCheck (CCC). Our cancer screening programs are modelled after the International Agency for Research on Cancer's (IARC's) requirements for the implementation of organized screening programs and use an evidence-based framework designed to maximize screening benefits and minimize limitations.

Trends in Program Participation and Retention

More than two million women were eligible to participate in breast cancer screening in 2013–2014, and 65 percent had a screening mammogram. Participation in breast cancer screening has remained steady at 65 percent since 2011–2012. From 2007 to 2014, retention in the OBSP decreased from 85 to 83 percent. These trends suggest that while the OBSP is expanding in size and reach, women still need to regularly participate in cancer screening to receive its full benefits.

Participation in cervical cancer screening decreased in all Local Health Integration Networks and age groups from 2009 to 2014. This reduction in participation corresponds with the implementation of the updated 2011 cervical cancer screening guidelines, which extended the recommended time between routine screens from once a year to once every three years. Of the women in Ontario who had a normal Pap test in 2011, 72 percent returned for a subsequent screen within 42 months.

In 2014, approximately 40 percent (1.6 million) of screen-eligible Ontarians were overdue for colorectal cancer screening. From 2008 to 2014, the percentage overdue for colorectal cancer screening in Ontario improved annually, decreasing from 50 percent in 2008 to 40 percent in 2014.

THE PARTICIPATION GAP

The participation gap analysis in this report explores the geographic and socio-demographic characteristics of Ontarians overdue for cancer screening. Within Ontario, there was wide variation in the proportion of people overdue for cancer screening across census subdivisions. A cross-sectional analysis found that factors such as participant age, participant sex, neighbourhood income quintile, enrolment in a patient enrolment model practice and physician sex are associated with differences in screening participation.

INITIATIVES TO IMPROVE PROGRAM PARTICIPATION AND RETENTION

Informed by recommendations from IARC on the key elements of organized screening, Cancer Care Ontario implements initiatives to increase participation and ensure routine recall. We also regularly develop and adhere to screening guidelines, and support quality assurance and follow-up of abnormal results. As a "prescribed registry" under Ontario's Personal Health Information Protection Act, we use a secure information technology infrastructure to support our cancer screening programs.

Our initiatives for improving program participation and retention include:

- Screening correspondence to eligible Ontarians;
- Physician-linked correspondence;
- The Primary Care Screening Activity Report;
- Tools to optimize cancer screening information in electronic medical records;
- An e-learning platform to support enhanced cancer screening knowledge and capabilities among primary care providers;
- Regional awareness campaigns; and
- Mobile screening units (mobile screening coaches).

Future Directions

All three cancer screening programs in Ontario are constantly evolving based on the latest evidence to ensure that they are of the highest quality.

OBSP

We identified transitioning mammography services from non-OBSP facilities to the OBSP as a priority quality initiative and work is currently underway to achieve this objective. Transitioning non-OBSP mammography into the OBSP will ensure that all eligible Ontario women receive the benefits of screening within the OBSP.

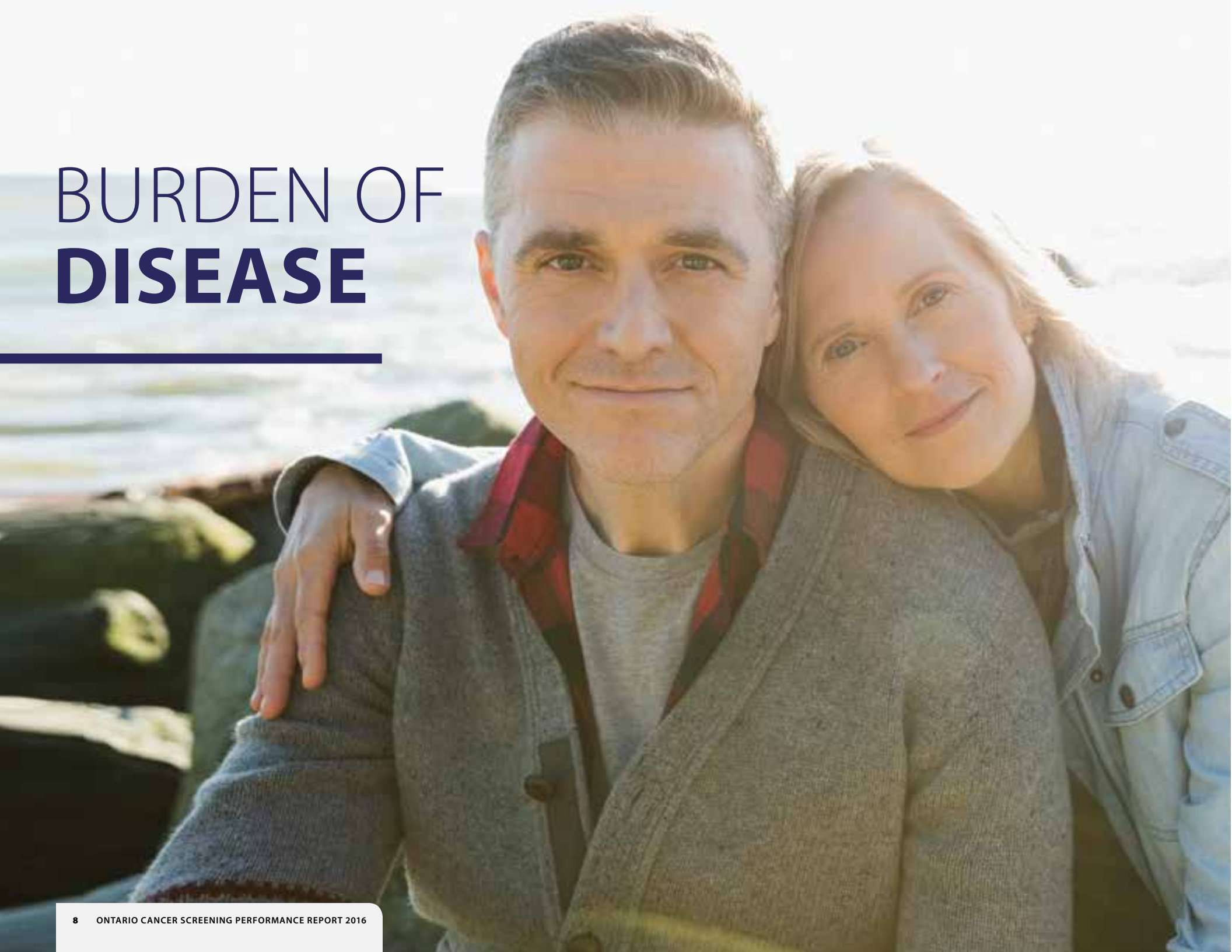
OCSP

We have recommended screening based on human papillomavirus (HPV) testing and are working with the Ministry of Health and Long-Term Care to assess the feasibility of HPV testing in Ontario. Until HPV testing has been implemented as a primary screening modality, we continue to recommend screening every three years with the Pap test.

CCC

We are planning to implement the fecal immunochemical test (FIT) in CCC as the recommended primary screening test for people at average risk of developing colorectal cancer. FIT is expected to increase participation in colorectal cancer screening and produce higher cancer detection rates.

BURDEN OF **DISEASE**



Cancer is the leading cause of death in Ontario and was responsible for approximately 30 percent of all deaths in 2012. Approximately one in two Ontarians will develop cancer in their lifetime and one in four will die of the disease. [1]

In Ontario, the most commonly diagnosed new cancers for men in 2012 (the most recent year of data available) were prostate (21.6 percent of all new male cases), lung (13.3 percent), colorectal (12.4 percent) and bladder (8.9 percent). In women, the leading cancers were breast (26.6 percent of all new female cases), lung (12.6 percent) and colorectal (11.1 percent). [1] For both sexes combined, the highest cancer mortality rates were for lung (49.9 per 100,000), followed by colorectal (22.9 per 100,000) and pancreatic (12.1 per 100,000) cancer. [1] Five-year relative survival has improved over the last two decades for Ontario's most common cancers. [2]

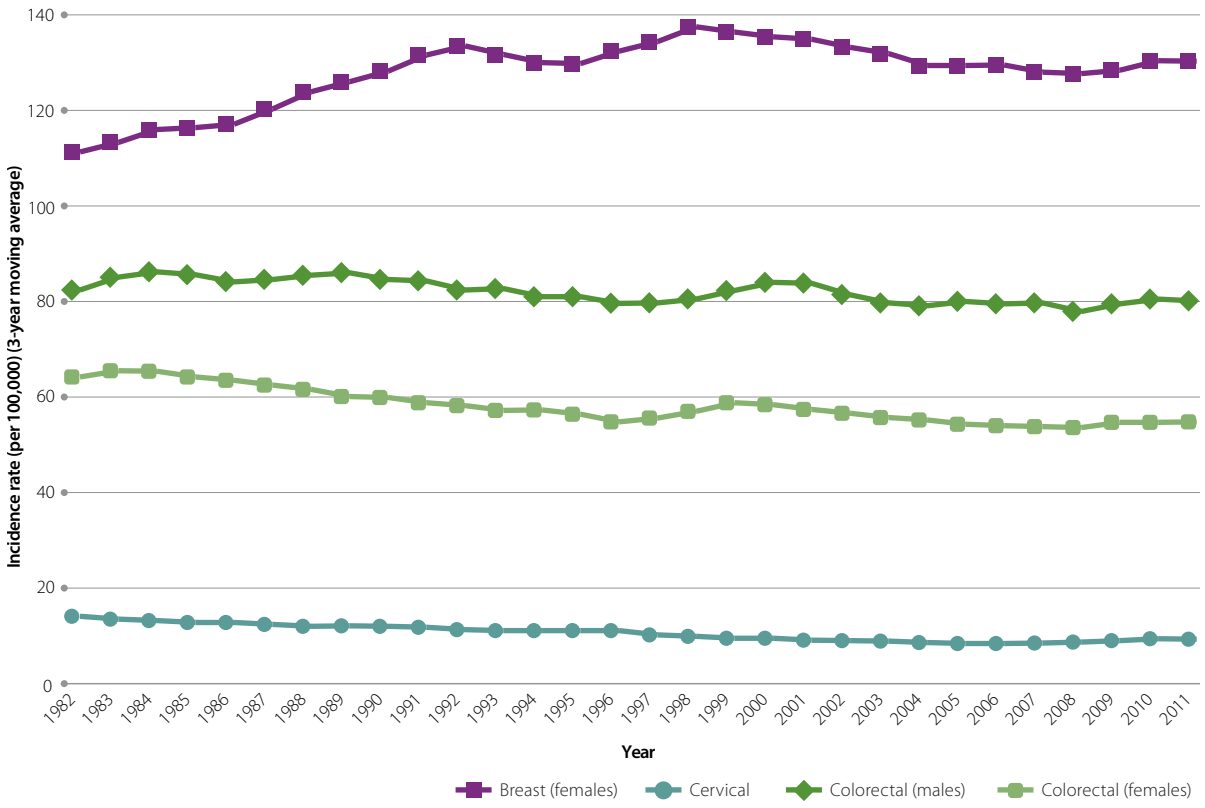
Trends in Cancer Incidence: Breast, Cervical and Colorectal Cancer

From 1982 to 1992, breast cancer incidence rates (newly diagnosed cases per 100,000 people) increased annually, likely due to an increase in opportunistic mammograms and programmatic mammograms provided through the Ontario Breast Screening Program (OBSP). From 1992 to 2012, breast cancer incidence rates decreased by 0.2 percent per year (Figure 1). [1]

Cervical cancer incidence rates have been decreasing since the early 1980s by about two percent per year (Figure 1). The incidence of cervical cancer is much lower than that of breast or colorectal cancer. In 2012 (the latest year of data available), 621 women were diagnosed with cervical cancer, while 10,283 women were diagnosed with breast cancer (the most common female cancer in Ontario) and 4,275 women were diagnosed with colorectal cancer. [1]

From 1982 to 2012, colorectal cancer incidence rates decreased by about 0.4 percent per year for both sexes (Figure 1). [1] In 2012, there were 9,172 new cases of colorectal cancer in Ontario (4,897 men and 4,275 women). [1]

Figure 1 **Age-standardized incidence rates for breast, cervical and colorectal cancer, Ontario, 1982–2012**



Notes: Rates are per 100,000 and standardized to the 2011 Canadian population. Rates are based on counts determined using the International Agency for Research on Cancer multiple primary rules.

Rates are calculated using a three-year moving average (i.e., the 2011 data point indicates an average of 2010, 2011 and 2012 incidence rates).

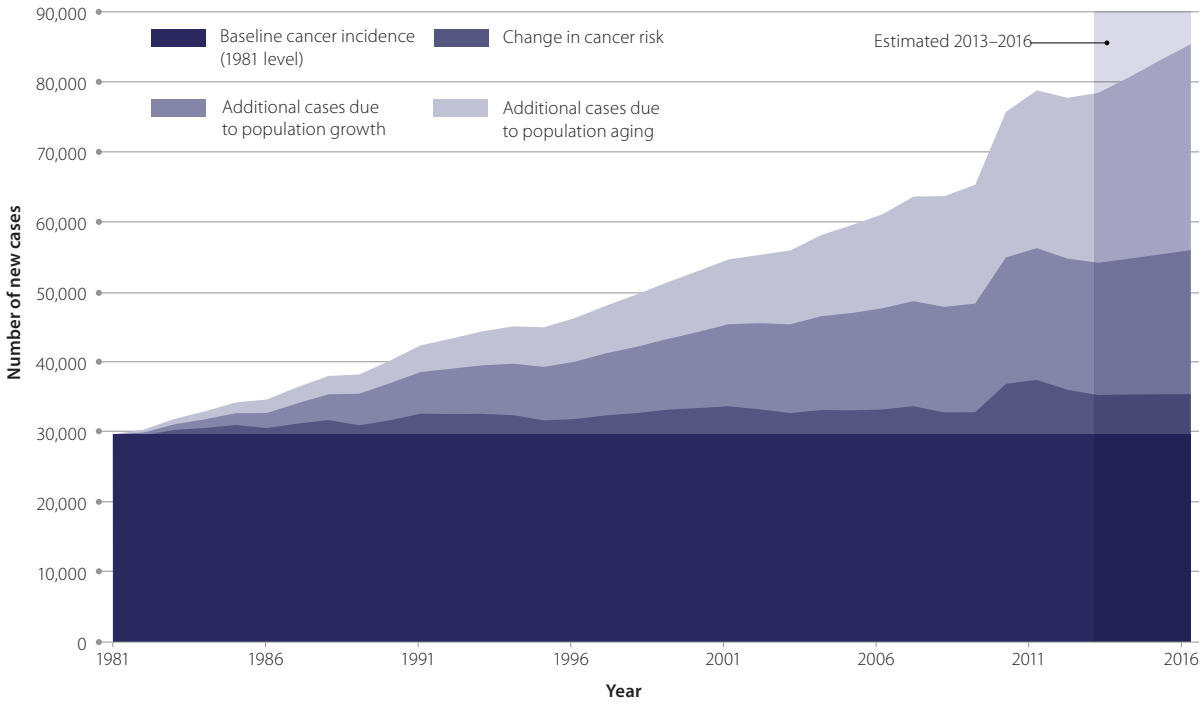
Analysis by: Surveillance, Analytics and Informatics, CCO.

Data sources: Population data source: pop est summary (1986–2011, Statistics Canada, Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care: IntelliHEALTH ONTARIO, extracted December 2013. For all other cancers: CCO SEER*Stat Package Release 10—Ontario Cancer Registry (August 2015). Population data source: pop est summary (Statistics Canada, Ontario Ministry of Finance), fall 2014 release, based on the 2011 census.

POPULATION GROWTH AND AGING

Over the past three decades, aging of the population and population growth have contributed far more to the number of new cancer cases than actual changes in cancer risk and cancer control practices. The number of cancer cases in Ontario due to an aging population is substantial (Figure 2), and Ontario's Ministry of Finance population projections indicate that by 2041, people age 65 and older will account for 25 percent of the province's population. [3]

Figure 2 **Growth in new cancer cases in Ontario, 1981–2016** [1]



Note: Rates standardized to the 2011 Canadian population.
Analysis by: Surveillance, Analytics and Informatics, CCO.
Data source: Cancer Care Ontario SEER* Stat Package Release 10—Ontario Cancer Registry (August 2015).

From 2008 to 2012, the incidence rate of breast cancer in women increased with age and was highest at ages 70 to 74 (Figure 3). The median age at diagnosis was 62. [1]

Colorectal cancer incidence rates for both sexes increased with age, particularly after age 50, and were highest in the oldest age group (85 and older). After age 50, colorectal cancer incidence rates were higher in men than women (Figure 3). Colorectal cancer was more common than breast cancer in women age 85 and older (Figure 3). [1]

Women were diagnosed with cervical cancer at younger ages than they were with breast and colorectal cancer. Cervical cancer incidence rates rose in women ages 35 to 44 and again in women ages 55 to 64 (Figure 4). The median age at diagnosis for cervical cancer was 48, compared to 62 for breast cancer, 69 for colorectal cancer (male) and 71 for colorectal cancer (female). [1]

UNIQUE CHALLENGES FACED BY FIRST NATIONS, INUIT AND MÉTIS PEOPLES IN ONTARIO

Ontario's First Nations, Inuit and Métis Peoples face unique health challenges and poorer health outcomes than the general population. The prevalence of modifiable cancer risk factors, such as smoking, poor diet and obesity, is higher among First Nations, Inuit and Métis populations, who also face inequities in cancer survival. [4, 5, 6, 7] These patterns underscore the importance of a cancer strategy that addresses the specific health needs of First Nations, Inuit and Métis Ontarians.

Assessing the burden and risk of cancer in these populations is challenging because of the lack of First Nations, Inuit and Métis identifiers in Ontario's health databases. [4, 7, 8] High-quality, comprehensive data specific to First Nations, Inuit and Métis Peoples are crucial to the development of evidence-based strategies to reduce cancer risk and burden. Building data sources for First Nations, Inuit and Métis Peoples is a priority identified in Cancer Care Ontario's *Aboriginal Cancer Strategy III* and supports the *Ontario Cancer Plan IV* goal of ensuring health equity for all Ontarians across the cancer system. [8] The Aboriginal Cancer Control Unit at Cancer Care Ontario works directly with First Nations, Inuit and Métis populations to address health inequities, and ensure that programs and strategies are relevant and effective at the community level. [8]

Figure 3 Age-specifi incidence rates for breast (female), cervical and colorectal cancer, Ontario, 2008–2012

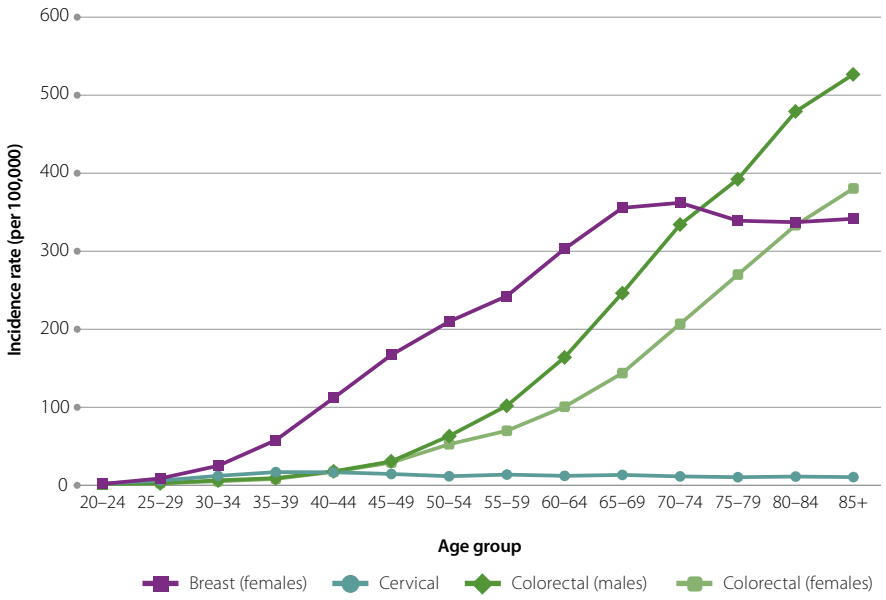
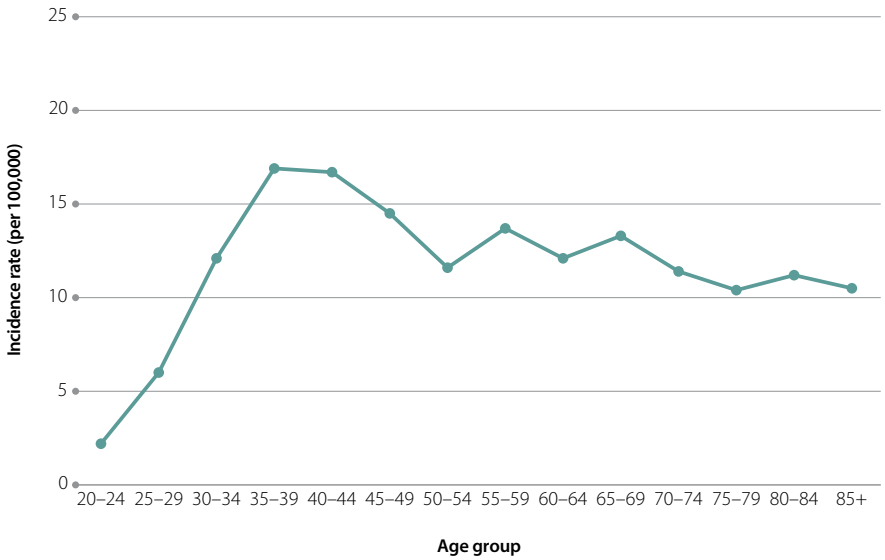


Figure 4 Age-specific incidence of cervical cancer, Ontario, 2008–2012



Note: Rates are per 100,000 and based on counts determined using the International Agency for Research on Cancer multiple primary rules.

Analysis by: Surveillance, Analytics and Informatics, CCO.

Data sources: Population data source: pop est summary (1986–2011, Statistics Canada, Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care: IntelliHEALTH ONTARIO, extracted December 2013. For all other cancers: CCO SEER*Stat Package Release 10—Ontario Cancer Registry (August 2015). Population data source: pop est summary (Statistics Canada, Ontario Ministry of Finance), fall 2014 release, based on the 2011 census.

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 they are easier to treat. [9]

Organized Cancer Screening

As Ontario's advisor on cancer prevention and care, Cancer Care Ontario plans, implements and evaluates the province's three cancer screening programs. Guided by high-quality research, the Ontario Breast Screening Program (OBSP), the Ontario Cervical Screening Program (OCSP) and ColonCancerCheck (CCC) support Ontario's capacity for cancer prevention and early detection.

Using an evidence-based framework designed to maximize screening benefits, while minimizing limitations, the breast, cervical and colorectal cancer screening programs are measured against accepted international standards. The infrastructure of these programs are also modelled after the International Agency for Research on Cancer's (IARC's) requirements for the implementation of organized screening programs. [10, 11, 12]

Informed by IARC recommendations on the key elements of organized cancer screening, we implement initiatives to increase participation and ensure routine recall. We also develop and adhere to screening guidelines, and support quality assurance and the follow-up of abnormal results. Furthermore, we are a designated "prescribed registry" under Ontario's Personal Health Information Protection Act, and are supported by a robust and secure information technology infrastructure that supports the provision of high-quality cancer screening services.

REQUIREMENTS OF AN ORGANIZED CANCER SCREENING PROGRAM

Informed by International Agency for Research on Cancer recommendations, Cancer Care Ontario's organized cancer screening programs should have the following features: [10, 12]

- 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 through the Screening Performance Measures Group (Table 1). This framework has subsequently been adopted nationally by other screening programs. [13] The goal of the framework is to promote consistency in the reporting, calculation and interpretation of key cancer screening performance measures. [13] The framework identifies five key performance domains organized to reflect the screening pathway, as well as performance indicators within each of the performance domains. The Screening Performance Measures Group selected the recommended performance indicators based on their relationship to meaningful outcomes; standardized definitions and data collection methods; data quality; and facilitation of regional, national and international comparisons.

The special focus of this report analyzes the first performance domain, "program coverage," and outlines our initiatives to increase and maintain program coverage. All indicators from the evaluation framework are reported in the Summary of Ontario Screening Performance section of this report.

Table 1 Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

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

Working in Partnership with the Regional Cancer Programs

Ontario has 14 Regional Cancer Programs, each run by a Cancer Care Ontario Regional Vice-President. Regional Vice-Presidents lead the implementation of cancer initiatives, including awareness campaigns. To support the Regional Cancer Programs, we produce monthly and quarterly reports that contain regional and facility-level data on key performance indicators (including screening participation and retention). We also meet quarterly with Regional Cancer Program leadership to discuss program performance.

OBSP Overview

Established in 1990, the OBSP is a province-wide organized cancer screening program that aims to reduce breast cancer mortality in Ontario. The program provides high-quality breast cancer screening services for women at average risk of breast cancer, as well as for women at high risk of breast cancer (see Table 2 for a summary of the OBSP).

In the OBSP, women at average risk of breast cancer ages 50 to 74 are screened every two years with mammography, a test that uses X-rays to find abnormalities in breast tissue. In July 2011, the OBSP expanded to include high risk screening services for eligible women ages 30 to 69 (see Table 3 for eligibility criteria). This expansion was supported by clinical practice guidelines indicating that women at high risk of developing breast cancer would benefit from annual screening with mammography and magnetic resonance imaging (MRI)—or ultrasound if MRI is contraindicated—within the context of an organized screening program. [14]

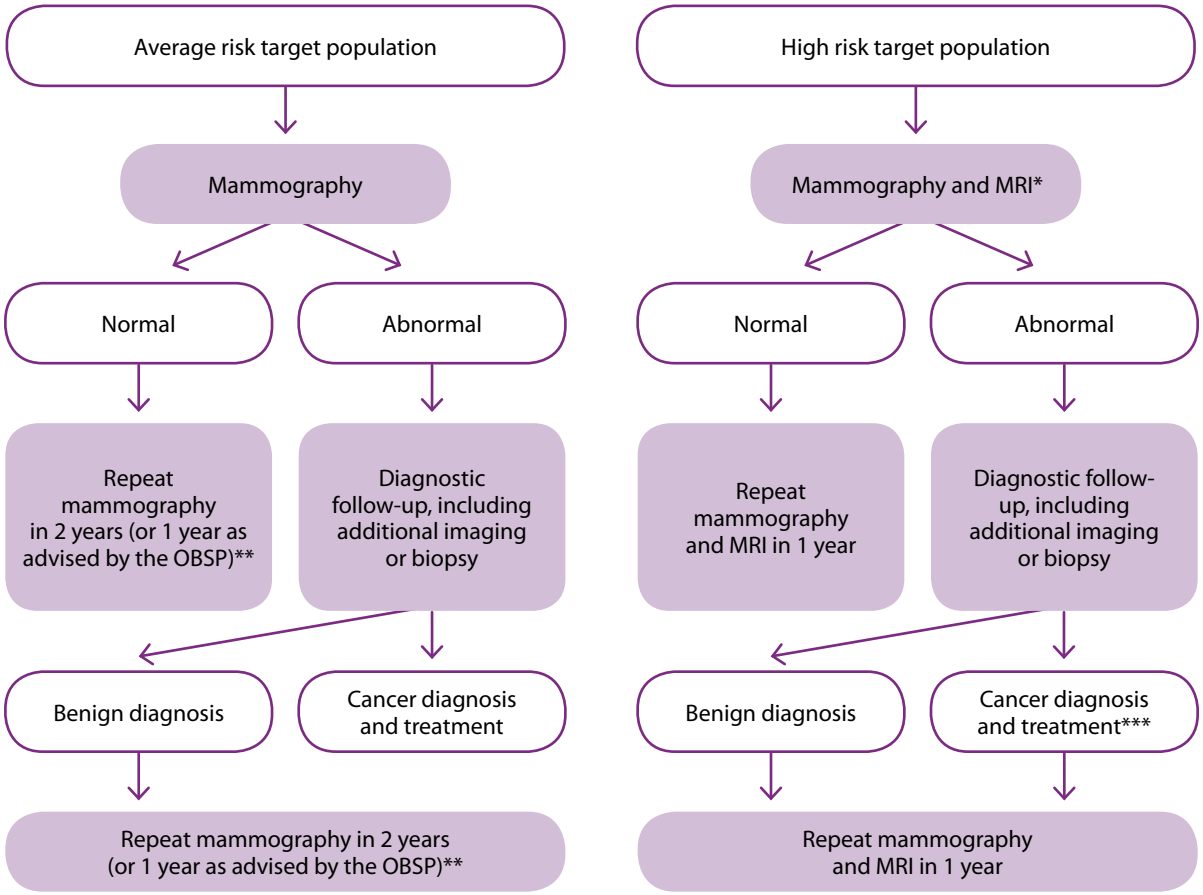
The OBSP invites and recalls women when they are due for screening, notifies women and their primary care providers of screening results and helps women with abnormal results navigate as they move through the diagnostic phase.

Not all breast screens done in Ontario are through the OBSP. From 2013 to 2014, approximately 27 percent of breast screens in Ontario were done at non-OBSP sites, and women screened at these sites may not have received the benefits of participating in an organized breast cancer screening program. With support from the Ministry of Health and Long-Term Care, we are currently developing plans to ensure that all sites providing screening mammography are a part of the OBSP. As of June 2016, there were 193 OBSP screening sites in Ontario. In addition to OBSP screening sites, OBSP assessment sites ensure a timely, coordinated approach to the assessment of breast abnormalities for women with abnormal results.

MAGNETIC RESONANCE IMAGING (MRI)

An MRI is an imaging technique that provides a more sensitive test for breast cancer than mammography because it creates detailed images of body tissue using a magnetic field and radio waves rather than X-rays. However, the test's higher sensitivity for detecting cancer can lead to more false-positive screening results, leading to a greater number of unnecessary follow-up procedures. Using MRI together with mammography has been shown to be effective in screening women at high risk of breast cancer. [14]

Figure 5 **Ontario Breast Screening Program (OBSP) participant pathway (see Table 3 for target population eligibility criteria)**



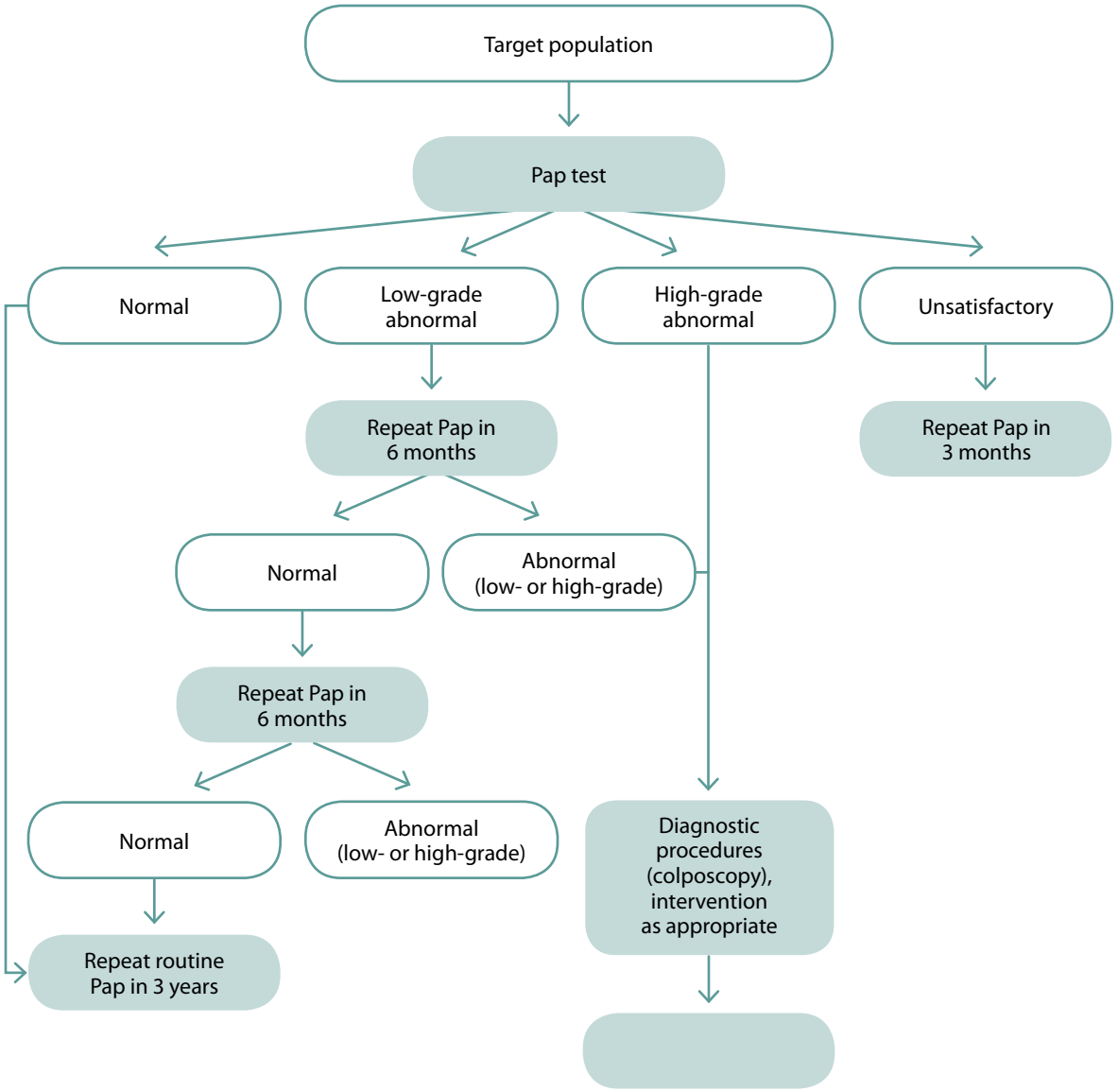
* If magnetic resonance imaging (MRI) is contraindicated, a woman is scheduled for a screening breast ultrasound.
** Reasons for 1-year recall include documented pathology of high-risk lesions, a personal history of ovarian cancer, two or more first-degree female relatives with breast cancer at any age, one first-degree female relative with breast cancer under age 50, one first-degree relative with ovarian cancer at any age, one 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 who have a personal history of breast cancer may still be eligible for high risk OBSP screening, and may be able to repeat annual high risk breast cancer screening if they continue to have no acute breast symptoms while in the high risk program.

OCSP Overview

The goal of the OCSP is to reduce the incidence and mortality of cervical cancer by identifying and treating women with pre-cancerous or cancerous lesions at an early stage. Primary care providers administer the Papanicolaou (Pap) test, the principal cervical cancer screening procedure for women ages 21 to 69 (Figure 6). Women with abnormal test results may be followed up with a colposcopy—a procedure that illuminates and magnifies the view of the transformation zone of the cervix—and if necessary, a biopsy of suspicious tissue. Based on an established body of evidence, Cancer Care Ontario's clinical guidelines for cervical cancer screening were updated in 2011 to optimize screening for cancer of the cervix. The guidelines recommend that women who are or ever have been sexually active get screened every three years with a Pap test (see Table 2 for a summary of the OCSP, and Table 3 for detailed eligibility criteria).

Pap tests are processed in hospital laboratories, or at participating community laboratories that enter screening results into a comprehensive database called Cytobase. Although tests processed at hospital laboratories are not entered into Cytobase, the database holds approximately 85 percent of all Pap test results performed in Ontario. We continue to work towards improving data collection of Pap test results in the province.

Figure 6 **Ontario Cervical Screening Program participant pathway (see Table 3 for target population eligibility criteria)**



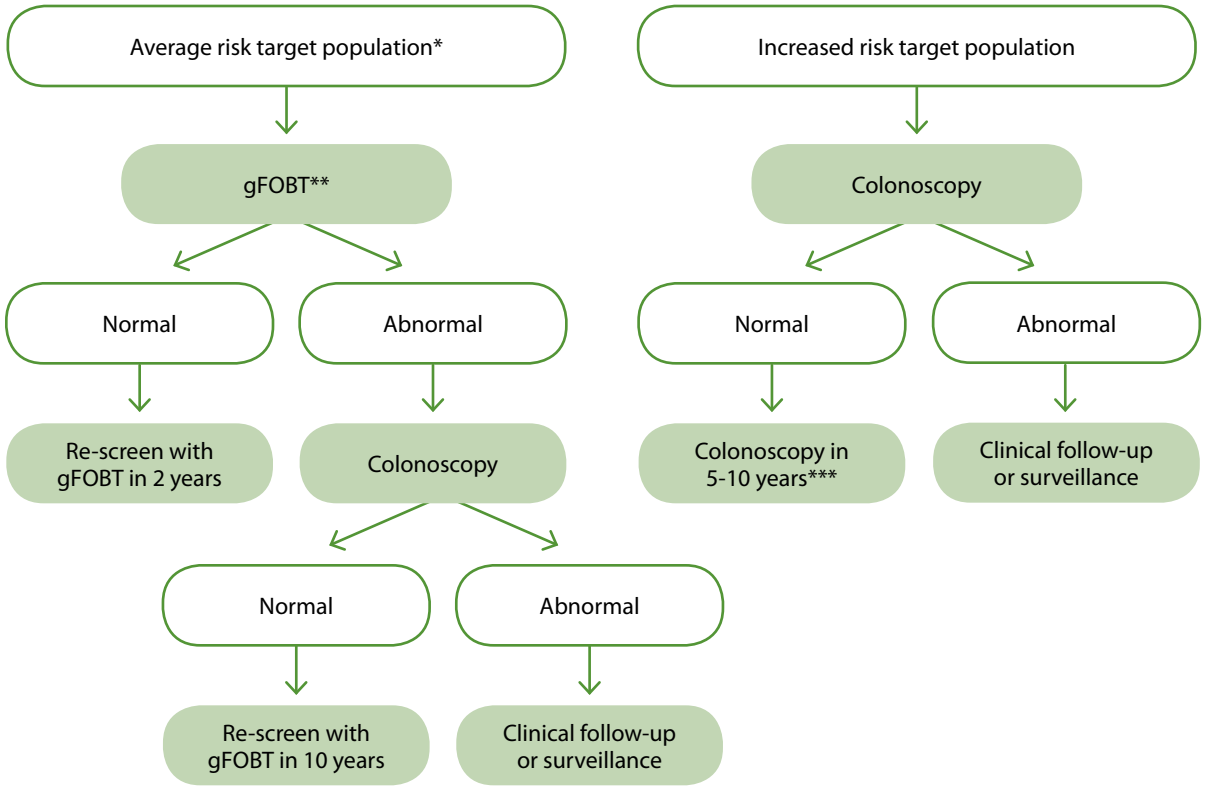
CCC Overview

CCC is an organized screening program designed to reduce the burden of colorectal cancer in Ontario. In May 2016, CCC updated its screening recommendations. [15] The program recommends that people at average risk of developing colorectal cancer (men and women ages 50 to 74 without a family history of the disease) screen with the guaiac fecal occult blood test (gFOBT) every two years. The gFOBT is a self-administered test that can detect the presence of blood in the stool. It is recommended that people with an abnormal gFOBT result follow up by getting a colonoscopy within eight weeks to determine whether they have cancer (see Table 2 for a summary of CCC, and Table 3 for detailed eligibility criteria).

Screening participants can get gFOBT kits through primary care providers, such as family physicians and nurse practitioners, once they are deemed to be at average risk of colorectal cancer. People without a primary care provider can get a kit at some local pharmacies, by contacting Telehealth Ontario or from one of the two mobile screening coaches. Cancer Care Ontario is planning to implement a more sensitive type of fecal occult blood test called the fecal immunochemical test (FIT) as the recommended primary screening test in CCC for people at average risk. When FIT is implemented, it will replace gFOBT in the program.

In some sites in Ontario, people at average risk of colorectal cancer can be screened every 10 years with flexible sigmoidoscopy, which is an endoscopic procedure that examines the lining of the rectum, sigmoid and descending colon.

Figure 7 **ColonCancerCheck participant pathway (see Table 3 for target population eligibility criteria)**



*People at average risk of colorectal cancer who choose to be screened with a flexible sigmoidoscopy should be screened every 10 years.
** Cancer Care Ontario is planning to implement the fecal immunochemical test (FIT) in ColonCancerCheck as the recommended primary screening test for people at average risk of developoing colorectal cancer. When FIT is implemented, it will replace the guaiac fecal occult blood test (gFOBT) in the program.
***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 wvery five years, while those with a first-degreen relative who was diagnosed with colorectal cancer at age 60 or older should be screened every 10 years, unless they require ademnoma surveillance at shorter intervals.

A colonoscopy is recommended for people at increased risk (men and women who have one or more first-degree relatives with colorectal cancer). Colonoscopy is a procedure that allows a physician to look for any abnormalities by examining the lining of the entire colon using a small camera attached to a flexible tube inserted through the rectum. People at increased risk should begin screening at age 50 or 10 years earlier than the age at which their relative was diagnosed, whichever occurs first.

Ontario Screening Program Summary

Table 2 Ontario screening program summary

Screening program	Target population	Screening test	Screening interval
Ontario Breast Screening Program (OBSP)	Women ages 50–74	Mammography	Every 2 years
High Risk Ontario Breast Screening Program (High Risk OBSP)	Women ages 30–69 at high risk of breast cancer	Mammography + MRI*	Every year
Ontario Cervical Screening Program (OCSP)	Women ages 21–69 who are or have ever been sexually active	Cytology test (Pap test)	Every 3 years
ColonCancerCheck (CCC average risk)	Men and women ages 50–74	gFOBT**	gFOBT** every 2 years
ColonCancerCheck (CCC increased risk)	Men and women who have 1 or more first-degree relatives with colorectal cancer	Colonoscopy	Colonoscopy every 5–10 years***

* If magnetic resonance imaging (MRI) is contraindicated, a woman is scheduled for a screening breast ultrasound.

**Cancer Care Ontario is planning to implement the fecal immunochemical test (FIT) in ColonCancerCheck as the recommended primary screening test for people at average risk of developing colorectal cancer. When FIT is implemented, it will replace the guaiac fecal occult blood test (gFOBT) in the program.

*** 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 adenoma surveillance at shorter intervals.

Table 3 Eligibility criteria by screening program

Screening program	Eligibility criteria
Ontario Breast Screening Program (OBSP)	Women who are ages 50–74 and have: • No acute breast symptoms • No personal history of breast cancer • No current breast implants • Not had a mammogram within the last 11 months Women age 74 and older may continue to be screened in the program with a referral 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 healthcare provider.
High Risk Ontario Breast Screening Program (High Risk OBSP)	Women who are ages 30–69 and: • Have a physician's referral • Have no acute breast symptoms • Fall into one of the following risk categories: - Known to be carriers of the BRCA1 or BRCA2 gene mutation - First-degree relative of a mutation carrier, has had genetic counselling and has declined genetic testing - Previously assessed by a genetic clinic as having ≥25% lifetime risk of breast cancer based on personal and family history, or - Received radiation therapy to the chest before age 30 and at least 8 years ago
Ontario Cervical Screening Program (OCSP)	Women who are age 21 and are or have ever been sexually active. This includes intercourse, as well as digital or oral sexual activity involving the genital area with a partner of either sex. Women who are not sexually active by age 21 should delay cervical cancer screening until sexually active. Screening may be discontinued at age 70 if there is an adequate (i.e., 3 or more normal Pap tests) normal cytology screening history in the previous 10 years.
ColonCancerCheck (CCC average risk)	People who are ages 50–74 and have: • No first-degree relative who has been diagnosed with colorectal cancer, and • No personal history of pre-cancerous colorectal polyps requiring surveillance or inflammatory bowel disease (i.e., Crohn's disease or ulcerative colitis)
ColonCancerCheck (CCC 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.

Evidence for Screening

Cancer Care Ontario's cancer screening guidelines and recommendations are built on a robust body of evidence about effective practices for reducing the morbidity and mortality associated with cancer. Because they are committed to the highest standards, all three screening programs consistently review the most rigorous research available to inform screening practices in Ontario.

OBSP EVIDENCE

Routine mammography continues to be the best screening approach for the early detection of breast cancer among people at average risk. A 2016 systematic review showed that compared with no screening, mammography screening is associated with lower breast cancer mortality and lower incidence of advanced stage breast cancer. [16] More specifically, Canadian breast cancer screening programs using mammography are associated with a 40 percent decrease in breast cancer mortality. [17] However, effective breast cancer screening programs must manage the potentially significant limitations of programmatic screening because false-positive mammography results and over-diagnosis of cancer can lead to unnecessary treatment. [18,19] In weighing the limitations and benefits of mammography, the Canadian Task Force on Preventive Health Care recommends breast cancer screening every two to three years for women ages 50 to 74 with no previous history of breast cancer. [19]

Women confirmed to be at high risk of breast cancer (e.g., due to family history or genetic testing) benefit significantly from additional MRI. In these women, breast cancer screening with both mammography and MRI results in higher sensitivity for cancer detection (93 to 100 percent) than mammography alone (25 to 59 percent). [20] In July 2011, the OBSP introduced organized screening using annual MRI and mammography for women at high risk of breast cancer. [21] When MRI is contraindicated, ultrasound is used instead, along with mammography.

TURNING DATA INTO DECISIONS

A landmark 2013 study led by Cancer Care Ontario found that digital direct radiography and screen film mammography are significantly more effective at detecting breast cancer than digital computed radiography. [22] After analyzing data from 688,418 women in Ontario, we recommended the full transition of all computed radiography to digital direct radiography technology. As a result, the Ministry of Health and Long-Term Care committed $25 million to the standardization of direct radiography technology across the province, ensuring that women in Ontario continue to receive the highest quality screening.

OCSP EVIDENCE

Virtually all cases of screen-detectable cervical cancer are caused by persistent infection with high risk human papillomavirus (HPV). [23, 24, 25] Approximately 14 high risk types of HPV have been linked to cervical and other cancers (e.g., oropharyngeal, anal, vulvar and vaginal). [26, 27, 28, 29] Two high risk HPV types, 16 and 18, account for 70 percent of all cases of cervical cancer. [27, 28] Most sexually active adults will acquire an HPV infection in their lifetime. [30, 31, 32] While young women have higher rates of HPV infection, about 90 percent of these infections will clear within 24 months without consequence to cervical health. [33, 34, 35, 36]

Early abnormalities in cervical cells typically precede cervical cancer by many years and the goal of screening is to detect these abnormalities by the Pap test long before the development of invasive cancer. [10] A recent meta-analysis of cervical cancer screening studies has shown that Pap tests are associated with significant long-term reductions in cervical cancer incidence and mortality. [37] One large randomized controlled trial conducted in India demonstrated that even a single screening test can reduce advanced cervical cancer incidence by 44 percent and mortality by 35 percent. [38]

Cervical cancer is rare in women younger than age 25 and even rarer in those younger than age 21. [39] Among women ages 15 to 19, there were fewer than 10 cases of cervical cancer from 2003 to 2007 in Ontario, and there is evidence that these cancers would not have been detected by screening. [40, 41] Therefore, screening before age 21 is discouraged.

Before 2011, the OCSP recommended annual cervical cancer screening; however, evidence shows that annual screening does not offer significantly more protection from cervical cancer than screening every three years. Furthermore, annual screening does not offset the potential limitations associated with more frequent screening (such as additional follow-up tests and potentially unnecessary treatments due to over-diagnosis or false-positive results). [10, 42]

Cancer Care Ontario's screening guidelines recommend that Ontario transition to primary HPV screening. We are working with the Ministry of Health and Long-Term Care to assess the feasibility of HPV testing in Ontario. [43] HPV testing is more sensitive than the Pap test, meaning that it is better able to detect cases of advanced pre-cancerous abnormalities that can lead to cervical cancer. [44] HPV testing also provides greater protection against cervical cancer because it detects persistent high-grade abnormal cells earlier than the Pap test. [45, 46]

CERVICAL SCREENING AND HUMAN PAPILLOMAVIRUS (HPV) VACCINATION

The Ontario school-based HPV vaccination program was introduced in 2007 and made the HPV vaccine available to all Grade 8 girls (ages 12 and 13) through the province's public health units. As more women who are vaccinated for HPV reach screen-eligible age (the first cohort vaccinated in the HPV vaccination program reached screen-eligible age in 2016), there may be changes in the uptake of cervical cancer screening. It is unknown exactly how HPV vaccination will impact screening behaviour, although some research suggests that vaccinated women are more likely to screen than women who choose not to vaccinate. [47, 48, 49] As more vaccinated women reach screen-eligible age, it will be important to continue to educate the population about the importance of regular screening and how these vaccines work along with the cervical cancer screening program to optimally prevent cervical cancer. Since the beginning of the 2016/2017 school year, the HPV vaccine has been made available to boys and girls, and is offered in Grade 7 rather than in Grade 8. [50] The move to offer the HPV vaccination at an earlier age aligns with expert recommendations. [50]

As more vaccinated women reach screen-eligible age, the prevalence of HPV infections in the screen-eligible population may decrease, resulting in fewer women developing high-grade cervical abnormalities and cervical cancer. [51, 52] Cancer Care Ontario is working to address the potential impact of the decrease in HPV prevalence on the Ontario Cervical Screening Program, including re-assessing screening recommendations.

CCC EVIDENCE

CCC recommends biennial screening for colorectal cancer in people ages 50 to 74 without a family history of the disease (i.e., who are average risk) using the gFOBT, followed by a colonoscopy for those with an abnormal gFOBT result. An expert panel convened by Cancer Care Ontario's Program in Evidence-Based Care has indicated that the anticipated limitations associated with this screening approach are small and are outweighed by its benefits. Regular screening with gFOBT (annual or biennial) is associated with a 13 percent reduction in colorectal cancer mortality. [53]

Research shows that more than two-thirds of people diagnosed with colorectal cancer have no family history of the disease. [54, 53] Those with a family history (one or more first-degree relatives with colorectal cancer) are at an increased risk of the disease and CCC recommends that these people get screened with a colonoscopy beginning at age 50 or 10 years earlier than the age at which their relative was diagnosed, whichever occurs first.

The gFOBT is a non-invasive test performed at home. However, in some sites in Ontario, someone at average risk may choose to screen with a flexible sigmoidoscopy, which has been shown to reduce risk of colorectal cancer by 18 percent and colorectal cancer mortality by 28 percent. [55]

FECAL IMMUNOCHEMICAL TEST (FIT)

Cancer Care Ontario is planning to implement FIT as the recommended primary screening test for people at average risk of developing colorectal cancer in Ontario. FIT is a more sensitive type of fecal occult blood test that uses antibodies to detect blood in the stool. It has a number of important advantages over the guaiac fecal occult blood test (gFOBT). [56, 53] For example, unlike gFOBT, FIT is specific for detecting human hemoglobin and is not affected by dietary substances or medications. Therefore, no dietary or medication restrictions are required before doing a FIT. It is also an easier test to complete, with a simpler sample collection method, fewer samples required and less stool-handling. Because of these advantages, use of FIT (compared to gFOBT) has been shown to increase participation in and compliance with colorectal cancer screening. [56] Furthermore, FIT has greater sensitivity than gFOBT, and is better at detecting colorectal cancer and advanced adenomas. It also has the potential for automation in the laboratory, which would improve efficiency.

Limitations of Screening

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

Screening tests are not diagnostic tests and can miss some cancers. In addition, someone with an abnormal screening test result does not necessarily have cancer (known as a false-positive test result). For example, in the OBSP, approximately 17 out of every 200 women screened will have an abnormal mammogram and only one will go on to be diagnosed with cancer. [57]

People with abnormal test results will be referred for further diagnostic testing. Diagnostic tests can cause discomfort or other risks (such as bowel perforation in colonoscopies) [58], as well as anxiety associated with undergoing more tests and waiting for results. [12, 10]

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 people participating in cancer screening are fully informed of the benefits and limitations) is a priority for us. All of our screening guidelines are also in line with the Canadian Task Force on Preventive Health Care's recommendations to ensure that the benefits of cancer screening are maximized and limitations are minimized.

SPECIAL FOCUS: TRENDS IN PROGRAM PARTICIPATION AND RETENTION

Screening for breast, cervical and colorectal cancer has been shown to improve outcomes and reduce mortality for these diseases. However, to maximize the benefit of screening, people must begin screening at the recommended ages and return for screening tests regularly as long as they are eligible. High participation and retention are essential for achieving population-level benefits in any screening program.

This section will focus on the first performance domain in the Canadian Partnership Against Cancer integrated evaluation framework: program coverage. The section will also feature an analysis of the participation gap, which explores the geographic and socio-demographic characteristics of people not participating in routine cancer screening.

The Canadian Partnership Against Cancer defines program coverage as participation and retention within the screening program. [13] Participation is defined as the percentage of people who have a screening test as a proportion of the eligible population during a defined period of time or interval. Retention is defined as the percentage of people who are re-screened within the recommended screening interval (see Table 4 for details of the Canadian Partnership Against Cancer's definition of program coverage).

Table 4 **Canadian Partnership Against Cancer definitions of program coverage***

Program coverage
Participation is the percentage of people who have a screening test as a proportion of the eligible population during a defined interval: $\frac{\text{Number of people screened}^{**}}{\text{Number of eligible people in target population}}$
Retention is the percentage of people who are re-screened within the recommended screening interval: $\frac{\text{Number of people re-screened}^{**}}{\text{Number of people eligible for re-screening}}$

**"Screened" and "re-screened" are defined as having completed at least one screening test during a defined interval. All tests are counted, regardless of test result.

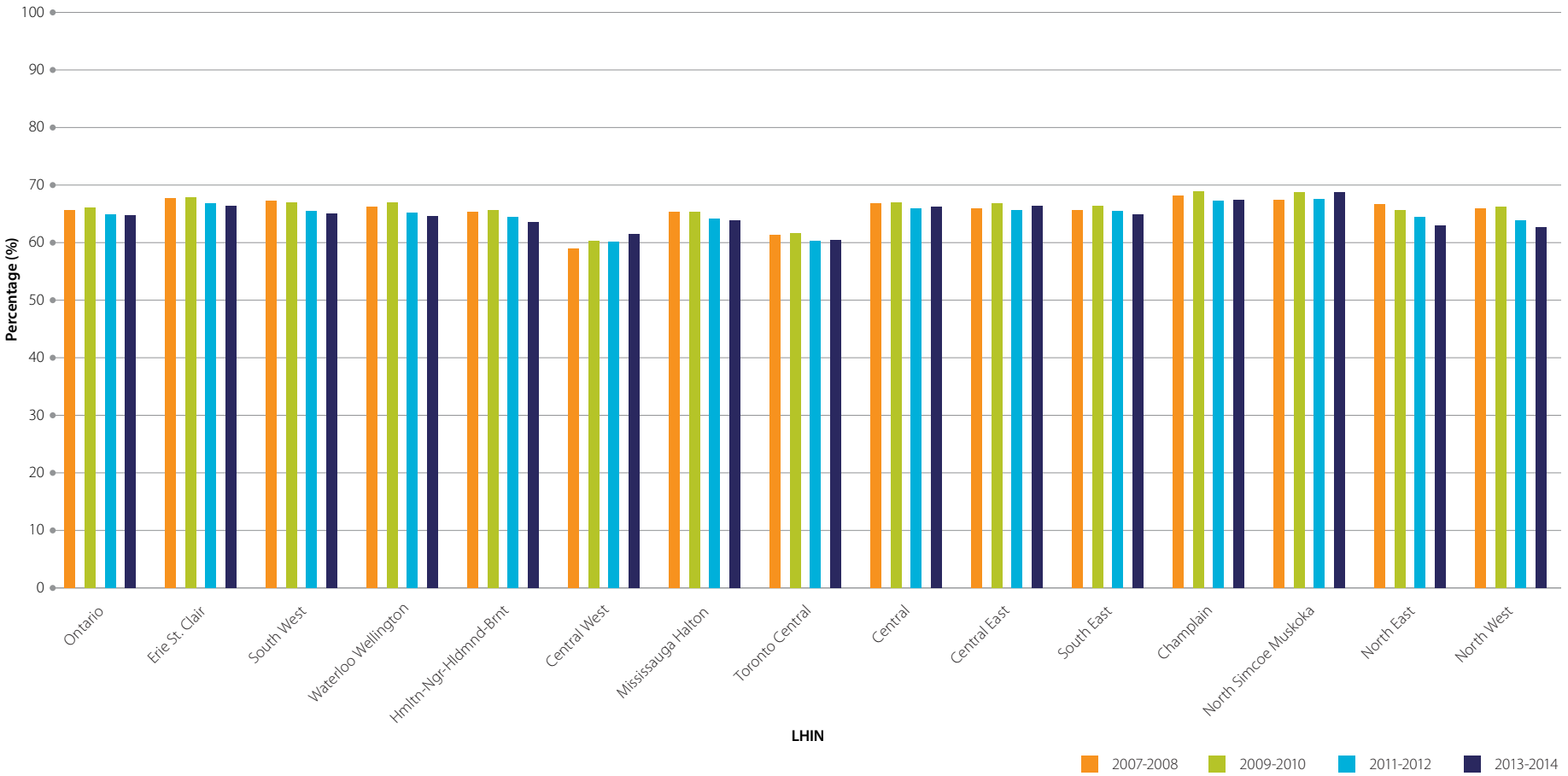
* This report adopts the Canadian Partnership Against Cancer definitions for program coverage. Other jurisdictions or authorities may define program coverage differently. The European Commission, for example, defines program coverage as coverage by invitation and coverage by examination. [64, 92, 93] Coverage by invitation refers to the extent to which the invitations sent out by the screening program include the eligible population within the defined interval. Coverage by examination refers to the extent to which screening examinations have been delivered to the eligible population within the defined interval. The European Commission guidelines do not include retention as a separate performance indicator.

Breast Cancer Screening in Ontario: Ontario Breast Screening Program (OBSP) and non-OBSP

In 2013–2014, approximately 1.3 million Ontario women ages 50 to 74 were screened for breast cancer with a mammogram in a 30-month period, representing 65 percent of the approximately two million women who were eligible for screening. Participation in breast cancer screening has remained steady at 65 percent since 2011–2012. A measurement period of 30 months was chosen for the participation and retention indicators to give women an additional six months beyond the recommended 24-month screening interval to account for appointment wait times or other scheduling challenges.

In 2013–2014, the Local Health Integration Network (LHIN) with the highest participation was North Simcoe Muskoka (69 percent). The Toronto Central LHIN had the lowest participation, at 60 percent. The Central West LHIN showed the greatest improvement in participation from the 2007–2008 reporting period to the 2013–2014 reporting period (up three percentage points) (Figure 8).

Figure 8 **Age-adjusted percentage of Ontario women, ages 50–74, who completed at least 1 mammogram within a 30-month period, by Local Health Integration Network (LHIN), 2007–2014**

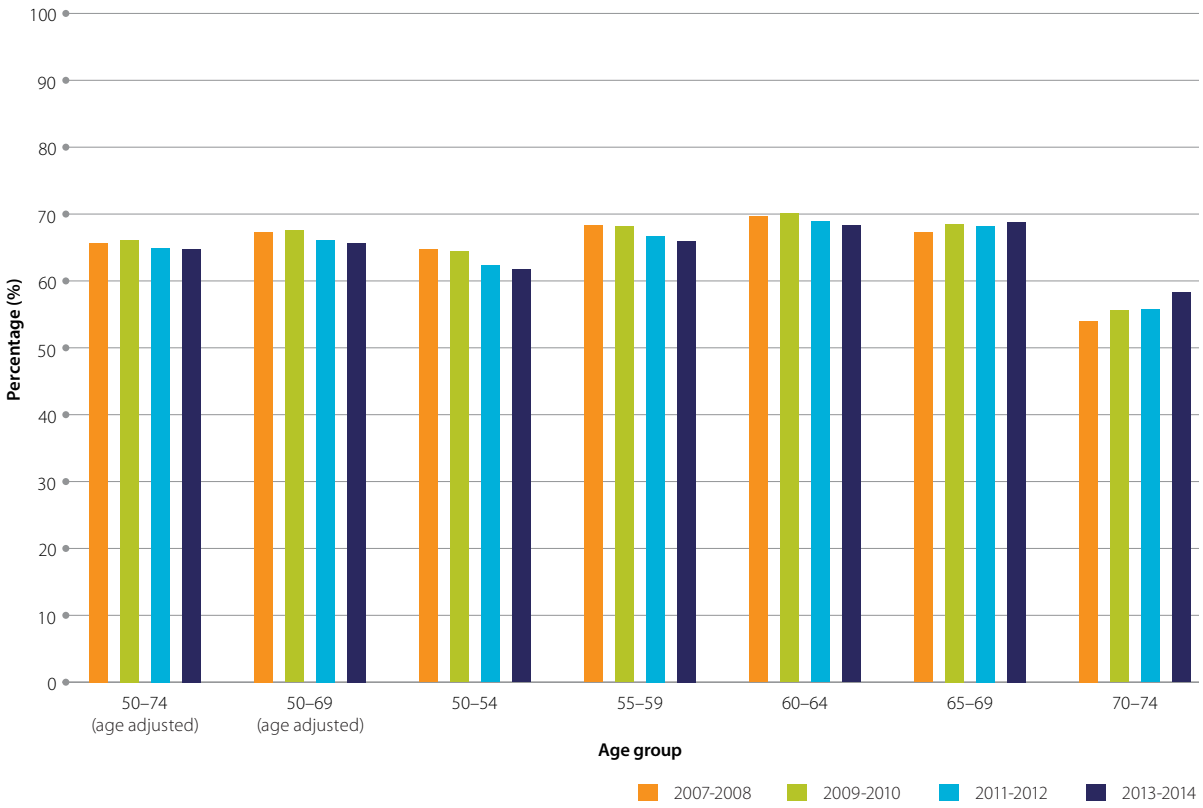


Breast cancer screening participation varied by age group (Figure 9). In 2013–2014, participation was highest for women ages 65 to 69 (69 percent) and lowest for women ages 70 to 74 (58 percent). A similar pattern can be seen in previous years.

Participation was lowest among women ages 70 to 74; however, they were the only age group that saw significant growth in participation (four percentage points) from 2007 to 2014.

Conversely, women ages 50 to 54 have shown a decrease in screening participation (Figure 9). In response to this decreasing trend, one Cancer Care Ontario initiative mails OBSP invitations to women who recently became eligible for screening. Launched in March 2014, invitation letters were associated with a 20.6 percent annual increase in screening participation among 50-year-old screen-eligible women in Ontario. [59]

Figure 9 **Percentage of Ontario women, ages 50–74, who completed at least 1 mammogram within a 30-month period, by age group, 2007–2014**



Launched in March 2014, invitation letters were associated with a 20.6 percent annual increase in screening participation among 50-year-old screen-eligible women in Ontario.

THE HIGH RISK OBSP

On July 1, 2011, the Ontario Breast Screening Program (OBSP) expanded its services to include annual screening mammography and magnetic resonance imaging (MRI) or ultrasound[†] for women ages 30 to 69 confirmed to be at high risk of breast cancer due to genetic factors, or medical or family history. [60]

The most significant aspect of the program is that women at high risk of breast cancer across Ontario are now being screened through an organized program using appropriate screening modalities. With support from the Regional Cancer Programs and the Cancer Care Ontario provincial office, providers and screening sites have developed capacity to deliver High Risk OBSP screening services. In addition, the collection of data from OBSP service providers allows key performance indicators and process measures to be monitored, which supports the provision of high-quality screening.

There were 8,438 women referred to the High Risk OBSP in 2014. Of these women, 1,140 (14 percent) were already known to be at high risk of breast cancer and were referred directly to the program by their physician. The remaining 7,298 women were referred to genetic assessment to determine their eligibility; approximately 34 percent of these women were eligible for the program (see Table 17 in the Ontario Screening Performance Indicators section of this report). A total of 3,643 women were newly enrolled in the High Risk OBSP in 2014.

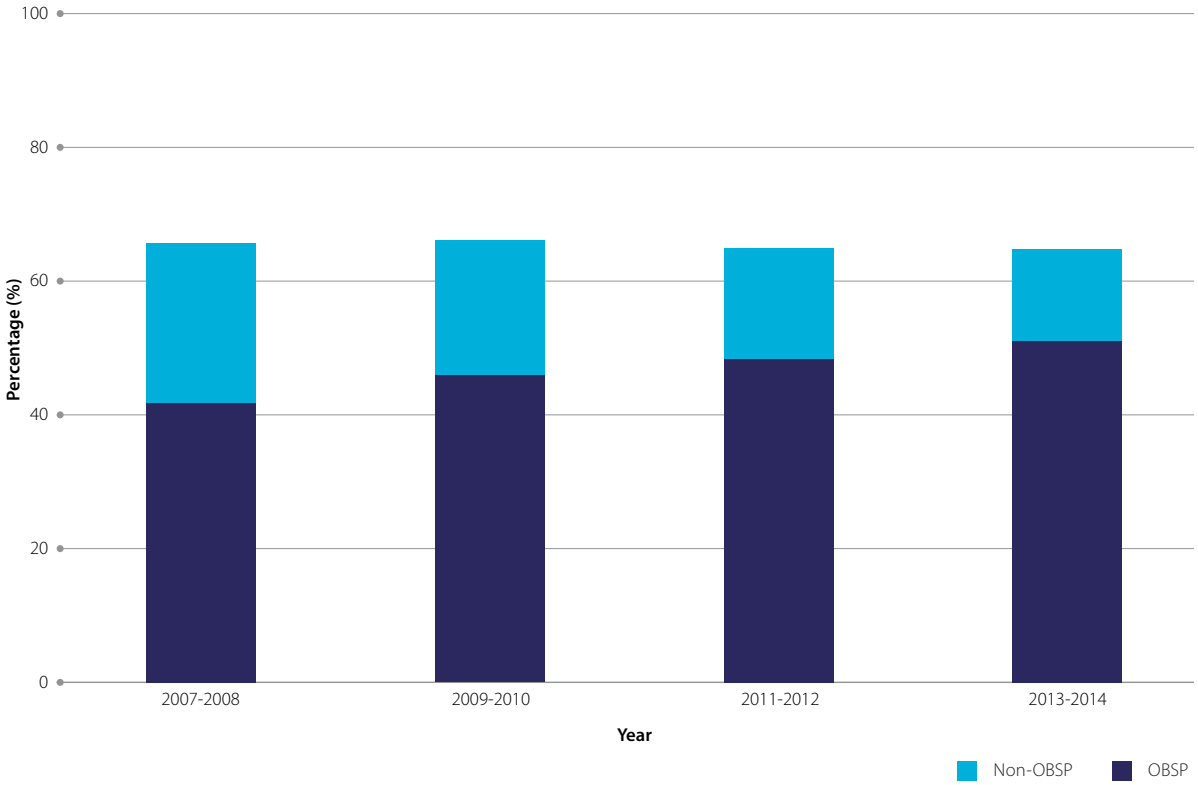
A total of 5,542 women were screened in the program with at least an MRI or ultrasound in 2014, including women returning for their annual high risk screen and women newly identified as being at high risk. Of these women, 1,277 (23 percent) had an abnormal screen (either an abnormal mammogram or abnormal MRI/ultrasound). Of the abnormal screens, 1,256 had a known final result (98 percent). There were 70 cancers detected in 2014, resulting in a positive predictive value of 5.6 percent and a cancer detection rate of 12.7 per 1,000.

There were 70 cancers detected in 2014, resulting in a positive predictive value of 5.6 percent and a cancer detection rate of 12.7 per 1,000.

[†] In some cases, MRI may be contraindicated. If MRI is contraindicated, a woman is scheduled for a screening breast ultrasound.

Of the women who underwent breast cancer screening in 2013–2014, 78 percent were screened within the OBSP, and this proportion has increased every reporting period since 2007–2008 (Figure 10). This progress was made possible, in part, by increasing the number of mammography screening sites in Ontario that are part of the OBSP, all of which are accredited by the Canadian Association of Radiologists' Mammography Accreditation Program (CAR-MAP). As of June 2016, the OBSP has 193 screening sites performing average risk services. With support from the Ministry of Health and Long-Term Care, Cancer Care Ontario is currently developing plans to ensure that all sites providing screening mammography are part of the OBSP.

Figure 10 **Ontario Breast Screening Program (OBSP) and non-OBSP breast cancer screening (mammogram) participation: age-adjusted percentage of Ontario women, ages 50–74, who completed at least 1 mammogram within a 30-month period, 2007–2014**



Program retention, measured as the proportion of women who had a mammogram within 30 months of a previous OBSP mammogram, decreased from 85 to 83 percent from 2007 to 2014, a trend that was similar in all LHINs and age groups (Figure 11 and Figure 12).

To increase screening retention, recall letters are sent about 24 months after a woman's OBSP mammogram, which is consistent with Cancer Care Ontario's screening guidelines. Along with invitations, these letters are a component of our larger correspondence campaign in place for all three screening programs (Figure 24). In addition to correspondence, coordinated awareness campaigns have been essential in engaging and educating target populations. For example, in recent years during October (Breast Cancer Awareness Month) CCO Communications, in collaboration with the Regional Cancer Programs, has delivered proactive, multi-channel public relations and social media campaigns to generate engagement and awareness of breast cancer screening in the community.

Figure 11 **Percentage of Ontario women, ages 50–72, who had a subsequent Ontario Breast Screening Program screening mammogram within 30 months of a previous program mammogram, by Local Health Integration Network (LHIN), 2009–2012**

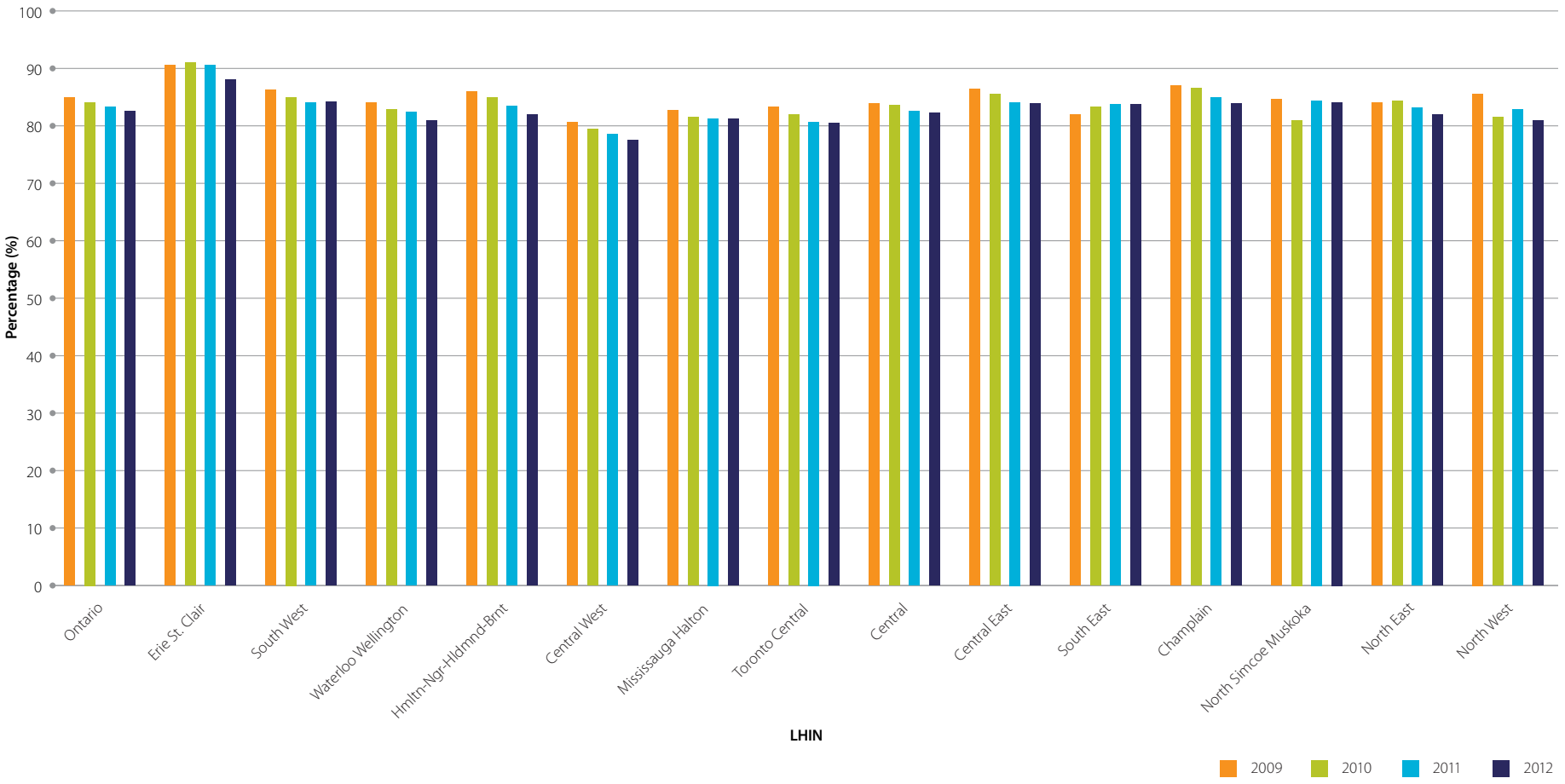
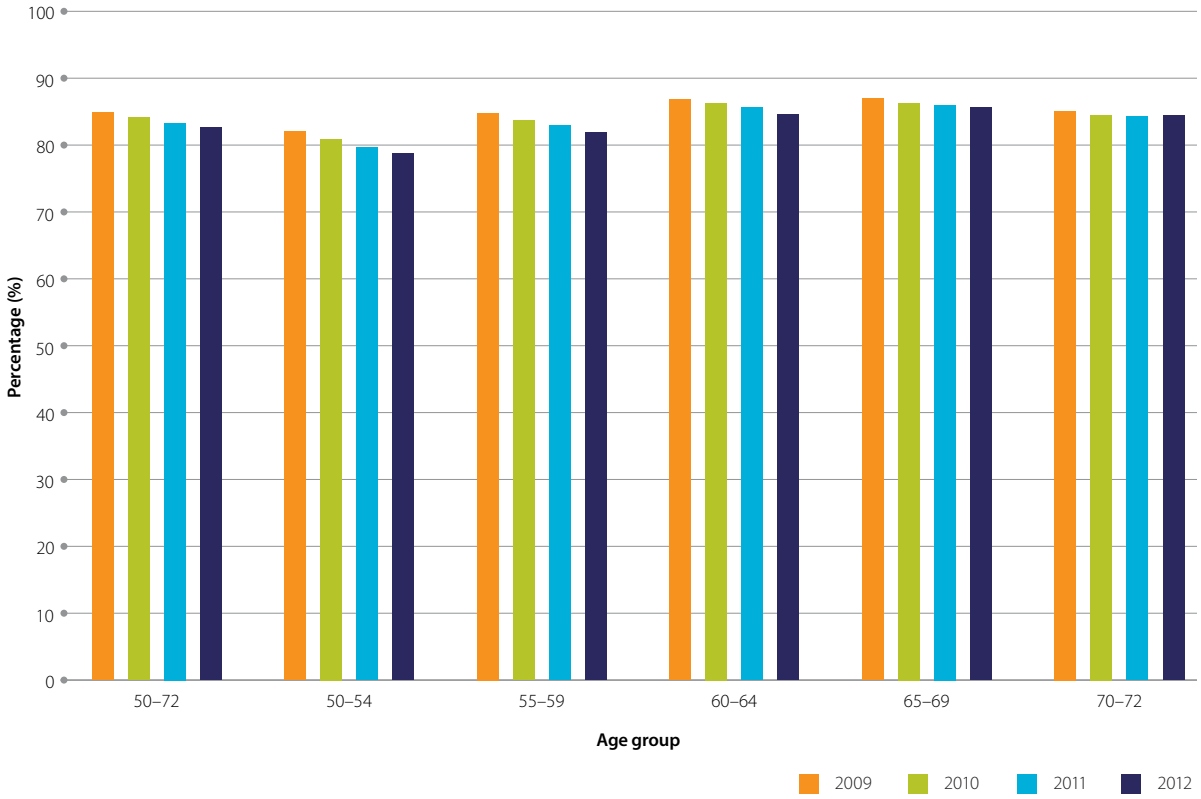


Figure 12 Percentage of Ontario women, ages 50–72, who had an Ontario Breast Screening Program screening mammogram within 30 months of a previous program mammogram, by age group, 2009–2012



Cervical Cancer Screening in Ontario

Participation in the Ontario Cervical Screening Program (OCSP) decreased from 68 percent in 2009–2011 to 63 percent in 2012–2014. This decrease coincided with the implementation of the updated 2011 cervical cancer screening guidelines that extended the recommended interval between routine screens from once a year to once every three years. Before the guideline change, participation had increased in every measurement period since 2003 (Figure 13). The decrease in participation in 2012–2014 was seen across all LHINs and age groups (Figure 13 and Figure 14).

Ontario's cervical cancer screening guidelines recommend Pap tests every three years (36 months). However, a measurement period of 42 months was chosen for the participation and retention indicators. This extra six months beyond the recommended 36-month interval accounts for appointment scheduling challenges or other delays women may face when booking time to return for a Pap test.

Figure 13 **Age-adjusted percentage of Ontario women, ages 21–69, who had at least 1 Pap test within a 42-month period, by Local Health Integration Network (LHIN), 2003–2014**

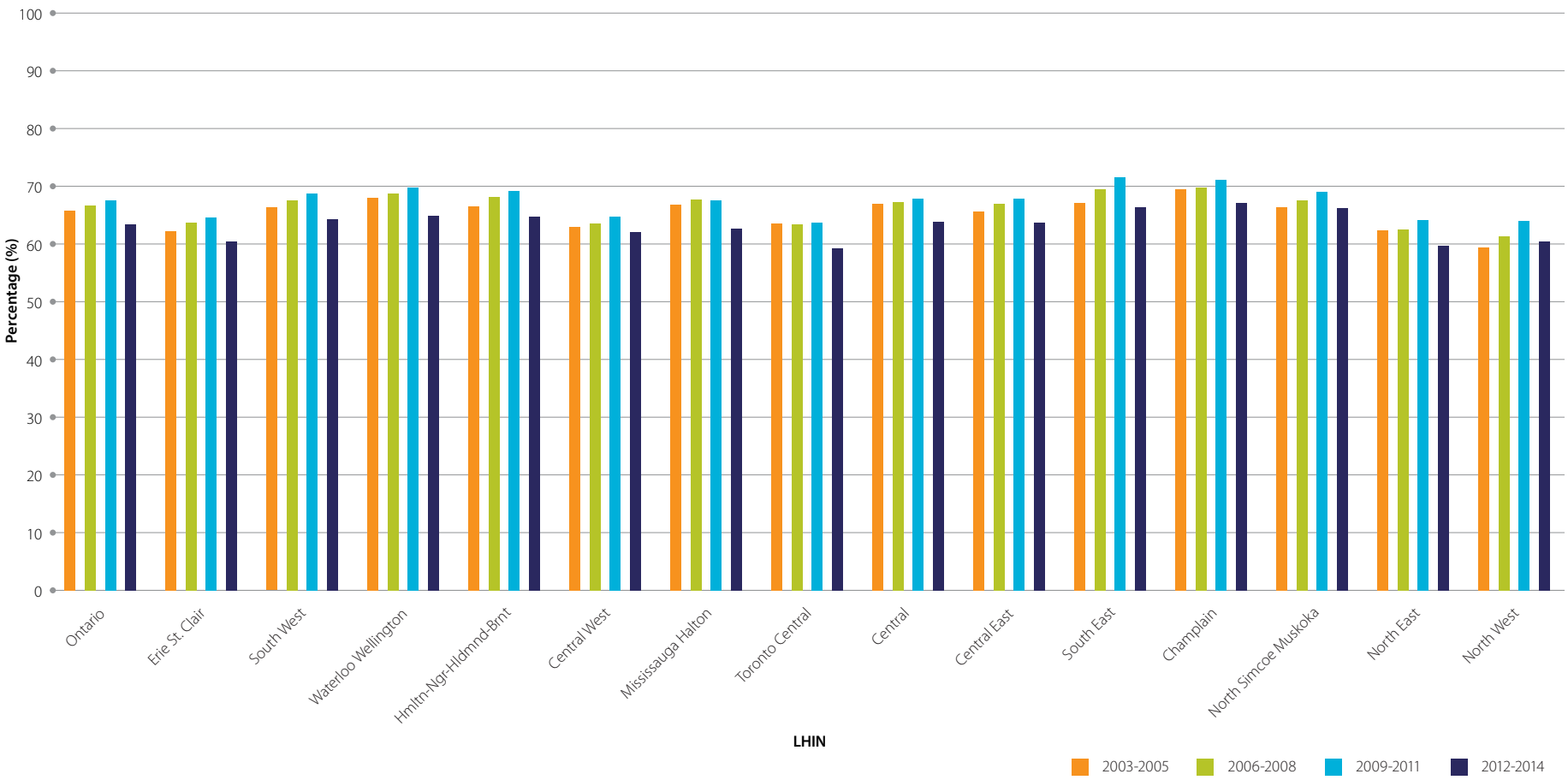
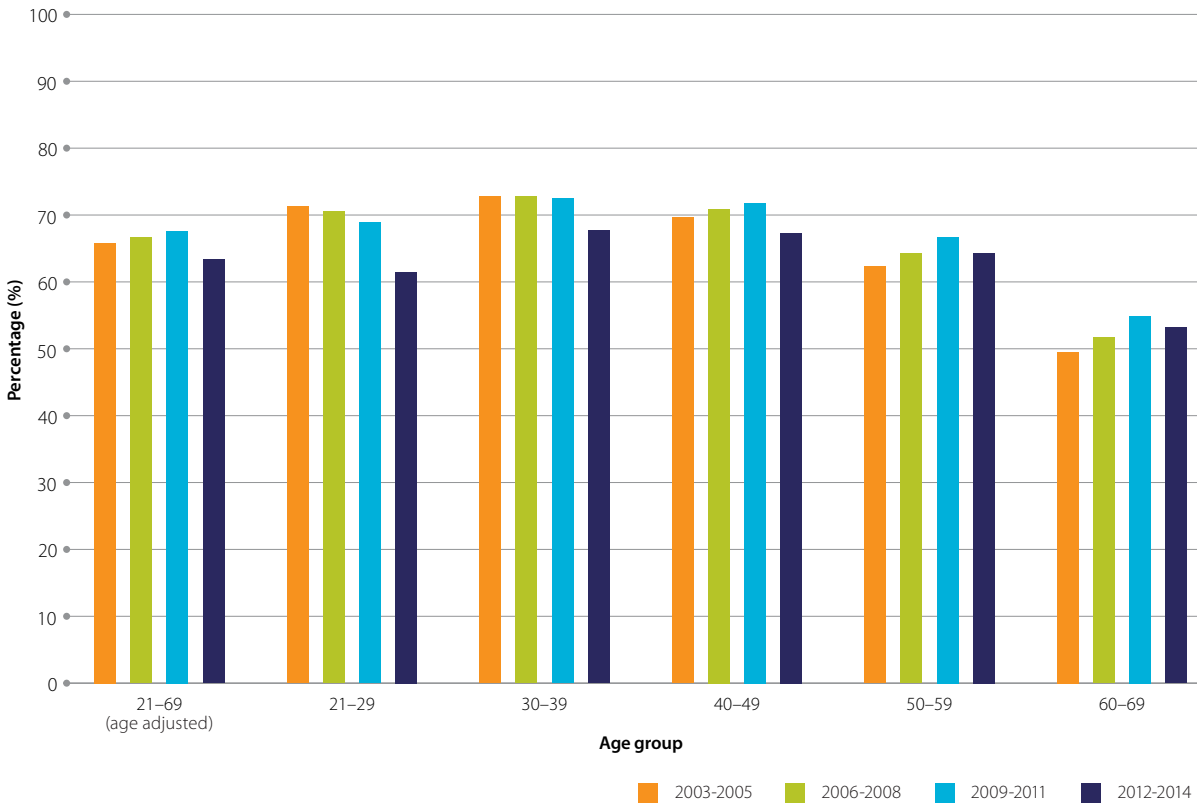


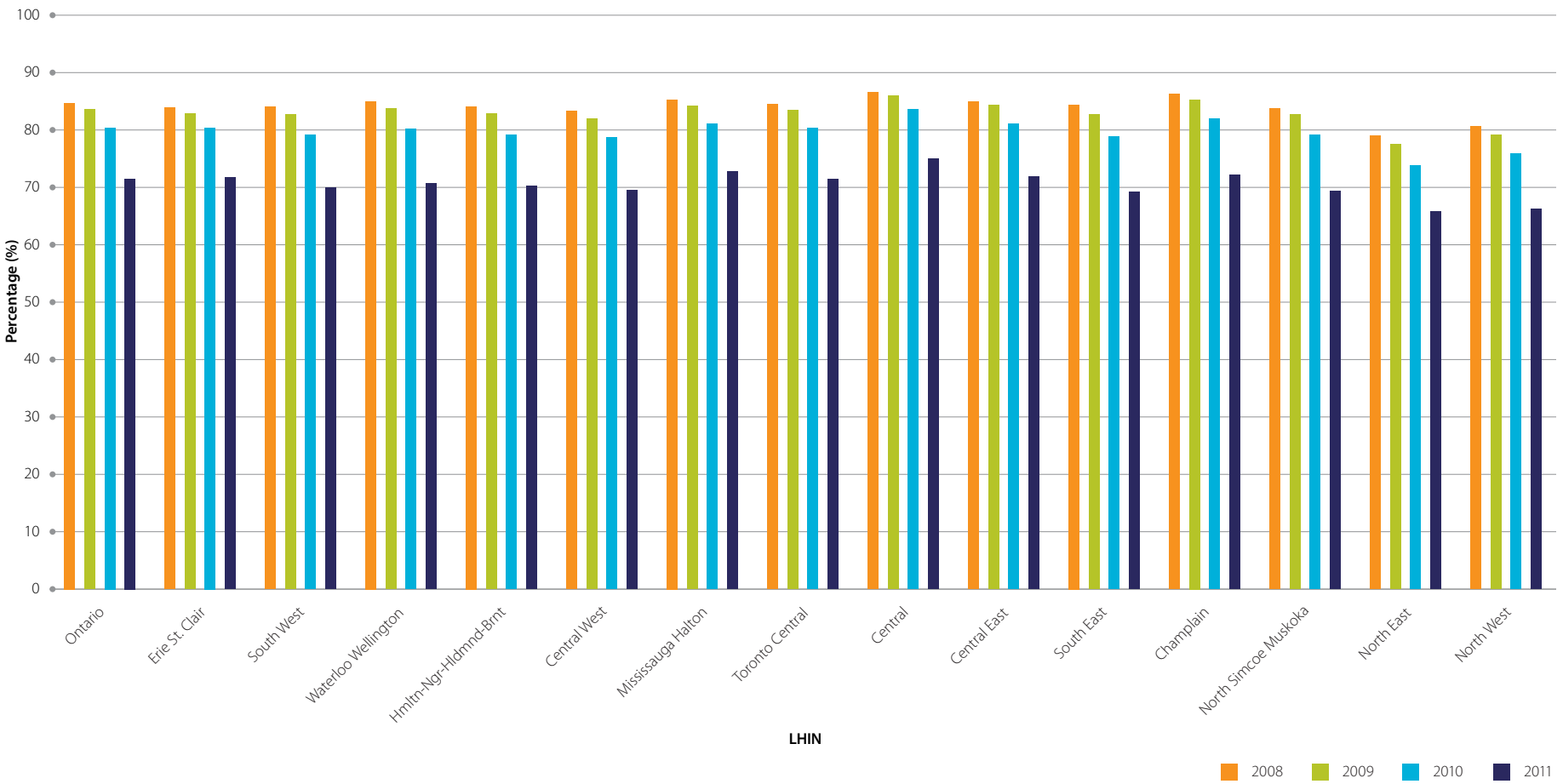
Figure 14 Percentage of Ontario women, ages 21–69, who completed at least 1 Pap test in a 42-month period, by age group, 2003–2014



Cervical cancer screening retention is defined as the proportion of women returning for a screening test within 42 months (3.5 years) of a normal Pap test. Of the women in Ontario who had a normal Pap test in 2011, 72 percent returned for a subsequent screen within 42 months (Figure 15). Retention in the OCSP has decreased for every cohort from 2008 to 2011 (Figure 15).

The decrease in cervical screening retention coincided with the update of Cancer Care Ontario's clinical guidelines for cervical cancer screening in 2011. Accordingly, for many women screened in 2010 and in 2011, re-screening may have been delayed until after a three-year window. In comparison, women screened in 2008 to 2010 may have been more likely to return within two years, as recommended by the previous guidelines. Ontario's physician billing schedule has since been updated to better align with the recommendation of cervical screening with Pap test every three years.

Figure 15 **Percentage of Ontario women, ages 21-66, who returned for a Pap test within 42 months of a normal Pap test result, by Local Health Integration Network (LHIN), 2008–2011**

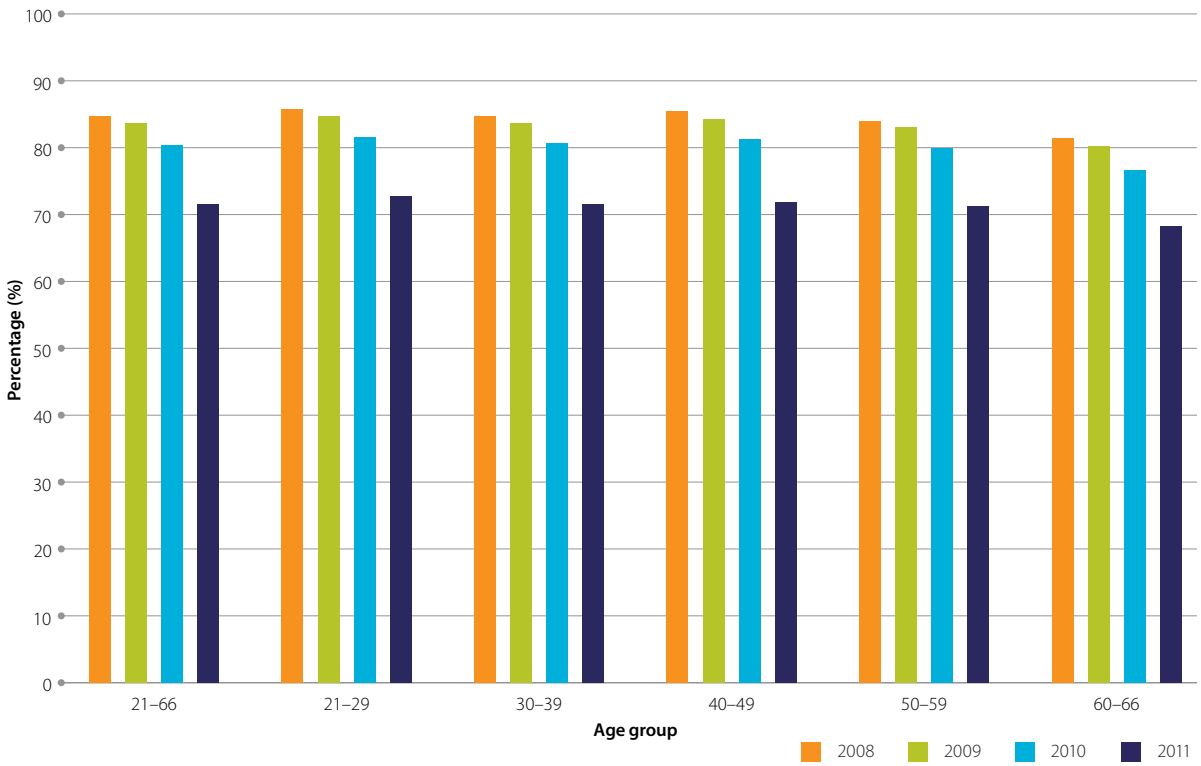


Older women were less likely than younger women to return for a subsequent Pap test (Figure 16). Among women who had a normal Pap test in 2011, the proportion of those returning for a Pap test within 42 months was highest in women ages 21 to 29 (73 percent). Retention was lowest in the oldest age group—women ages 60 to 66 (68 percent). The median age of diagnosis for cervical cancer in Ontario was 48 and most cases occurred in women ages 30 to 59. [61] Cervical cancer mortality was also higher in older women. [62] Therefore, it is important for primary care providers to emphasize the need for regular Pap tests to women age 40 and older who are eligible for cervical cancer screening.

It is important that women get screened regularly for cervical cancer. While the Pap test is an effective screening test, some cervical abnormalities may be missed. [63] Routine screening ensures that there are multiple opportunities to identify high-grade abnormalities and refer women for appropriate follow-up.

The OCSP correspondence program started in 2013 to support the updated cervical cancer screening guidelines, and efforts to improve program participation and retention. Women are sent letters when they are due for a Pap test, as well as reminder letters if they do not get screened within four months of being sent their invitation letter. In addition, women receive a letter communicating the results of their screening test and providing next steps for any necessary follow-up.

Figure 16 **Percentage of Ontario women, ages 21–66, who returned for a Pap test within 42 months of a normal Pap test result, by age group, 2008–2011**



Colorectal Cancer Screening in Ontario: ColonCancerCheck (CCC) and non-CCC

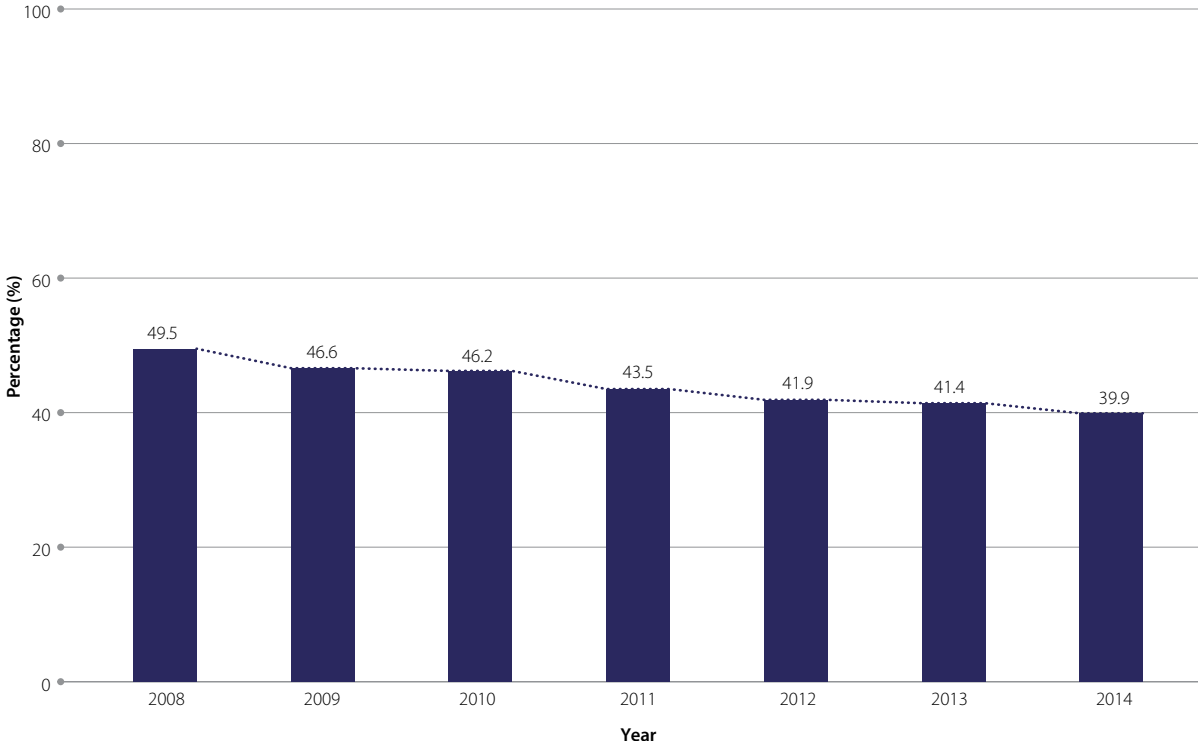
Although the guaiac fecal occult blood test (gFOBT) is the recommended screening test for colorectal cancer in average risk populations in Ontario, non-programmatic or opportunistic screening using colonoscopy also occurs. Opportunistic screening refers to screening activities that take place outside an organized screening program, usually when people ask for a test or are offered a test by their primary care provider. Because opportunistic screening in Ontario predated CCC, gFOBT participation alone is an underestimation of colorectal cancer screening participation. The percentage overdue for colorectal cancer screening has been recommended to measure screening coverage in jurisdictions where opportunistic screening is available because it includes the use of colonoscopy and flexible sigmoidoscopy in addition to fecal-based testing. [64]

The percentage of people overdue for colorectal cancer screening identifies the proportion of screen-eligible Ontarians ages 50 to 74 who are overdue for colorectal cancer screening at the end of each calendar year. This measure excludes people who have had a recent colonoscopy or flexible sigmoidoscopy (for any reason) because they do not need to be screened for colorectal cancer using gFOBT. The measure essentially defines the population that should be targeted for screening. People are considered overdue for colorectal cancer screening if they:

- Did not complete a gFOBT in the last two years; and
- Did not have a colonoscopy in the last 10 years; and
- Did not have a flexible sigmoidoscopy in the last five years.‡

In 2014, approximately 1.6 million screen-eligible people in Ontario ages 50 to 74 were overdue for colorectal cancer screening, which represents 40 percent of the over four million screen-eligible Ontarians in the same year. From 2008 to 2014, the percentage overdue in Ontario improved annually, decreasing from 50 percent in 2008 to 40 percent in 2014, which is a 10 percentage point difference (Figure 17).

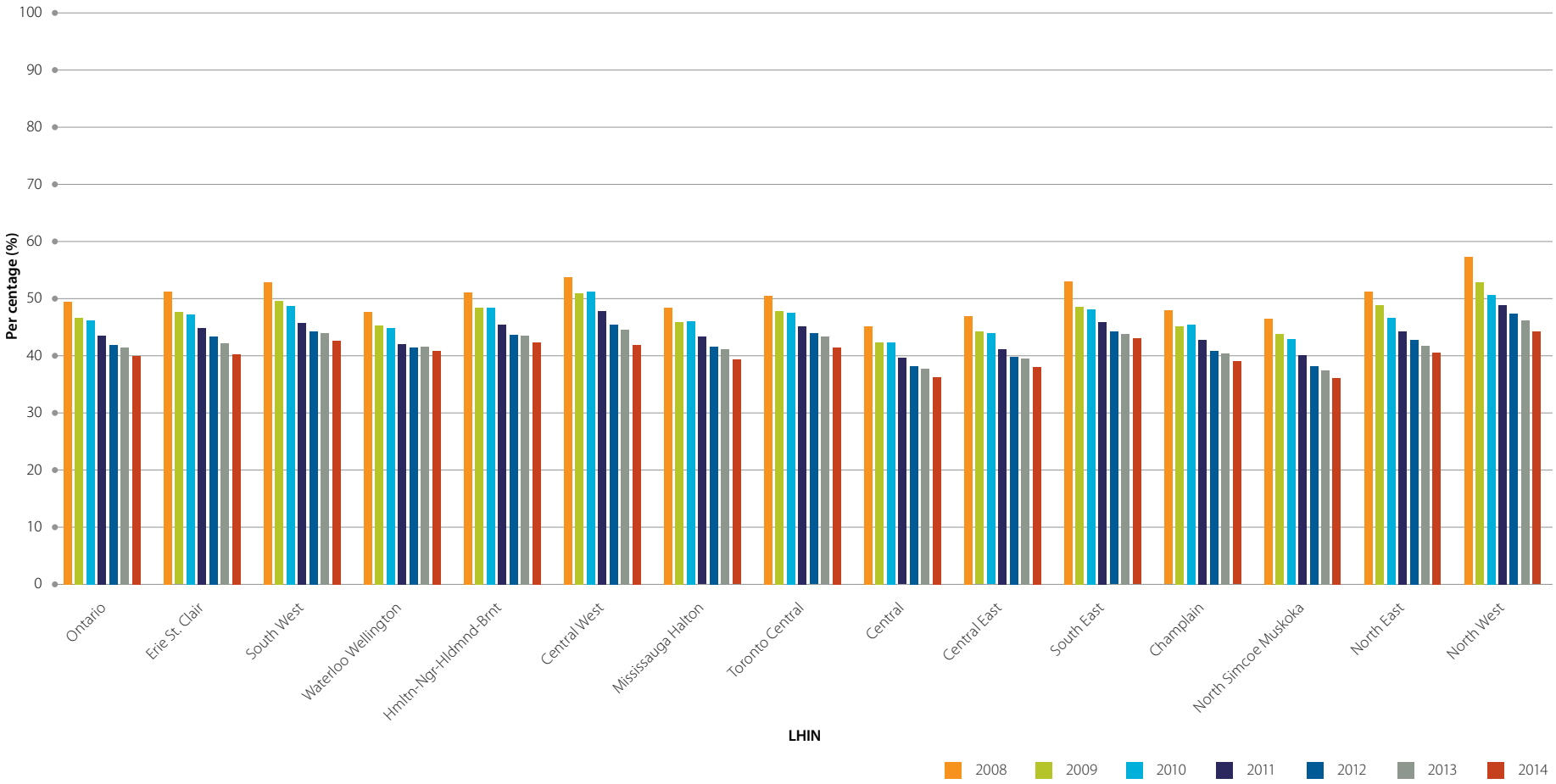
Figure 17 **Age-adjusted percentage of Ontarians, ages 50–74, who were overdue for colorectal cancer screening in a calendar year, 2008–2014**



‡ A five-year look-back window for flexible sigmoidoscopy was used to calculate the percentage overdue for colorectal screening because before May 2016, people screened with flexible sigmoidoscopy were typically re-screened every five years. The new Cancer Care Ontario colorectal cancer screening guideline released in May 2016 recommends a 10-year recall interval for flexible sigmoidoscopy. [15]

In 2014, the LHINs with the lowest percentage overdue for colorectal cancer screening were North Simcoe Muskoka (36 percent) and Central (36 percent). The LHIN with the highest percentage overdue for colorectal cancer screening was North West (44 percent) (Figure 18). Similar to the overall Ontario trend, the percentage overdue improved (i.e., decreased) in all LHINs from 2008 to 2014. The LHIN that showed the greatest improvement during this period was North West, which decreased 13 percentage points over seven years.

Figure 18 **Age-adjusted percentage of Ontarians, ages 50–74, who were overdue for colorectal cancer screening in a calendar year, by Local Health Integration Network (LHIN), 2008–2014**



The percentage overdue for colorectal cancer screening improved with increasing age (Figure 19). In 2014, 50 percent of eligible people ages 50 to 54 were overdue for colorectal cancer screening, while only 32 percent of people ages 65 to 69 were overdue, which is a difference of 18 percentage points. Similar trends were observed in all seven years reported (2008 to 2014).

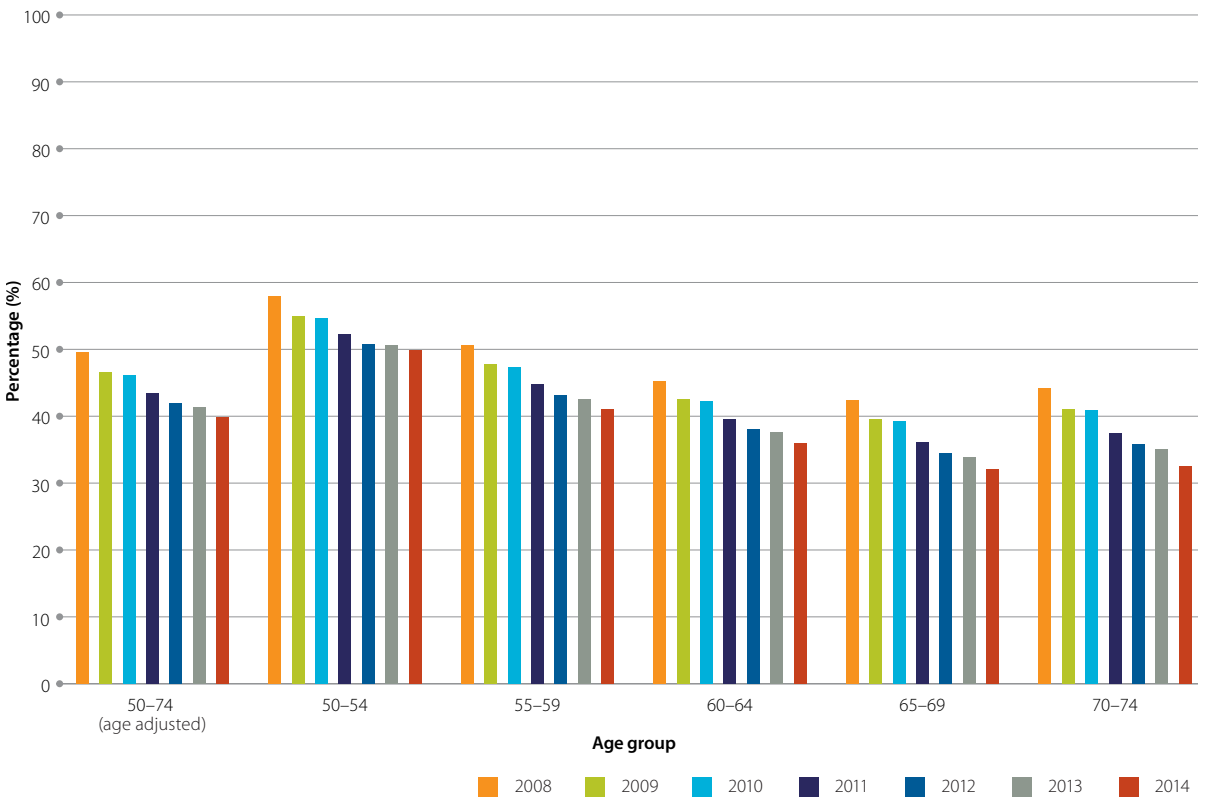
Not only was the percentage overdue for screening higher in the younger eligible age groups than in older age groups, but the absolute number of people overdue for screening was also significantly higher in younger age groups due to their larger population size. In 2014, for example, the 50 to 54 age group had over three times as many people overdue for screening as the 70 to 74 age group (548,678 and 156,120 overdue people, respectively). Therefore, the younger eligible age groups represent a significant segment of the population that is under-screened.

Colorectal cancer incidence rates increased with age, with this trend becoming especially pronounced after age 50 (Figure 3). People are at a considerably higher risk of developing colorectal cancer after age 50 and this risk continues to rise with age. Therefore, it is important to recognize that a large proportion of younger eligible people (i.e., ages 50 to 59) are under-screened despite being at risk of colorectal cancer. It is important that primary care providers emphasize the need for colorectal cancer screening in this demographic group.

Similar to the Ontario trend, the percentage overdue for colorectal cancer screening improved in all age groups from 2008 to 2014. People ages 70 to 74 showed the greatest improvement during this period, decreasing from 44 percent in 2008 to 33 percent in 2014, which is a difference of 11 percentage points. People ages 50 to 54 showed the smallest improvement, decreasing from 58 percent in 2008 to 50 percent in 2014, which is a difference of eight percentage points.

Men were more likely to be overdue for colorectal cancer screening than women. In 2014, 43 percent (836,941) of eligible men were overdue for colorectal cancer screening, compared to 37 percent (766,673) of women. Colorectal cancer incidence is also generally higher among men than women (Figure 3). Therefore, primary care providers should continue to emphasize colorectal cancer screening in men.

Figure 19 **Percentage of Ontario people, ages 50–74, who were overdue for colorectal cancer screening in a calendar year, by age group, 2008–2014**



TEMPORAL TRENDS IN ANNUAL GUAIAC FECAL OCCULT BLOOD TEST (gFOBT) AND COLONOSCOPY VOLUMES IN ONTARIANS AGES 50 TO 74, 2003 TO 2014

Temporal trends in gFOBT and colonoscopy volumes in Ontario before and after ColonCancerCheck's (CCC's) 2008 launch were reviewed to better understand the impact of implementing an organized colorectal cancer screening program on gFOBT uptake and colonoscopy volumes.

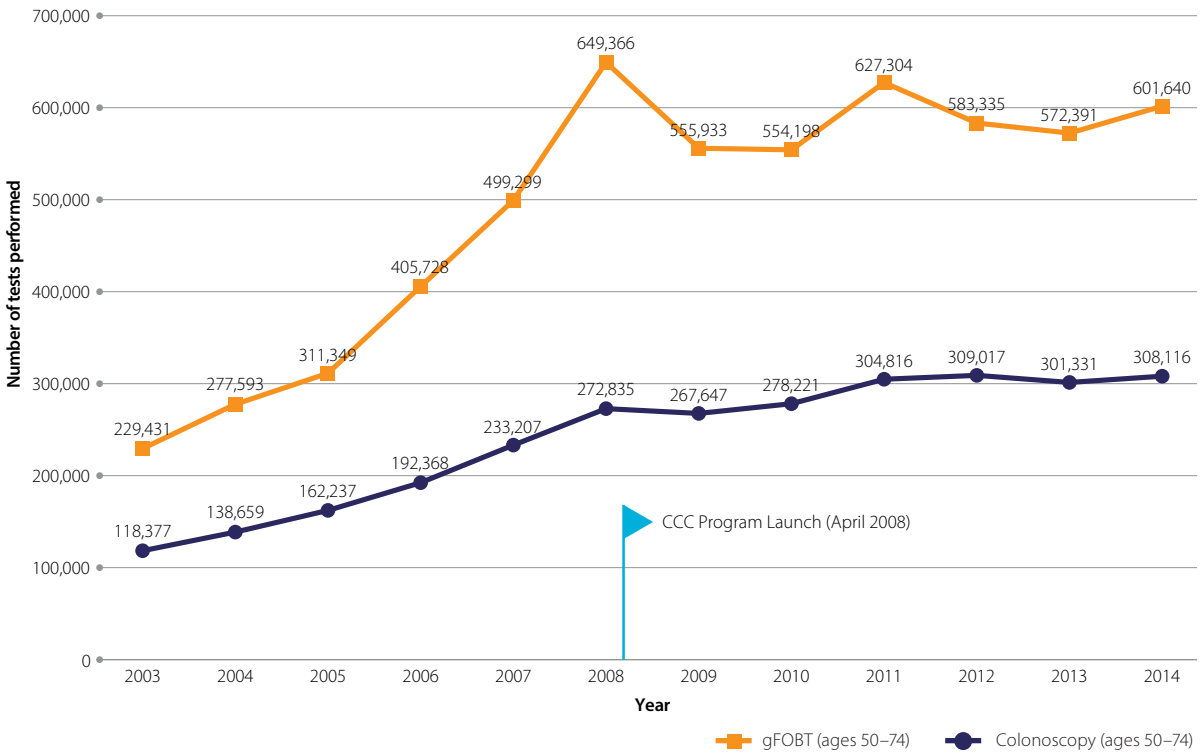
Figure 20 shows the annual number of gFOBTs and colonoscopies performed in Ontario for people ages 50 to 74 from 2003 to 2014.

When CCC was launched in 2008, there was a relatively sharp increase in the number of gFOBTs performed in people ages 50 to 74, compared to previous years (499,299 gFOBTs in 2007, 649,366 gFOBTs in 2008). This increase can be attributed, in part, to the province-wide public awareness and education campaign efforts that accompanied the program launch in 2008. From 2009 to 2014, gFOBT volumes showed an overall plateauing trend, with fluctuations from year to year, and a second peak in 2011 (627,304 gFOBTs).

Colonoscopy volumes in people ages 50 to 74 plateaued after CCC launched in 2008. The number of colonoscopies performed in recent years has been relatively steady (304,816 colonoscopies in 2011, 308,116 colonoscopies in 2014). The overall increase in gFOBT uptake after CCC's launch may have attenuated the rise in the number of colonoscopies.

Plateauing gFOBT volumes suggest a continual need to improve participation in colorectal cancer screening using the gFOBT. Screening with colonoscopy in average risk populations is not recommended due to a lack of direct high-quality evidence to support it and due to the uncertainty of the undesirable effects of screening with colonoscopy in people at average risk. [53]

Figure 20 **Number of guaiac fecal occult blood tests (gFOBTs) and colonoscopies performed in Ontario for people ages 50–74 by calendar year, 2003–2014[§]**



[§] Colonoscopy volumes include colonoscopies for all indications in people ages 50 to 74 at the time of the procedure.

Overall, the percentage of people overdue for colorectal cancer screening in Ontario improved over time, meaning that an increasing number of Ontarians were up to date with colorectal cancer screening every year. However, gFOBT volumes have showed a plateauing trend in recent years. Cancer Care Ontario is planning to implement the fecal immunochemical test (FIT) in CCC as the recommended primary screening test for people at average risk of colorectal cancer. FIT is expected to lead to improvements in screening uptake because it is easier to complete. In addition, FIT is better at detecting colorectal cancer and advanced adenomas. [56]

Regular screening is important for improving colorectal cancer outcomes. To increase colorectal cancer screening coverage, CCC sends correspondence letters to screen-eligible Ontarians inviting them to get screened for colorectal cancer, reminding them to return for their next screening test, and informing them of their screening results and next steps for appropriate follow-up. In 2016, physician-linked correspondence was fully implemented in CCC across the province for primary care physicians practicing in a patient enrolment model (PEM) who consented to participate. These correspondence letters include an endorsement from a patient's primary care provider, which has been shown to significantly improve screening participation. [65]

CONNECTING UNATTACHED PEOPLE WITH ABNORMAL GUAIAC FECAL OCCULT BLOOD TEST (gFOBT) RESULTS TO PRIMARY CARE PROVIDERS

To ensure that all people with abnormal gFOBT results receive appropriate follow-up in a timely manner, Cancer Care Ontario identifies and links them to a primary care provider if they do not have one (i.e., they are unattached). From April 2012 to December 2015, we identified 137 unattached people with abnormal gFOBT results and 94 percent (129 out of 137) of them were successfully attached to a primary care provider in their local community. We courier gFOBT results to people who remain unattached using the address on file and telephone them (up to three attempts). If all previous steps fail, we mail a final "attempt to reach" letter.

This process is also used to assist unattached people who are at increased risk of colorectal cancer (one or more first-degree relatives diagnosed with the disease) in finding primary care providers in their local community.

PATIENT ENROLMENT MODEL (PEM)

"PEM" refers to a range of group-based primary care practice models in which patients are formally rostered (i.e., registered) to a primary care physician or a team. In most practice models, the enrolling physicians commit to providing comprehensive, continuous and proactive care to their rostered patients. Examples of PEMs include family health teams, family health organizations and family health networks.

SCREENING PARTICIPATION IN WOMEN ELIGIBLE FOR ALL THREE SCREENING PROGRAMS

The overall screening participation indicator measures screening participation in women ages 50 to 69 who are eligible for all three cancer screening programs. For this indicator, women are considered up to date with breast cancer screening if they have had a mammogram in the last two years and up to date with cervical cancer screening if they have had a Pap test in the last three years. Women are considered up to date with colorectal cancer screening if they have had a gFOBT in the past two years, a flexible sigmoidoscopy in the last five years or a colonoscopy in the last 10 years.

In 2014, 79 percent of screen-eligible women ages 50 to 69 were up to date for at least one test and 34 percent were up to date with all three of the cancer screening tests—a difference of 45 percentage points. Women up to date with at least one test, but not all three tests, may represent an important group to target because they have demonstrated some degree of willingness to engage in screening activities.

When examining participation by age group, women ages 50 to 54 (the youngest eligible age group) were least likely to be up to date with either measure. The 50- to 54-year-old age group contains the greatest number of screen-eligible women and may therefore represent an important group to target with initiatives to improve screening participation and retention.

In 2014, 79 percent of screen-eligible women ages 50 to 69 were up to date for at least one test and 34 percent were up to date with all three of the cancer screening tests—a difference of 45 percentage points.

Cancer Screening: The Participation Gap

Organized screening programs must achieve high participation and retention to be effective. Despite universal health coverage and organized provincial screening programs, barriers to screening exist and affect certain groups or populations more than others. To identify these barriers, the participation gap analysis focused on the geographic and socio-demographic characteristics associated with being overdue for cancer screening. This investigation marks Cancer Care Ontario's commitment to the development of tailored strategies to increase participation, particularly for populations at higher risk of being under-screened for cancer. This commitment aligns with the strategic goal outlined in the *Ontario Cancer Plan IV* for 2015–2019 to ensure health equity for all Ontarians across the cancer system.

METHODS

A cross-sectional analysis was conducted to determine the percentage of screen-eligible Ontarians who were overdue for breast and cervical cancer screening as of July 1, 2015. For colorectal cancer screening, analyses focused on people who were overdue for colorectal cancer screening as of January 1, 2015 (the previous section, *Trends in Program Participation and Retention*, reports similar data using a date of December 31, 2014).

Our analyses aimed to describe these overdue populations by geography and socio-demographic characteristics, including age, sex, neighbourhood income quintile, being rostered to a PEM physician and physician sex.

Geographic Information Systems (GIS) were used to explore spatial patterns of screening in Ontario. GIS technology integrates health data with mapping functions, allowing decision-makers to identify locations where interventions are needed. [66] The proportion of screen-eligible Ontarians who are overdue for breast, cervical or colorectal cancer screening was mapped by census subdivision. Census subdivisions are municipalities (as defined by provincial/territorial laws) or areas that are considered municipal equivalents. Census subdivisions are commonly used for statistical reporting purposes. [66]

For detailed information on methodology and data sources, see Appendix III: Technical Specifications.

Overdue for breast cancer screening was defined as screen-eligible women ages 52** to 74 who were at least six months past due for a mammogram (i.e., they had not had a mammogram in the past 2.5 years). Overdue for cervical cancer screening was defined as screen-eligible women ages 24†† to 69 who were at least six months past due for a Pap test (i.e., they had not had a Pap test in the past 3.5 years). Overdue for colorectal cancer screening was defined as screen-eligible people ages 50 to 74 who had not had a gFOBT in the last two years, flexible sigmoidoscopy in the last five years and colonoscopy in the last 10 years.‡‡

Despite universal health coverage and organized provincial screening programs, barriers to screening exist and affect certain groups or populations more than others.

** The Ontario Breast Screening Program serves screen-eligible women ages 50 to 74. However, this analysis only includes women ages 52 to 74 because 52 is the minimum age at which someone can be overdue for breast cancer screening.

†† The Ontario Cervical Screening Program serves screen-eligible women ages 21 to 69. However, this analysis only includes women ages 24 to 69 because 24 is the minimum age at which someone can be overdue for cervical cancer screening.

‡‡ A five-year look-back window for flexible sigmoidoscopy was used to calculate the percentage overdue for colorectal cancer screening because before May 2016, people screened with flexible sigmoidoscopy were recommended to be re-screened every five years. The new colorectal cancer screening guideline released in May 2016 recommends a 10-year recall interval for flexible sigmoidoscopy. [15]

SPATIAL ANALYSIS

Breast Cancer Screening

As of July 2015, 34 percent (623,200) of Ontario's screen-eligible women were overdue for breast cancer screening, meaning they had not had a mammogram in the past 2.5 years.

Of these women:

- 31 percent (191,412) had a mammogram 2.5 to five years prior;
- 32 percent (199,170) had a mammogram more than five years prior; and
- 37 percent (232,618) do not have a mammogram on record (since at least 1990).

There was wide variation in percentage overdue for breast cancer screening by census subdivision, which ranged from eight to 80 percent across different census subdivision areas (Figure 21). Several LHINs contain zones where there were high percentages of overdue women, suggesting the need for focused efforts in these communities.

Cervical Cancer Screening

As of July 2015, 36 percent (1,300,935) of Ontario's screen-eligible women were overdue for cervical cancer screening, meaning they had not had a Pap test in more than 3.5 years.

Of these women:

- 26 percent (331,458) had a Pap test 3.5 to 5 years prior;
- 38 percent (487,594) had not had a Pap test in more than five years; and
- 37 percent (481,883) had no Pap test on record (since at least 2000).

Similar to breast cancer screening, there was wide geographical variation in the percentage of women overdue for cervical cancer screening in Ontario. The percentage of women overdue for cervical cancer screening among census subdivisions ranged from 23 to 67 percent. In central Ontario, the percentage of women overdue for cervical cancer screening varied from 20 to 66 percent (Figure 22).

Colorectal Cancer Screening

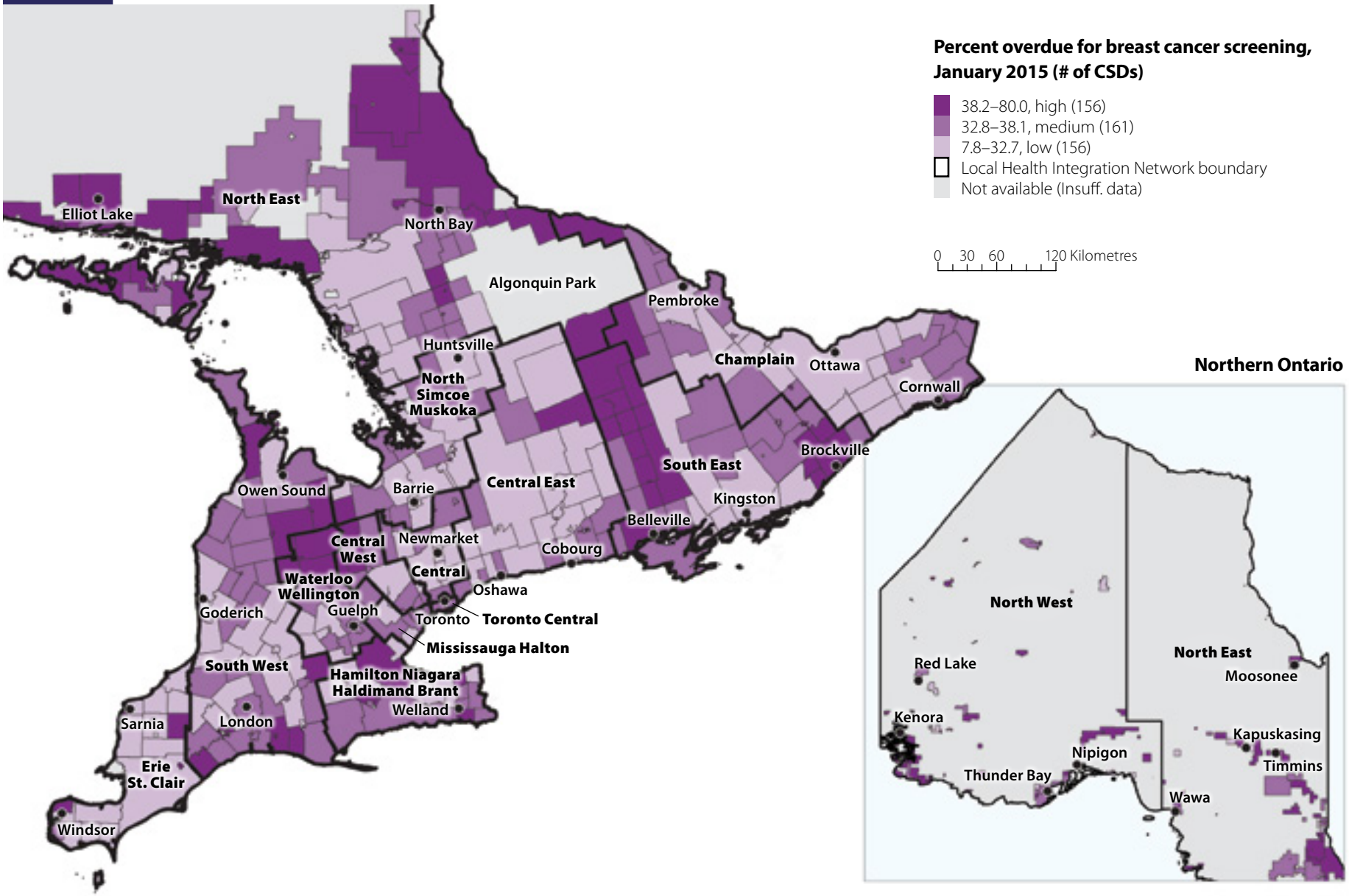
As of January 2015, 40 percent (1,603,614) of Ontario's screen-eligible population were overdue for colorectal cancer screening, meaning they had not completed a gFOBT in the last two years, a flexible sigmoidoscopy in the last five years and a colonoscopy in the last 10 years.

Of these overdue people:

- 18 percent (292,953) had at least one gFOBT two to five years prior;
- 11 percent (183,125) had at least one gFOBT more than five years prior;
- Three percent (40,187) had no prior gFOBT, but had at least one colonoscopy or flexible sigmoidoscopy since 1998; and
- 68 percent (1,087,349) had no prior colorectal test on record (since at least 1998, the earliest year for which Cancer Care Ontario has Ontario Health Insurance Plan data).

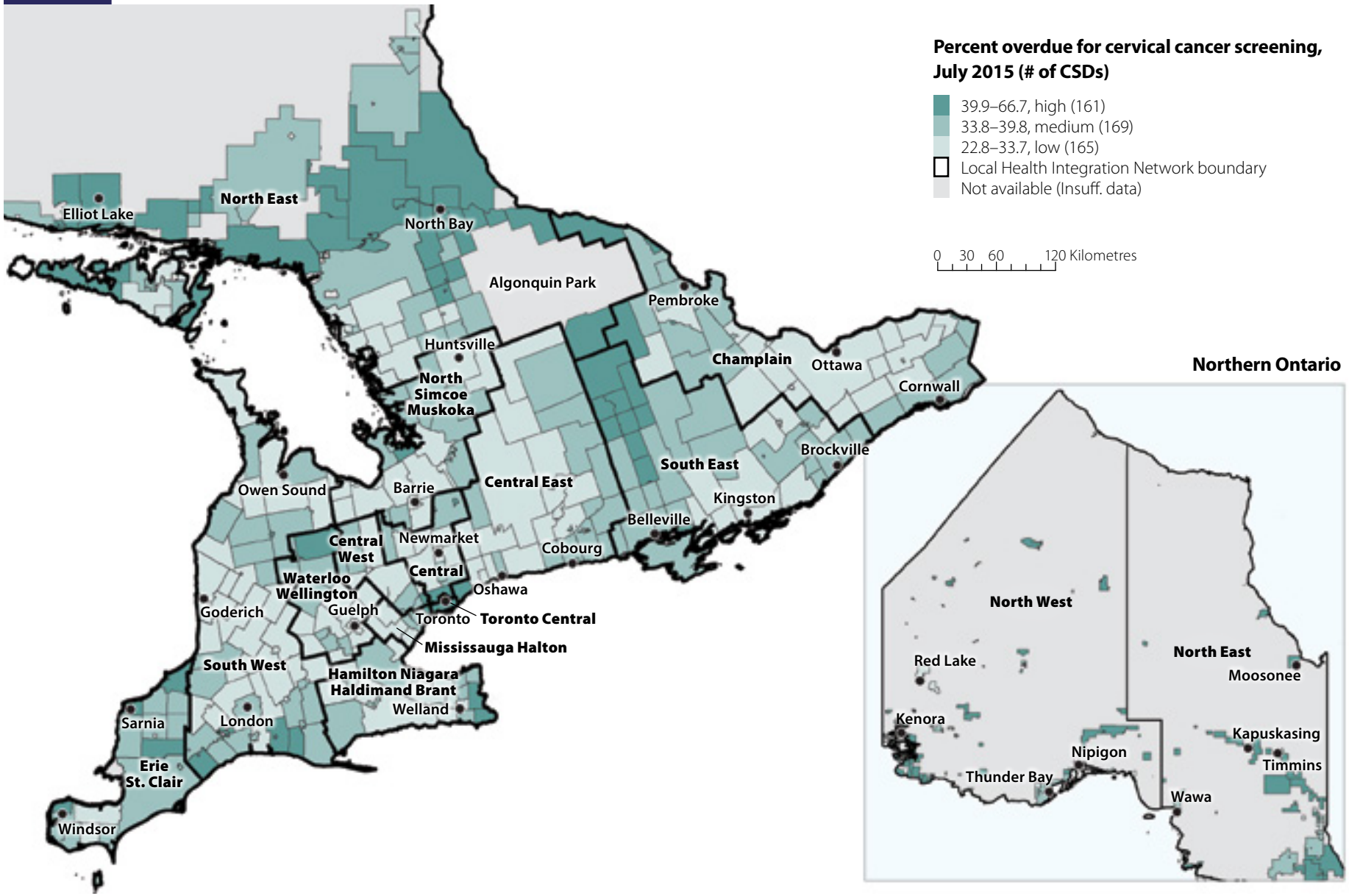
Similar to breast and cervical cancer screening, there was wide geographical variation in the percentage overdue for colorectal cancer screening in Ontario, ranging from 27 to 90 percent across census subdivisions (Figure 23).

Figure 21 Percentage of Ontario women, ages 52–74, who were overdue for breast cancer screening tests by census subdivisions (CSDs), July 2015



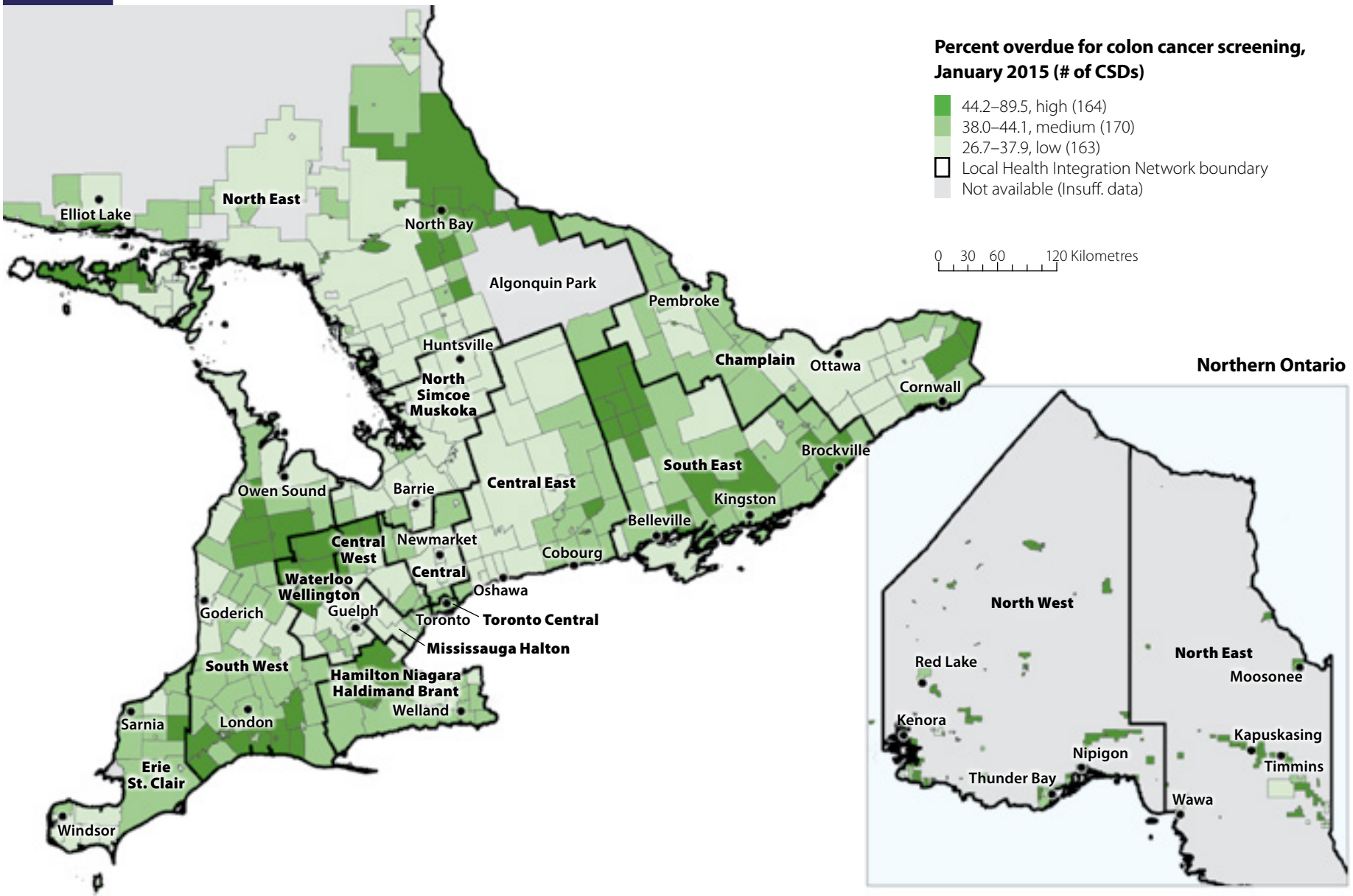
Data Sources: Integrated Client Management System, the Ontario Health Insurance Plan's Claims History Database, the Ontario Cancer Registry and the Registered Persons Database (RPDB).
Notes: Using postal codes from the RPDB, residents were assigned to specific CSDs using Statistics Canada's Postal Code Conversion File Plus. For privacy reasons, data for CSDs with population of less than 20 people was excluded.
Three cut-offs (tertiles) were used to divide Ontario CSDs by percentage overdue into three categories of low, medium and high. The tertiles were defined within each program. Choropleth (shaded) maps were used to depict the percentage of eligible people in each CSD who were overdue for cancer screening (cervical, breast, colorectal), where the intensity of shading indicates the magnitude of percentage overdue for screening. For example, low percentage overdue category for each program represents lowest tertile for cancer screening overdue percentages.

Figure 22 Percentage of Ontario women, ages 24–69, who were overdue for cervical cancer screening by census subdivisions (CSDs), July 2015



Data Sources: Cytobase, Ontario Health Insurance Plan's Claims History Database, the Ontario Cancer Registry and the Registered Persons Database (RPDB).
Notes: Using postal codes from the RPDB, residents were assigned to specific CSDs using Statistics Canada's Postal Code Conversion File Plus. For privacy reasons, data for CSDs with population of less than 20 people was excluded.
Three cut-offs (tertiles) were used to divide Ontario CSDs by percentage overdue into three categories of low, medium and high. The tertiles were defined within each program. Choropleth (shaded) maps were used to depict the percentage of eligible people in each CSD who were overdue for cancer screening (cervical, breast, colorectal), where the intensity of shading indicates the magnitude of percentage overdue for screening. For example, low overdue percentage category for each program represents lowest tertile for cancer screening overdue percentages.

Figure 23 Percentage of Ontario men and women, ages 50–74, who were overdue for colorectal cancer screening by census subdivisions (CSDs), January 2015



Data Sources: Colonoscopy Interim Reporting Tool, Laboratory Reporting Tool, Ontario Health Insurance Plan's Claims History Database, Ontario Cancer Registry and Registered Persons Database (RPDB).
Notes: Using postal codes from the RPDB, residents were assigned to specific CSDs using Statistics Canada's Postal Code Conversion File Plus. For privacy reasons, data for CSDs with population of less than 20 people was excluded. Three cut-offs (tertiles) were used to divide Ontario CSDs by percentage overdue into three categories of low, medium and high. The tertiles were defined within each program. Choropleth (shaded) maps were used to depict the percentage of eligible people in each CSD who were overdue for cancer screening (cervical, breast, colorectal), where the intensity of shading indicates the magnitude of percentage overdue for screening. For example, low overdue percentage category for each program represents lowest tertile for cancer screening overdue percentages.

SOCIO-DEMOGRAPHIC ANALYSIS

Analyzing Ontario's cancer screening participation gap by socio-demographic factor highlights several common themes among all three screening programs. Table 5 highlights these findings.

All programs showed that younger age was associated with an increased likelihood of being overdue for screening. However, the oldest eligible age groups for breast and cervical cancer screening were also associated with a higher likelihood of being overdue. Lower breast and cervical cancer screening participation in older age groups is particularly concerning for two reasons: 1) the risk of breast cancer increases as women age [19] and 2) some older women perceive themselves as being at low risk of cervical cancer, even when the benefits of screening outweigh the risks for their age group. [42, 67, 68]

Not being enrolled with a PEM physician and living in a low-income neighbourhood were associated with a higher likelihood of being overdue for screening, which has been observed in other public health contexts. [69, 70, 71, 72] Physician sex was also a significant factor in participation; male PEM physicians had higher proportions of patients overdue for screening than their female counterparts. A 2013 Montreal study examining primary care physician sex and screening for breast and cervical cancer documented a similar pattern for cervical cancer screening. [73]

Table 5 **Summary of socio-demographic analyses for overdue population**

	Description	Breast cancer screening (% overdue for screening)	Cervical cancer screening (% overdue for screening)	Colorectal cancer screening (% overdue for screening)
Age	Breast and cervical cancer screening: the youngest and oldest age groups had the highest proportion of women overdue for screening	• Youngest age group (52–54): 37% • Oldest age group (70–74): 38%	• Youngest age group (24–29): 42% • Oldest age group (60–69): 42%	• Youngest age group (ages 50–54) had the highest proportion of people overdue for screening: 50%
Sex	Men were more likely to be overdue for colorectal cancer screening than women (43% vs. 37%)	N/A	N/A	Men were more likely to be overdue for colorectal cancer screening than women (43% vs. 37%)
Income quintile	The lowest income quintile neighbourhoods reported the highest percentages overdue for screening, and the highest income quintile neighbourhoods showed the lowest overdue percentages	• Lowest quintile: 41% • Highest quintile: 30%	• Lowest quintile: 42% • Highest quintile: 32%	• Lowest quintile: 47% • Highest quintile: 34%
Patient enrolment model (PEM)	People not registered with a PEM physician were two times more likely to be overdue for cancer screening than registered people	• Not registered: 62% • Registered: 28%	• Not registered: 60% • Registered: 29%	• Not registered: 62% • Registered: 34%
Physician sex	Patients with a male PEM physician were more likely to be overdue for cancer screening than patients registered to a female PEM physician	• Male PEM physician: 31% • Female PEM physician: 24%	• Male PEM physician: 32% • Female PEM physician: 26%	• Male PEM physician: 36% • Female PEM physician: 32%

INITIATIVES TO INCREASE PROGRAM **PARTICIPATION AND RETENTION**

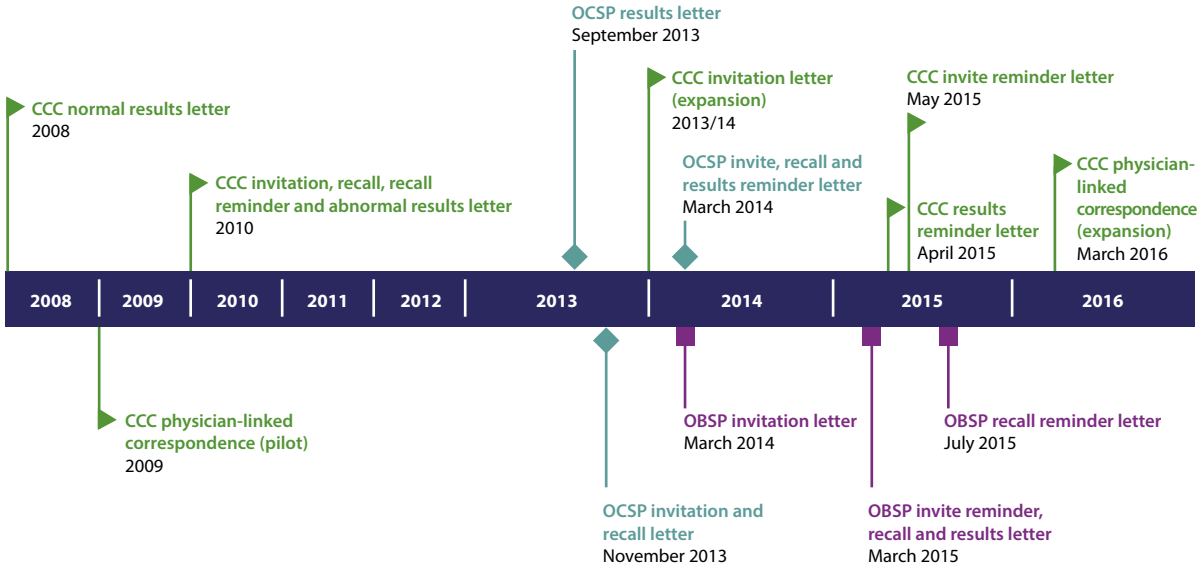
Cancer Care Ontario is dedicated to improving cancer screening services in Ontario. This report highlights several initiatives designed to improve screening program coverage and quality of cancer screening services for Ontarians.

Centralized Provincial Correspondence

To improve screening participation and retention, we began a centralized effort in 2008 to send correspondence letters directly to Ontarians. This initiative sends personalized letters inviting all screen-eligible Ontarians to get screened for cancer (invitation letter), reminding them when it is time to return for their next screening test (recall letter) and informing them of their screening results (results letter). Reminder letters are also sent to Ontarians who have not taken action to get screened or who have not followed up on abnormal screening results after receiving correspondence letters.

The correspondence program was rolled out in a phased approach (Figure 24). Currently, all three screening programs—the Ontario Breast Screening Program (OBSP), the Ontario Cervical Screening Program (OCSP) and ColonCancerCheck (CCC)—are included in centralized correspondence.

Figure 24 **Timeline of centralized correspondence launch dates[§§]**



[§§] In 2008, the CCC sent abnormal result letters to unattached people only (i.e., people without a family physician). Abnormal results letters were sent to all program participants in 2010.

Centralized correspondence is an important feature of an organized screening program because it allows people in the target population to be invited or recalled for screening. Correspondence letters have also been specifically designed to offer eligible Ontarians the opportunity to participate in cancer screening, emphasizing that screening can prevent cancer or detect it early when it is easier to treat. Although primary care providers are a key source of information about the importance of regular screening, not everyone visits their primary care provider on a regular basis and screening is not always discussed when they do. Therefore, direct-mail correspondence is an effective way to reach a wide audience of screen-eligible Ontarians.

Centralized correspondence is an important feature of an organized screening program because it allows people in the target population to be invited or recalled for screening.

We have evaluated the centralized correspondence campaigns and found that invitation letters for all three screening programs and recall letters for the OCSP are associated with increasing screening uptake. An evaluation of OCSP invitation letters using a cohort design found that women who were sent an invitation letter were more likely to have a Pap test than women who were not sent a letter (adjusted odds ratio [AOR]=1.74, 95% confidence interval [CI]= 1.69–1.79). [74] A randomized controlled trial evaluating the impact of standard and tailored CCC invitation letters on colorectal cancer screening participation found that sending any type of invitation letter significantly increased guaiac fecal occult blood test (gFOBT) participation in men and women (AOR ranging from 6.0 [95% CI 4.77–7.55] to 7.23 [95% CI 5.76–9.07]), compared to no letter sent. For men, sex-specific letters were more effective than a standard letter (OR=1.21, 95% CI=1.07–1.36). [75] A randomized controlled trial evaluating OBSP invitation letters found that women who were sent a letter were significantly more likely to screen with mammography within the first four months of being mailed the letter (rate ratio [RR]=1.34, 95% CI 1.23–1.47) than women who were not sent a letter. [59] Methods and results of completed correspondence evaluations are summarized in Appendix I.

Physician-Linked Correspondence

Research has shown that physicians can influence their patients' participation in cancer screening. [76,77,78,79] Studies from countries with organized screening programs similar to Ontario's have shown that in the organized program context, physician-linked invitation letters (letters from someone's physician inviting them to participate in screening) were associated with increases in colorectal cancer screening participation [80], both for initial screens [81,82] and for up to four additional rounds of screening. [81]

In 2009, Cancer Care Ontario conducted a two-phase pilot to evaluate the feasibility and effectiveness of physician-linked correspondence in CCC. The first phase of the pilot involved 102 primary care providers practicing in patient enrolment models (PEMs) and their nearly 11,000 associated eligible patients. Patients were mailed invitation letters that included their physician's name inviting them to visit their doctor to get a gFOBT kit or a referral for a colonoscopy (if appropriate). The uptake of gFOBT in this group of patients was compared to a control group of patients who did not receive invitation letters by mail. [65] People in the first phase of the pilot study who received a physician-linked invitation letter were more likely to complete a gFOBT within six months of receiving their invitation letter than a matched control group that did not receive invitation letters. Twenty-two percent of participants who received an invitation letter completed a gFOBT within six months, compared to eight percent of matched controls who did not receive an invitation letter. [65] A "number needed to treat" analysis found that for every seven letters sent, one additional person was screened. [65]

The next phase of the pilot specifically compared the impact of physician-linked letters to unlinked letters (letters that do not contain an endorsement from someone's physician) in a sample of patients enrolled to 1,000 physicians who volunteered to participate in the pilot. It compared uptake of gFOBT in patients who received physician-linked invitations to uptake in patients who were enrolled to the same group of physicians, but sent unlinked letters one year earlier. Patients who received physician-linked letters were more likely to complete a gFOBT than patients who received unlinked letters (17 percent vs. 13 percent for invitation letters, 55 percent vs. 48 percent for recall letters), [83, 84] although selection bias and secular trends due to the study design may have influenced the findings.

Based on the results of the two-phased pilot, in February of 2016 we expanded registration for physician-linked correspondence for colorectal cancer screening to all PEM physicians in Ontario. The physician-linked correspondence program will include breast and cervical cancer screening in the future.

Primary Care Screening Activity Report

The Screening Activity Report (SAR) is an innovative reporting tool developed by Cancer Care Ontario to help physicians monitor and improve cancer screening for their patients. The SAR was first released for CCC in 2011. In 2014, the SAR was expanded to become the Primary Care SAR (PC SAR), which includes all three screening programs (breast, cervical and colorectal).

The PC SAR supports physicians in increasing cancer screening participation and follow-up in three ways:

- It provides a comparison of physician screening activities relative to other physicians in Ontario and within their Local Health Integration Network (LHIN);
- It identifies rostered patients who are due for screening; and
- It highlights rostered patients who may require follow-up after an abnormal screening test.

This tool organizes current information about patient screening status and results on an easy-to-navigate electronic dashboard. Physicians practicing in a PEM may access the PC SAR electronically by registering for eHealth Ontario's ONE®ID system.

ONE®ID

eHealth Ontario's ONE®ID system is an identity and access management service that allows healthcare providers to access eHealth services in a trusted and secure manner. Enhanced privacy and security safeguards are built into the ONE®ID system to protect patient and provider information.

In 2014, we evaluated the PC SAR to assess its effectiveness and identify opportunities for improvement. Overall, a modest association was found between using the PC SAR and increases in screening participation across all three screening programs, suggesting that the PC SAR may be an effective tool in helping physicians improve cancer screening participation. [85] The PC SAR highlights the value of using large databases to deliver provider-level reporting, and to improve screening participation and physician engagement in cancer screening. We will continue to work with key partners to explore opportunities for integrating the PC SAR with other eHealth platforms, such as electronic medical records, to further improve screening participation and follow-up.

Electronic Medical Record (EMR) Toolkit

Cancer Care Ontario has developed a suite of training guides and other supporting tools to help primary care providers in Ontario use the full functionality of their EMR systems for comprehensive cancer screening.

The training guides and tools support primary care providers in the following ways:

- They encourage adopting standardized EMR data entry and data cleaning best practices;
- They help create searches for population-based identification of patients who may be eligible for cancer screening;
- They provide instruction on creating EMR-based reminders and alerts to prompt screening conversations during patient visits; and
- They promote adopting effective, provider-tested and office-based workflows that can optimize cancer screening.

The EMR toolkit was piloted in 2014 by several primary care units in select regions and is now being made available to additional primary care providers across the province.

E-Learning Platform

To meet the growing learning needs of primary care providers, Cancer Care Ontario developed multi-modal cancer screening education and cultural competency training via an online learning platform. The main goals of the platform are to deliver cancer screening education to a broader audience of primary care providers, and to foster a culture of sensitivity and understanding of First Nations, Inuit and Métis history and culture for those working with these populations.

The Cancer Care Ontario E-Learning platform was created in 2015 to offer primary care providers online Mainpro-accredited*** continuing professional development courses. This platform allows providers to register on the system, take self-directed courses and receive Mainpro-M1 credits that count towards continuing medical education or membership and/or designations with the College of Family Physicians of Canada. The platform currently hosts four online cancer screening modules. These modules consist of an introduction to cancer screening, as well as modules on breast, colorectal and cervical cancer screening. A series of nine online Aboriginal Relationship and Cultural Competency courses were also developed and are available on the platform. These modules address First Nations, Inuit and Métis culture, history, determinants of health, Aboriginal health services, Indigenous knowledge and traditional health.

In the future, existing courses will continue to be updated and new courses will be added to help primary care providers stay informed about new cancer screening guidelines and recommendations, learn about new screening tests and further their understanding of how to best use provider tools to support their cancer screening practices (e.g., EMR toolkit, PC SAR). To find out more about the e-learning platform, please visit elearning.cancercare.on.ca.

The Cancer Care Ontario E-Learning platform was created in 2015 to offer primary care providers online Mainpro-accredited*** continuing professional development courses.

*** Mainpro (Maintenance of Proficiency) is the College of Family Physicians of Canada program designed to support and promote continuing professional development for family physicians. Mainpro sets standards, and reviews and accredits continuing professional development programs.

Awareness Campaigns

For each of the three cancers targeted by the screening programs (breast, cervical and colorectal), Cancer Care Ontario carries out regular awareness campaigns in partnership with the Regional Cancer Programs. These campaigns are designed to increase awareness and improve screening participation using a multi-faceted approach with provincial and regional engagement. Our awareness campaigns use social media, print and radio. Shareable infographics and other digital assets are used to clearly communicate the message and maximize the impact of each campaign.

- March is Colorectal Cancer Awareness Month. In 2016, our "Call the Shots on Colorectal Cancer" campaign, which featured former Maple Leafs captain Darryl Sittler, encouraged men ages 55 to 65 to get screened with a gFOBT. Men were targeted for this campaign because they are more likely to be overdue for colorectal cancer screening than women.
- In April 2016, we launched a campaign to encourage women ages 35 to 49 who have not had a Pap test in at least three years to get screened for cervical cancer. Women ages 35 to 49 were targeted in this campaign because participation begins to decrease after age 49 and the median age of diagnosis is 48. The April 2016 awareness campaign was the first cervical cancer awareness campaign since 2012.
- October is Breast Cancer Awareness Month. In October 2016, our "Just Book It" campaign encouraged eligible women ages 50 to 54 to book a screening mammogram. While women are eligible for breast cancer screening from ages 50 to 74, the 50- to 54-year-old age group includes the greatest number of unscreened eligible women.

Mobile Screening Coaches

In an effort to improve access to cancer screening services for Ontarians who live in rural remote areas and to increase screening participation in under-screened communities, Cancer Care Ontario has two mobile coaches, one in the North West region and the other in the Hamilton Niagara Haldimand Brant region. The coaches travel to various communities in these regions and offer on-site screening services for breast cancer (digital mammography) and cervical cancer (Pap test), and distribute gFOBT kits for colorectal cancer screening. The North West region mobile coach is an expansion of an existing mobile mammography unit that had been in operation since 1992; the Hamilton Niagara Haldimand Brant region mobile coach was launched in 2013.

While mobile mammography screening has become increasingly common in jurisdictions across Canada, the mobile coaches in Ontario are unique in that they provide additional screening services. The mobile coaches are an innovative way to engage with hard-to-reach communities, and improve health equity and access to screening services across Ontario. For more information about our mobile screening coaches, please visit cancercare.on.ca/pcs/screening/mobile_screening.

While mobile mammography screening has become increasingly common in jurisdictions across Canada, the mobile coaches in Ontario are unique in that they provide additional screening services.

FUTURE DIRECTIONS

Non-Ontario Breast Screening Program (OBSP) to OBSP Transition

In Ontario, over 70 percent of breast cancer screening services (mammography) for women ages 50 to 74 are delivered at mammography facilities affiliated with the OBSP. Facilities not affiliated with the OBSP that also offer breast cancer mammography screening services are referred to as "non-OBSP facilities."

Cancer Care Ontario identified transitioning mammography services from non-OBSP facilities to the OBSP as a priority quality initiative and work is currently underway to achieve this objective. Transitioning non-OBSP mammography into the OBSP will ensure that all eligible women receive high-quality breast cancer screening services in an organized and integrated fashion. This transition also provides opportunities for monitoring, evaluation and quality assurance of mammography services across the province.

Human Papillomavirus (HPV) Testing as Primary Screening Modality

Cancer Care Ontario has made recommendations for screening based on HPV testing. [86] However, HPV testing is not currently funded through the Ontario Health Insurance Plan and we continue to work with the Ministry of Health and Long-Term Care to explore the feasibility of HPV testing as the primary screening modality in Ontario. [86, 87] Part of the work involved in implementing widespread HPV testing will include centralized data collection. Currently, the frequency of HPV testing in Ontario is unknown due to a lack of centralized data. Until HPV testing as a primary screening modality has been fully explored, we continue to recommend screening every three years with the Pap test.

Fecal Immunochemical Test (FIT)

Cancer Care Ontario is planning to implement the fecal immunochemical test (FIT) in ColonCancerCheck as the recommended primary screening test for people at average risk of colorectal cancer. FIT has a number of advantages over the guaiac fecal occult blood test, including easier sample collection and greater sensitivity for detecting colorectal cancer and advanced adenomas. [53, 56] Due to these advantages, FIT is expected to increase participation in colorectal cancer screening and produce higher cancer detection rates, leading to better health outcomes.

SUMMARY

This report evaluates Ontario's cancer screening performance with a focus on program coverage from 2011 to 2014.

The analyses show that breast cancer screening participation has remained relatively steady, while retention has decreased slightly. Cervical cancer screening participation and retention have decreased slightly in recent years, possibly related to a change in cervical screening guidelines. Although the percentage overdue for colorectal cancer screening has improved (i.e., decreased), guaiac fecal occult blood test uptake has plateaued. These findings highlight the continual need for strategies to improve screening participation and retention. Cancer Care Ontario is committed to ensuring that Ontario's cancer screening programs meet the highest quality standards and achieve the population health benefits of organized cancer screening programs.

This report also highlights relationships between screening behaviour and demographic variables. The participation gap analysis explores the geographic and socio-demographic characteristics of Ontarians overdue for cancer screening. Factors such as geography, participant age, participant sex, neighbourhood income, enrolment with a patient enrolment model physician and physician sex are associated with screening participation. We will continue to undertake efforts to better understand the equity gaps in cancer screening, inform evidence-based and locally relevant strategies, and thereby ensure equitable access to cancer screening services in Ontario.

ONTARIO CANCER SCREENING PERFORMANCE INDICATORS

ONTARIO SCREENING PROGRAM PERFORMANCE: LOOKING BEYOND PARTICIPATION AND RETENTION

This section provides detailed LHIN-level performance data on Ontario's cancer screening program performance up to 2014 for each of the domains of the Canadian Partnership Against Cancer performance evaluation framework (Table 1).

BREAST CANCER SCREENING

Follow-up for women with abnormal mammogram results has improved in Ontario. In particular, the percentage of women who needed a tissue biopsy and were diagnosed within seven weeks of their abnormal mammogram result improved, increasing from 64 percent in 2011 to 77 percent in 2014 (Table 11). The percentage of women who did not need a tissue biopsy and were diagnosed within five weeks of their abnormal mammogram also improved, increasing from 2011 to 2014 (Table 10). The percentage of women who were diagnosed within six months of an abnormal mammogram result remained consistently high (over 95 percent) from 2011 to 2014 (Table 9).

Indicators measuring the quality of breast cancer screening, such as mammogram sensitivity, specificity and positive predictive value, remained stable between 2011 and 2014 (Tables 12 to 14).

CERVICAL CANCER SCREENING

Although participation and retention in the OCSP have decreased in recent years, the follow-up of abnormal Pap test results improved from 2011 to 2014 for high-grade and low-grade abnormal Pap results (Table 22 and Table 23). Timely follow-up is essential for reducing cervical cancer incidence and mortality. In the same time period (2011 to 2014), the proportion of women with abnormal Pap test results also decreased (Table 21).

COLORECTAL CANCER SCREENING

Follow-up of abnormal gFOBT results has improved from 2011 to 2014 and has remained stable in recent years. In 2011, 75 percent of Ontarians with abnormal gFOBT results underwent a colonoscopy within six months, compared to 78 percent in 2013 and 77 percent in 2014 (Table 29). Similarly, in 2011, 38 percent of Ontarians with abnormal gFOBT results had a colonoscopy within eight weeks, compared to 46 percent in 2013 and 2014 (Table 30). While gFOBT identifies people at risk of colorectal cancer, colonoscopy is required to make a definitive diagnosis. Therefore, timely follow-up of abnormal gFOBT results with a colonoscopy is important in order to realize the full benefits of screening with gFOBT.

Positive predictive value for gFOBT remained stable between 2010 (five percent) and 2013 (four percent) (Table 31). Invasive cancer detection rate for the average risk population screened with gFOBT and invasive cancer detection rate for the increased risk population (family history of colorectal cancer) screened with colonoscopy also remained stable between 2010 and 2013 (Table 33 and Table 34).

Ontario Breast Screening Program (OBSP): Average Risk

Table 6 Breast cancer screening participation

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

Local Health Integration Network	Percentage (95% confidence interval)			
	2007–2008	2009–2010	2011–2012	2013–2014
Ontario	**65.7 (65.6–65.8)**	**66.1 (66.0–66.2)**	**64.9 (64.8–65.0)**	**64.8 (64.8–64.9)**
Erie St. Clair	67.7 (67.4–68.1)	67.8 (67.5–68.1)	66.8 (66.5–67.1)	66.4 (66.1–66.7)
South West	67.3 (67.0–67.5)	66.9 (66.6–67.1)	65.5 (65.3–65.8)	65.1 (64.9–65.3)
Waterloo Wellington	66.3 (65.9–66.6)	66.9 (66.6–67.2)	65.2 (64.9–65.5)	64.6 (64.3–64.9)
Hamilton Niagara Haldimand Brant	65.3 (65.1–65.6)	65.6 (65.4–65.8)	64.5 (64.3–64.7)	63.6 (63.4–63.8)
Central West	59.0 (58.7–59.3)	60.3 (60.0–60.6)	60.2 (59.9–60.5)	61.5 (61.2–61.8)
Mississauga Halton	65.3 (65.0–65.5)	65.3 (65.0–65.5)	64.1 (63.9–64.3)	63.8 (63.6–64.1)
Toronto Central	61.4 (61.1–61.6)	61.6 (61.3–61.9)	60.3 (60.1–60.6)	60.4 (60.1–60.6)
Central	66.8 (66.6–67.0)	67.0 (66.8–67.2)	66.0 (65.8–66.2)	66.3 (66.1–66.5)
Central East	65.9 (65.7–66.1)	66.8 (66.6–67.0)	65.7 (65.5–65.9)	66.4 (66.2–66.6)
South East	65.7 (65.4–66.1)	66.4 (66.1–66.8)	65.5 (65.2–65.9)	64.9 (64.6–65.2)
Champlain	68.2 (68.0–68.4)	68.9 (68.7–69.1)	67.2 (67.0–67.4)	67.4 (67.2–67.6)
North Simcoe Muskoka	67.4 (67.0–67.7)	68.8 (68.4–69.1)	67.5 (67.2–67.9)	68.7 (68.3–69.0)
North East	66.6 (66.2–66.9)	65.6 (65.3–65.9)	64.5 (64.2–64.8)	62.9 (62.6–63.2)
North West	65.9 (65.4–66.4)	66.2 (65.7–66.7)	63.9 (63.4–64.4)	62.6 (62.1–63.1)

Data sources: OHIP CHDB, ICMS, OCR, RPDB, PCCF+ version 6a.

Table 7 Breast cancer screening retention

Percentage of Ontario screen-eligible women, ages 50–72, who had a subsequent Ontario Breast Screening Program screening mammogram within 30 months of a previous program mammogram

Local Health Integration Network	Percentage (95% confidence interval)			
	2009	2010	2011	2012
Ontario	**84.9 (84.8–85.0)**	**84.1 (84.0–84.2)**	**83.3 (83.2–83.4)**	**82.6 (82.5–82.7)**
Erie St. Clair	90.5 (90.2–90.9)	91.0 (90.6–91.3)	90.5 (90.1–90.9)	88.0 (87.6–88.4)
South West	86.2 (85.9–86.6)	85.0 (84.7–85.4)	84.0 (83.7–84.4)	84.2 (83.8–84.5)
Waterloo Wellington	84.0 (83.5–84.5)	82.9 (82.5–83.4)	82.4 (82.0–82.9)	80.9 (80.5–81.4)
Hamilton Niagara Haldimand Brant	85.9 (85.5–86.2)	84.9 (84.6–85.2)	83.4 (83.1–83.7)	82.0 (81.7–82.3)
Central West	80.6 (80.0–81.1)	79.4 (78.8–79.9)	78.5 (78.0–79.1)	77.5 (76.9–78.0)
Mississauga Halton	82.7 (82.3–83.1)	81.5 (81.1–81.9)	81.3 (80.9–81.6)	81.2 (80.8–81.6)
Toronto Central	83.3 (82.9–83.8)	82.0 (81.6–82.5)	80.7 (80.2–81.1)	80.5 (80.0–80.9)
Central	83.9 (83.6–84.2)	83.6 (83.3–83.9)	82.6 (82.3–82.9)	82.2 (82.0–82.5)
Central East	86.4 (86.1–86.7)	85.5 (85.2–85.8)	84.1 (83.8–84.4)	83.9 (83.7–84.2)
South East	81.9 (81.3–82.4)	83.3 (82.8–83.8)	83.7 (83.2–84.1)	83.8 (83.4–84.3)
Champlain	87.0 (86.7–87.4)	86.5 (86.1–86.8)	84.9 (84.6–85.3)	83.9 (83.5–84.3)
North Simcoe Muskoka	84.6 (84.0–85.2)	81.0 (80.4–81.6)	84.4 (83.8–84.9)	84.1 (83.6–84.7)
North East	84.0 (83.6–84.5)	84.3 (83.8–84.7)	83.2 (82.8–83.6)	81.9 (81.5–82.3)
North West	85.6 (84.9–86.3)	81.5 (80.7–82.3)	82.8 (82.1–83.6)	80.9 (80.1–81.7)

Data sources: ICMS, OCR, PCCF+ version 6a.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

Table 8 Breast cancer screening abnormal call rate

Percentage of Ontario screen-eligible women, ages 50-74, with an abnormal Ontario Breast Screening Program screening mammogram result who were referred for further testing, per 100 women screened

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario (women with abnormal screens)	***40,759***	***44,351***	***46,190***	***49,698***
Ontario	**8.2 (8.1–8.3)**	**8.4 (8.4–8.5)**	**8.7 (8.6–8.7)**	**8.6 (8.5–8.7)**
Erie St. Clair	6.3 (6.0–6.6)	5.8 (5.5–6.1)	7.4 (7.1–7.8)	7.4 (7.1–7.7)
South West	9.4 (9.2–9.7)	9.5 (9.2–9.8)	8.7 (8.4–9.0)	8.5 (8.3–8.8)
Waterloo Wellington	8.9 (8.5–9.2)	8.4 (8.1–8.8)	8.1 (7.8–8.4)	8.2 (7.8–8.5)
Hamilton Niagara Haldimand Brant	9.9 (9.7–10.1)	9.5 (9.2–9.7)	10.2 (9.9–10.4)	10.0 (9.8–10.3)
Central West	9.5 (9.1–9.9)	9.6 (9.3–10.0)	8.6 (8.3–9.0)	8.8 (8.5–9.1)
Mississauga Halton	9.2 (8.9–9.5)	8.9 (8.6–9.2)	9.2 (8.9–9.5)	9.5 (9.2–9.7)
Toronto Central	7.8 (7.5–8.1)	8.0 (7.7–8.3)	8.3 (8.0–8.6)	8.9 (8.6–9.2)
Central	7.1 (6.9–7.3)	7.3 (7.2–7.5)	8.2 (8.0–8.4)	7.6 (7.5–7.8)
Central East	9.0 (8.7–9.2)	9.5 (9.3–9.7)	9.2 (9.0–9.4)	9.1 (8.9–9.3)
South East	7.8 (7.4–8.1)	9.5 (9.1–9.9)	9.0 (8.6–9.4)	7.9 (7.6–8.3)
Champlain	5.4 (5.2–5.6)	5.4 (5.2–5.7)	6.0 (5.8–6.3)	6.3 (6.1–6.5)
North Simcoe Muskoka	8.0 (7.6–8.4)	9.5 (9.0–9.9)	9.4 (9.0–9.8)	8.7 (8.3–9.1)
North East	8.3 (8.0–8.6)	9.3 (9.0–9.7)	10.3 (9.9–10.6)	10.6 (10.3–11.0)
North West	7.7 (7.2–8.3)	8.7 (8.1–9.2)	8.4 (7.8–9.0)	9.0 (8.4–9.5)

Data source: ICMS.

Table 9 Breast cancer screening 6-month abnormal follow-up

Percentage of Ontario screen-eligible women, ages 50–74, with an abnormal Ontario Breast Screening Program screening mammogram result who were diagnosed (benign or cancer) within 6 months of the abnormal screen date

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario (denominator)	***40,759***	***44,351***	***46,190***	***49,698***
Ontario	**97.5 (97.3–97.6)**	**97.9 (97.8–98.1)**	**97.8 (97.7–97.9)**	**98.4 (98.3–98.5)**
Erie St. Clair	97.4 (96.6–98.1)	96.6 (95.7–97.5)	94.7 (93.6–95.6)	98.0 (97.4–98.6)
South West	98.6 (98.3–99.0)	98.8 (98.4–99.1)	99.0 (98.7–99.3)	98.9 (98.6–99.2)
Waterloo Wellington	98.9 (98.4–99.3)	99.1 (98.7–99.5)	99.0 (98.5–99.4)	99.3 (98.9–99.6)
Hamilton Niagara Haldimand Brant	95.3 (94.7–95.8)	96.6 (96.1–97.0)	96.9 (96.4–97.3)	97.6 (97.3–98.0)
Central West	97.5 (96.8–98.1)	98.2 (97.7–98.8)	95.2 (94.3–96.1)	96.9 (96.2–97.6)
Mississauga Halton	97.4 (96.8–97.9)	97.5 (96.9–98.0)	97.0 (96.4–97.5)	97.1 (96.6–97.6)
Toronto Central	93.9 (93.0–94.9)	96.0 (95.2–96.7)	97.1 (96.5–97.7)	98.4 (98.0–98.8)
Central	97.5 (97.1–98.0)	97.9 (97.5–98.3)	98.0 (97.6–98.3)	98.1 (97.8–98.4)
Central East	98.1 (97.7–98.4)	98.4 (98.1–98.7)	98.6 (98.3–98.8)	99.0 (98.8–99.2)
South East	98.8 (98.3–99.3)	98.6 (98.1–99.1)	98.8 (98.3–99.2)	99.1 (98.6–99.5)
Champlain	98.7 (98.2–99.1)	99.2 (98.8–99.5)	98.6 (98.2–99.1)	99.5 (99.3–99.8)
North Simcoe Muskoka	98.0 (97.2–98.8)	97.9 (97.2–98.6)	98.1 (97.4–98.7)	99.0 (98.5–99.5)
North East	99.0 (98.6–99.4)	99.1 (98.7–99.4)	99.1 (98.7–99.4)	99.5 (99.2–99.7)
North West	98.7 (97.9–99.4)	98.0 (97.0–98.8)	98.6 (97.7–99.4)	98.6 (97.7–99.3)

Data source: ICMS.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

Table 10 Breast cancer screening diagnostic interval: ≤5 weeks without tissue biopsy

Percentage of Ontario screen-eligible women, ages 50–74, with an abnormal Ontario Breast Screening Program (OBSP) screening mammogram result, who did not need a tissue biopsy and were diagnosed within 5 weeks of the abnormal screen date (denominator includes women with an abnormal OBSP mammogram result who did not need a tissue biopsy)

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario (denominator)	***34,612***	***37,633***	***38,949***	***41,751***
Ontario	**86.1 (85.8–86.5)**	**90.9 (90.6–91.2)**	**92.5 (92.2–92.7)**	**92.8 (92.5–93.0)**
Erie St. Clair	88.2 (86.3–90.0)	92.0 (90.3–93.5)	86.9 (85.2–88.6)	90.9 (89.4–92.2)
South West	57.8 (56.2–59.5)	79.2 (77.9–80.5)	88.7 (87.6–89.8)	84.6 (83.4–85.8)
Waterloo Wellington	74.6 (72.7–76.5)	86.5 (85.0–88.0)	94.0 (92.9–95.0)	96.4 (95.6–97.2)
Hamilton Niagara Haldimand Brant	86.4 (85.4–87.3)	93.6 (92.9–94.3)	92.8 (92.1–93.5)	91.9 (91.2–92.6)
Central West	88.1 (86.6–89.6)	94.0 (92.9–95.0)	95.6 (94.5–96.5)	94.4 (93.3–95.4)
Mississauga Halton	85.9 (84.7–87.1)	93.9 (93.1–94.8)	93.5 (92.6–94.3)	94.3 (93.5–95.0)
Toronto Central	88.7 (87.3–90.1)	90.6 (89.4–91.8)	92.1 (91.0–93.1)	93.9 (93.0–94.8)
Central	93.0 (92.2–93.7)	92.3 (91.6–93.1)	93.5 (92.9–94.2)	95.4 (94.9–96.0)
Central East	94.3 (93.7–95.0)	95.3 (94.7–95.8)	95.5 (94.9–96.0)	96.4 (95.9–96.9)
South East	92.3 (91.0–93.6)	87.8 (86.3–89.3)	85.3 (83.7–87.0)	87.3 (85.6–88.8)
Champlain	94.1 (93.0–95.2)	94.9 (93.9–95.9)	92.4 (91.3–93.5)	91.3 (90.2–92.4)
North Simcoe Muskoka	95.8 (94.5–97.0)	93.8 (92.5–95.0)	95.4 (94.3–96.4)	94.8 (93.6–95.9)
North East	89.6 (88.2–90.9)	85.1 (83.7–86.5)	91.7 (90.6–92.8)	92.8 (91.9–93.8)
North West	84.3 (81.5–87.0)	87.0 (84.6–89.4)	86.2 (83.5–88.7)	81.7 (78.9–84.3)

Data source: ICMS.

Table 11 Breast cancer screening diagnostic interval: ≤7 weeks with tissue biopsy

Percentage of Ontario screen-eligible women, ages 50–74, with an abnormal Ontario Breast Screening Program (OBSP) screening mammogram result who needed a tissue biopsy and were diagnosed within 7 weeks of the abnormal screen date (denominator includes women with an abnormal OBSP screening mammogram result, ages 50–74, who needed a tissue biopsy)

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario (denominator)	***5,517***	***6,101***	***6,557***	***7,365***
Ontario	**64.1 (62.9–65.4)**	**70.4 (69.2–71.5)**	**73.3 (72.2–74.3)**	**77.1 (76.1–78.0)**
Erie St. Clair	72.7 (68.3–76.9)	70.2 (65.3–74.8)	73.5 (69.2–77.5)	73.7 (69.7–77.4)
South West	43.4 (39.4–47.2)	66.6 (62.7–70.2)	76.6 (73.1–80.0)	75.7 (72.1–79.0)
Waterloo Wellington	63.4 (57.2–69.2)	75.0 (69.4–80.2)	75.1 (69.9–80.0)	81.4 (76.8–85.7)
Hamilton Niagara Haldimand Brant	75.1 (71.7–78.3)	78.5 (75.2–81.6)	78.8 (75.8–81.7)	78.4 (75.5–81.1)
Central West	54.7 (48.4–60.6)	73.9 (68.6–78.8)	73.6 (68.2–78.7)	79.3 (74.8–83.4)
Mississauga Halton	47.7 (43.0–52.2)	65.6 (61.2–69.8)	60.2 (55.8–64.4)	69.4 (65.8–72.8)
Toronto Central	59.5 (53.7–65.0)	64.9 (59.7–69.7)	71.1 (66.5–75.4)	73.8 (69.8–77.6)
Central	67.9 (64.1–71.5)	74.3 (70.9–77.6)	75.7 (72.7–78.7)	80.3 (77.6–82.9)
Central East	68.9 (65.3–72.3)	70.2 (67.0–73.2)	75.3 (72.4–78.1)	80.0 (77.4–82.4)
South East	73.3 (68.0–78.3)	71.7 (66.7–76.5)	64.8 (59.8–69.6)	68.1 (62.9–73.0)
Champlain	80.1 (76.0–83.9)	78.0 (74.1–81.8)	73.2 (69.1–77.0)	82.8 (79.6–85.9)
North Simcoe Muskoka	68.2 (60.9–74.9)	71.7 (66.1–76.9)	80.1 (75.3–84.6)	84.5 (80.1–88.6)
North East	65.9 (60.8–70.7)	60.2 (55.6–64.5)	72.8 (68.6–76.7)	79.6 (76.0–83.0)
North West	45.0 (35.2–53.8)	49.6 (40.4–58.0)	57.0 (46.8–66.2)	49.1 (39.4–57.9)

Data source: ICMS.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

Table 12 Mammography positive predictive value

Percentage of Ontario screen-eligible women, ages 50–74, with an abnormal Ontario Breast Screening Program screening mammogram result, who were diagnosed with breast cancer (ductal carcinoma in situ or invasive) after diagnostic work-up

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario	**5.9 (5.7–6.2)**	**5.9 (5.7–6.2)**	**5.9 (5.7–6.1)**	**6.4 (6.1–6.6)**
Erie St. Clair	10.3 (8.8–11.8)	10.3 (8.7–11.8)	7.9 (6.7–9.1)	9.1 (7.8–10.3)
South West	5.8 (5.1–6.5)	5.6 (4.9–6.3)	6.5 (5.7–7.2)	6.5 (5.7–7.3)
Waterloo Wellington	5.1 (4.2–6.0)	4.8 (3.9–5.7)	6.2 (5.2–7.2)	5.6 (4.7–6.5)
Hamilton Niagara Haldimand Brant	5.7 (5.1–6.3)	5.7 (5.1–6.3)	5.8 (5.2–6.3)	5.9 (5.3–6.5)
Central West	4.9 (3.9–5.8)	4.8 (3.9–5.7)	5.2 (4.2–6.2)	5.6 (4.7–6.6)
Mississauga Halton	5.3 (4.5–6.0)	6.1 (5.3–6.9)	4.7 (4.0–5.3)	5.7 (5.0–6.4)
Toronto Central	6.1 (5.1–7.0)	5.9 (5.0–6.8)	6.5 (5.6–7.4)	6.3 (5.5–7.1)
Central	6.3 (5.6–7.0)	5.7 (5.1–6.3)	5.5 (5.0–6.1)	6.6 (5.9–7.2)
Central East	4.8 (4.2–5.4)	4.7 (4.2–5.3)	4.9 (4.4–5.4)	5.5 (4.9–6.0)
South East	6.9 (5.7–8.0)	6.6 (5.5–7.6)	7.2 (6.1–8.3)	6.9 (5.7–8.0)
Champlain	7.5 (6.4–8.6)	9.3 (8.1–10.4)	8.4 (7.3–9.4)	9.1 (8.0–10.1)
North Simcoe Muskoka	6.1 (4.7–7.4)	6.3 (5.1–7.5)	5.4 (4.3–6.4)	6.7 (5.5–7.8)
North East	5.9 (5.0–6.9)	5.9 (5.0–6.7)	5.3 (4.5–6.1)	5.6 (4.8–6.4)
North West	5.7 (4.0–7.2)	4.9 (3.4–6.3)	5.8 (4.1–7.4)	5.9 (4.3–7.4)

Data source: ICMS.

Table 13 Mammography sensitivity

Percentage of women, ages 50–74, diagnosed with breast cancer (ductal carcinoma in situ or invasive) within a year of the mammogram date who had an abnormal Ontario Breast Screening Program screening mammogram result followed by a final diagnosis of breast cancer after completion of diagnostic assessment

Local Health Integration Network	Percentage (95% confidence interval)			
	2009	2010	2011	2012
Ontario	**84.5 (83.1–86.0)**	**84.6 (83.2–85.9)**	**85.1 (83.8–86.4)**	**88.0 (86.8–89.2)**
Erie St. Clair	84.6 (78.0–90.4)	81.7 (75.0–87.7)	88.6 (83.7–92.9)	90.2 (85.4–94.3)
South West	83.8 (78.9–88.4)	87.8 (83.6–91.6)	86.3 (82.1–90.3)	89.7 (85.8–93.2)
Waterloo Wellington	84.9 (78.0–90.9)	76.0 (68.2–83.0)	84.8 (78.4–90.4)	84.7 (78.2–90.5)
Hamilton Niagara Haldimand Brant	87.2 (83.4–90.7)	88.7 (85.1–91.9)	88.9 (85.5–92.0)	89.0 (85.6–92.1)
Central West	85.2 (78.0–91.4)	83.6 (76.8–89.6)	88.3 (81.9–93.8)	90.0 (84.2–95.0)
Mississauga Halton	79.6 (73.6–85.0)	86.4 (81.3–90.9)	81.5 (76.2–86.3)	90.0 (85.8–93.6)
Toronto Central	91.5 (86.6–95.8)	79.5 (73.0–85.4)	86.5 (81.0–91.4)	87.9 (82.9–92.4)
Central	82.6 (78.1–86.7)	82.9 (78.9–86.7)	82.6 (78.6–86.3)	85.7 (81.9–89.2)
Central East	85.0 (80.1–89.5)	84.9 (80.8–88.6)	81.8 (77.4–85.8)	84.2 (80.2–87.8)
South East	87.8 (81.8–93.0)	83.1 (76.1–89.3)	91.9 (86.9–96.1)	91.7 (87.1–95.7)
Champlain	81.0 (75.6–85.9)	85.0 (80.2–89.4)	81.8 (76.3–86.8)	87.8 (83.5–91.7)
North Simcoe Muskoka	82.9 (74.2–90.5)	90.2 (83.6–95.7)	88.0 (80.3–94.4)	93.8 (88.9–97.8)
North East	85.9 (80.4–90.8)	83.6 (77.6–89.1)	83.0 (77.1–88.2)	87.8 (82.8–92.2)
North West	82.5 (71.7–91.5)	86.7 (78.3–93.7)	81.5 (70.2–90.9)	80.8 (69.1–90.5)

Data source: ICMS.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

Coverage
Participation
Retention

Follow-up
Proportion of abnormal results
Follow-up of abnormal results
Diagnostic interval

Quality of screening
Sensitivity
Positive predictive value

Detection
Pre-cancer detection rate
Invasive cancer detection rate
Interval cancer detection rate

Disease extent at diagnosis
Early stage invasive cancer detection rate

Table 14 Mammography specificity

Percentage of women, ages 50–74, without a breast cancer diagnosis (ductal carcinoma in situ or invasive) within a year of the mammogram date who had a normal Ontario Breast Screening Program screening mammogram result

Local Health Integration Network	Percentage (95% confidence interval)			
	2009	2010	2011	2012
Ontario	**93.0 (93.0–93.1)**	**92.8 (92.7–92.9)**	**92.4 (92.3–92.4)**	**92.1 (92.0–92.2)**
Erie St. Clair	95.4 (95.1–95.7)	94.6 (94.3–94.9)	94.4 (94.1–94.7)	94.8 (94.5–95.1)
South West	92.5 (92.2–92.7)	92.1 (91.8–92.3)	91.1 (90.9–91.4)	91.0 (90.8–91.3)
Waterloo Wellington	93.6 (93.3–93.9)	92.9 (92.5–93.2)	91.6 (91.3–91.9)	92.0 (91.7–92.3)
Hamilton Niagara Haldimand Brant	91.5 (91.2–91.7)	91.0 (90.8–91.3)	90.7 (90.4–90.9)	91.1 (90.8–91.3)
Central West	91.4 (91.0–91.8)	91.8 (91.4–92.2)	91.1 (90.7–91.5)	90.9 (90.5–91.3)
Mississauga Halton	91.9 (91.6–92.2)	92.1 (91.8–92.3)	91.4 (91.1–91.7)	91.7 (91.5–92.0)
Toronto Central	93.1 (92.8–93.4)	92.8 (92.5–93.1)	93.0 (92.7–93.3)	92.7 (92.4–92.9)
Central	94.1 (93.9–94.3)	93.9 (93.7–94.1)	93.5 (93.3–93.6)	93.2 (93.0–93.4)
Central East	91.8 (91.6–92.1)	91.9 (91.7–92.1)	91.6 (91.3–91.8)	91.1 (90.9–91.3)
South East	93.3 (92.9–93.6)	92.9 (92.5–93.2)	92.8 (92.5–93.1)	91.2 (90.8–91.5)
Champlain	95.7 (95.5–95.9)	95.1 (94.9–95.3)	95.0 (94.8–95.2)	95.0 (94.8–95.2)
North Simcoe Muskoka	92.0 (91.6–92.4)	91.7 (91.3–92.1)	92.6 (92.1–93.0)	91.2 (90.8–91.6)
North East	93.4 (93.1–93.7)	93.8 (93.6–94.1)	92.2 (91.9–92.5)	91.2 (90.9–91.5)
North West	92.8 (92.2–93.3)	92.3 (91.8–92.8)	92.8 (92.3–93.3)	91.8 (91.3–92.4)

Data source: ICMS.

Table 15 Invasive breast cancer detection rate

Proportion of women with an invasive screen-detected breast cancer, per 1,000 women who had an Ontario Breast Screening Program screening mammogram

Local Health Integration Network	Rate per 1,000 screened (95% confidence interval)			
	2010	2011	2012	2013
Ontario	**4.0 (3.8–4.2)**	**3.9 (3.8–4.1)**	**4.0 (3.8–4.1)**	**4.1 (4.0-4.3)**
Erie St. Clair	4.0 (3.1–4.7)	5.2 (4.3–6.0)	4.7 (3.8–5.5)	5.1 (4.2–6.0)
South West	4.2 (3.6–4.8)	4.3 (3.7–4.9)	4.3 (3.6–4.8)	4.5 (3.9–5.1)
Waterloo Wellington	3.4 (2.7–4.2)	3.6 (2.9–4.3)	3.5 (2.8–4.2)	4.1 (3.3–4.8)
Hamilton Niagara Haldimand Brant	4.5 (3.9–5.0)	4.8 (4.2–5.3)	4.4 (3.8–4.9)	4.8 (4.2–5.3)
Central West	4.2 (3.3–5.0)	3.4 (2.6–4.2)	3.7 (2.9–4.4)	3.2 (2.5–4.0)
Mississauga Halton	3.6 (3.0–4.2)	3.9 (3.3–4.5)	4.4 (3.7–5.0)	3.4 (2.9–4.0)
Toronto Central	3.8 (3.1–4.5)	3.5 (2.8–4.1)	3.3 (2.7–3.9)	4.3 (3.6–5.0)
Central	3.8 (3.3–4.3)	3.5 (3.1–3.9)	3.2 (2.8–3.6)	3.8 (3.3–4.2)
Central East	3.9 (3.3–4.4)	3.5 (3.0–3.9)	3.6 (3.1–4.0)	3.6 (3.2–4.1)
South East	4.1 (3.2–4.9)	4.7 (3.8–5.5)	5.4 (4.4–6.3)	5.1 (4.2–6.0)
Champlain	4.1 (3.5–4.7)	3.4 (2.8–3.9)	3.6 (3.1–4.2)	3.9 (3.3–4.5)
North Simcoe Muskoka	3.8 (2.9–4.7)	4.3 (3.2–5.3)	4.9 (3.8–5.9)	4.0 (3.1–4.9)
North East	4.2 (3.4–4.9)	4.0 (3.2–4.7)	4.5 (3.7–5.2)	4.6 (3.8–5.4)
North West	5.4 (3.9–6.7)	3.6 (2.4–4.8)	3.7 (2.5–4.8)	4.2 (2.9–5.5)

Data source: ICMS.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

Table 16 Early stage invasive breast cancer detection rate

Proportion of women with an early stage (stage I) invasive screen-detected breast cancer, per 100 women who had an invasive screen-detected breast cancer

Local Health Integration Network	Rate per 100 (95% confidence interval)			
	2010	2011	2012	2013
Ontario	**62.0 (59.6–64.2)**	**60.6 (58.4–62.8)**	**60.8 (58.6–62.9)**	**60.1 (58.0–62.2)**
Erie St. Clair	61.7 (51.3–71.0)	61.2 (52.4–69.3)	65.5 (56.6–73.7)	56.9 (48.0–65.1)
South West	58.1 (50.3–65.3)	57.0 (49.6–63.8)	61.0 (53.6–67.8)	64.0 (56.9–70.6)
Waterloo Wellington	63.9 (52.9–73.6)	58.5 (48.0–67.9)	53.3 (42.5–63.1)	57.4 (47.6–66.3)
Hamilton Niagara Haldimand Brant	57.1 (50.6–63.1)	59.2 (53.1–64.9)	64.2 (58.0–70.0)	58.8 (52.9–64.4)
Central West	59.2 (47.5–69.6)	59.5 (47.6–70.0)	55.7 (44.1–66.0)	54.3 (41.9–65.2)
Mississauga Halton	64.9 (54.9–73.9)	61.3 (53.2–68.8)	62.2 (54.2–69.5)	56.6 (47.6–64.8)
Toronto Central	69.7 (60.1–78.2)	68.8 (59.7–77.0)	60.0 (50.4–68.7)	61.7 (53.6–69.2)
Central	64.1 (57.6–70.2)	62.0 (55.8–67.9)	59.4 (52.7–65.6)	59.9 (53.8–65.5)
Central East	65.8 (58.8–72.3)	60.9 (54.0–67.3)	59.2 (52.6–65.4)	60.6 (54.1–66.7)
South East	70.0 (59.3–79.4)	60.6 (50.9–69.3)	65.1 (56.4–73.0)	65.5 (56.4–73.7)
Champlain	57.7 (50.0–64.9)	55.9 (47.7–63.5)	62.7 (55.0–69.9)	55.3 (47.3–62.8)
North Simcoe Muskoka	51.4 (33.4–66.6)	58.7 (45.8–70.1)	52.6 (40.7–63.2)	73.9 (62.8–83.5)
North East	61.4 (52.0–69.9)	61.4 (52.0–69.9)	58.4 (49.8–66.3)	57.9 (49.1–65.9)
North West	64.2 (50.3–76.1)	78.4 (63.8–90.3)	69.4 (53.0–83.1)	72.7 (56.0–86.4)

Data source: ICMS.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

Ontario Breast Screening Program (OBSP): High Risk

Table 17 Percentage of Category B women confirmed to be at high risk

Percentage of Ontario women (Category B*) confirmed to be at high risk by genetic assessment (counselling and/or testing) in 2014 **

Local Health Integration Network	Number of women referred to High Risk OBSP	Number of women receiving genetic assessment	Percentage of genetically assessed women confirmed to be at high risk
Ontario	**8,438**	**7,298**	**34.3 (33.2–35.3)**
Erie St. Clair	309	297	25.9 (20.8–30.7)
South West	532	426	34.5 (29.9–38.9)
Waterloo Wellington	396	342	36.0 (30.7–40.9)
Hamilton Niagara Haldimand Brant	728	648	34.7 (31.0–38.3)
Central West	359	329	38.9 (33.5–44.0)
Mississauga Halton	612	556	46.2 (42.0–50.3)
Toronto Central	1,415	1,208	31.3 (28.6–33.9)
Central	1,328	1,188	31.5 (28.8–34.1)
Central East	872	801	32.0 (28.7–35.1)
South East	209	163	36.8 (29.1–43.9)
Champlain	873	659	36.9 (33.1–40.5)
North Simcoe Muskoka	257	230	39.1 (32.6–45.2)
North East	414	341	33.1 (28.0–38.0)
North West	134	110	26.4 (17.7–34.1)

Data source: ICMS, OCR, PIMS.

*Category B is defined as women who are referred to genetic assessment to determine their eligibility for the High Risk OBSP.

**The latest year of available data is presented.

Table 18 Abnormal call rates, positive predictive values and cancer detection rates

Ontario abnormal call rates, positive predictive values and cancer detection rates by screening modality for High Risk OBSP

Indicator	2011–2012	2013	2014
Number of screens	2,903	3,879	5,521
Number of abnormal screens	745	938	1,256
Number of cancers	50	51	70
Abnormal call rate (%)	25.7	24.2	22.7
Positive predictive value (%)	6.7	5.4	5.6
Cancer detection rate per 1,000	17.2	13.1	12.7

Data sources: ICMS, OCR, PIMS.

*The High Risk OBSP began on July 1, 2011. As a result, data are only available for six months of the 2011 calendar year.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

Ontario Cervical Screening Program (OCSP)

Table 19 Cervical cancer screening participation

Age-adjusted percentage of Ontario screen-eligible women, ages 21–69, who completed at least 1 Pap test in a 42-month period

Local Health Integration Network	Percentage (95% confidence interval)			
	2003–2005	2006–2008	2009–2011	2012–2014
Ontario	**65.8 (65.8–65.8)**	**66.6 (66.6–66.7)**	**67.6 (67.6–67.6)**	**63.4 (63.4–63.4)**
Erie St. Clair	62.2 (62.2–62.3)	63.7 (63.7–63.7)	64.6 (64.6–64.6)	60.5 (60.5–60.6)
South West	66.3 (66.3–66.3)	67.5 (67.4–67.5)	68.7 (68.7–68.7)	64.3 (64.3–64.4)
Waterloo Wellington	68.0 (67.9–68.0)	68.8 (68.8–68.8)	69.8 (69.8–69.8)	64.9 (64.9–64.9)
Hamilton Niagara Haldimand Brant	66.5 (66.4–66.5)	68.2 (68.2–68.2)	69.2 (69.2–69.2)	64.8 (64.8–64.8)
Central West	62.9 (62.9–62.9)	63.6 (63.6–63.6)	64.8 (64.7–64.8)	62.0 (62.0–62.0)
Mississauga Halton	66.8 (66.8–66.8)	67.7 (67.7–67.8)	67.5 (67.5–67.5)	62.7 (62.7–62.8)
Toronto Central	63.5 (63.5–63.5)	63.4 (63.4–63.4)	63.7 (63.6–63.7)	59.2 (59.2–59.2)
Central	66.9 (66.9–66.9)	67.2 (67.2–67.2)	67.8 (67.8–67.8)	63.9 (63.9–63.9)
Central East	65.7 (65.7–65.7)	66.9 (66.9–66.9)	67.9 (67.9–67.9)	63.7 (63.7–63.7)
South East	67.1 (67.0–67.1)	69.5 (69.5–69.6)	71.6 (71.5–71.6)	66.4 (66.4–66.4)
Champlain	69.5 (69.5–69.5)	69.8 (69.8–69.8)	71.1 (71.1–71.1)	67.1 (67.1–67.1)
North Simcoe Muskoka	66.4 (66.4–66.5)	67.6 (67.5–67.6)	69.1 (69.0–69.1)	66.2 (66.1–66.2)
North East	62.3 (62.3–62.3)	62.5 (62.5–62.6)	64.2 (64.1–64.2)	59.7 (59.7–59.8)
North West	59.4 (59.4–59.5)	61.3 (61.3–61.4)	64.0 (63.9–64.0)	60.5 (60.4–60.5)

Data sources: OHIP CHDB, CytoBase, OCR, RPDB, PCCF+ version 6a.

Table 20 Cervical cancer screening retention

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

Local Health Integration Network	Percentage (95% confidence interval)			
	2008	2009	2010	2011
Ontario	**84.7 (84.5–84.9)**	**83.6 (83.5–83.8)**	**80.4 (80.3–80.6)**	**71.5 (71.3–71.6)**
Erie St. Clair	83.9 (83.2–84.7)	82.8 (82.1–83.6)	80.4 (79.6–81.1)	71.7 (71.0–72.4)
South West	84.0 (83.4–84.6)	82.7 (82.1–83.3)	79.1 (78.5–79.7)	70.0 (69.4–70.6)
Waterloo Wellington	85.0 (84.3–85.7)	83.7 (83.0–84.3)	80.2 (79.5–80.8)	70.7 (70.0–71.3)
Hamilton Niagara Haldimand Brant	84.1 (83.6–84.6)	82.9 (82.4–83.4)	79.1 (78.6–79.6)	70.3 (69.8–70.7)
Central West	83.3 (82.6–83.9)	81.9 (81.2–82.5)	78.7 (78.0–79.3)	69.5 (68.9–70.1)
Mississauga Halton	85.3 (84.8–85.9)	84.2 (83.6–84.7)	81.1 (80.6–81.6)	72.8 (72.3–73.3)
Toronto Central	84.5 (84.0–85.0)	83.5 (82.9–84.0)	80.3 (79.8–80.8)	71.4 (70.9–71.9)
Central	86.6 (86.2–87.0)	85.9 (85.5–86.3)	83.6 (83.2–84.0)	75.0 (74.6–75.4)
Central East	84.9 (84.4–85.4)	84.3 (83.8–84.7)	81.1 (80.6–81.5)	71.9 (71.5–72.3)
South East	84.4 (83.5–85.2)	82.7 (81.9–83.5)	78.8 (78.0–79.6)	69.2 (68.5–70.0)
Champlain	86.2 (85.7–86.7)	85.3 (84.8–85.8)	81.9 (81.4–82.4)	72.2 (71.8–72.7)
North Simcoe Muskoka	83.7 (82.8–84.7)	82.7 (81.8–83.6)	79.1 (78.3–80.0)	69.4 (68.6–70.2)
North East	79.0 (78.1–79.9)	77.5 (76.6–78.4)	73.8 (73.0–74.6)	65.8 (65.0–66.6)
North West	80.6 (79.3–81.9)	79.2 (78.0–80.5)	75.9 (74.7–77.1)	66.3 (65.2–67.5)

Data sources: OHIP CHDB, CytoBase, OCR, RPDB, PCCF+ version 6a.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

Table 21 Cervical cancer screening abnormal results

Percentage of Ontario screen-eligible women, ages 21-69, with an abnormal Pap test result in a given time period

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario	**5.0 (5.0–5.0)**	**5.4 (5.3–5.4)**	**6.4 (6.3–6.4)**	**5.2 (5.1–5.2)**
Erie St. Clair	7.0 (6.8–7.2)	7.3 (7.0–7.5)	8.9 (8.6–9.2)	5.6 (5.4–5.9)
South West	5.7 (5.6–5.9)	6.0 (5.8–6.1)	6.5 (6.2–6.7)	4.8 (4.6–5.0)
Waterloo Wellington	5.9 (5.7–6.1)	6.0 (5.8–6.2)	7.0 (6.8–7.2)	5.9 (5.7–6.1)
Hamilton Niagara Haldimand Brant	5.2 (5.0–5.3)	5.6 (5.5–5.8)	7.0 (6.8–7.1)	5.7 (5.6–5.9)
Central West	3.7 (3.6–3.9)	4.2 (4.0–4.3)	4.8 (4.6–5.0)	4.4 (4.2–4.6)
Mississauga Halton	4.1 (4.0–4.2)	4.4 (4.3–4.5)	5.3 (5.1–5.4)	4.2 (4.1–4.4)
Toronto Central	4.7 (4.5–4.8)	5.1 (4.9–5.2)	5.8 (5.6–6.0)	5.0 (4.9–5.2)
Central	4.0 (3.9–4.1)	4.5 (4.4–4.6)	5.3 (5.1–5.4)	4.5 (4.4–4.6)
Central East	4.3 (4.2–4.4)	4.7 (4.6–4.9)	5.6 (5.4–5.7)	4.5 (4.4–4.7)
South East	6.9 (6.7–7.2)	7.4 (7.2–7.7)	8.4 (8.1–8.7)	6.5 (6.2–6.7)
Champlain	4.7 (4.6–4.9)	5.0 (4.9–5.1)	6.6 (6.4–6.7)	5.6 (5.5–5.8)
North Simcoe Muskoka	5.9 (5.7–6.1)	6.5 (6.2–6.7)	7.9 (7.6–8.3)	6.1 (5.8–6.3)
North East	7.4 (7.1–7.6)	7.5 (7.3–7.8)	8.7 (8.3–9.0)	6.6 (6.3–6.9)
North West	7.8 (7.5–8.2)	8.4 (8.0–8.8)	10.0 (9.4–10.5)	7.1 (6.7–7.5)

Data sources: OHIP CHDB, CytoBase, OCR, RPDB, PCCF+ version 6a.

Table 22 Cervical cancer screening follow-up (low-grade Pap tests)

Percentage of Ontario screen-eligible women, ages 21–69, with a low-grade result on a Pap test who underwent a repeat Pap, colposcopy or definitive treatment within 9 months of the low-grade abnormal screen date

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario	**74.7 (74.3–75.0)**	**75.1 (74.8–75.5)**	**76.9 (76.5–77.3)**	**77.6 (77.2–78.1)**
Erie St. Clair	78.3 (77.0–79.6)	79.4 (78.0–80.8)	79.0 (77.4–80.6)	78.0 (76.0–80.0)
South West	75.0 (73.7–76.3)	73.2 (71.8–74.6)	77.7 (76.1–79.2)	77.5 (75.7–79.3)
Waterloo Wellington	77.1 (75.8–78.4)	76.6 (75.2–78.0)	77.0 (75.3–78.6)	77.6 (75.9–79.4)
Hamilton Niagara Haldimand Brant	74.6 (73.5–75.7)	73.9 (72.8–75.0)	77.0 (75.7–78.2)	77.0 (75.7–78.4)
Central West	72.0 (70.3–73.6)	72.9 (71.3–74.5)	75.5 (73.6–77.4)	75.7 (73.7–77.7)
Mississauga Halton	75.3 (74.0–76.5)	76.5 (75.3–77.8)	79.3 (77.9–80.7)	79.5 (77.9–81.0)
Toronto Central	74.6 (73.4–75.8)	76.0 (74.8–77.2)	77.4 (76.0–78.8)	79.5 (78.1–81.0)
Central	74.8 (73.8–75.8)	75.5 (74.5–76.5)	78.5 (77.3–79.6)	79.4 (78.1–80.6)
Central East	74.0 (72.9–75.1)	75.1 (74.0–76.2)	76.4 (75.1–77.7)	77.9 (76.5–79.3)
South East	74.3 (72.7–75.9)	76.8 (75.2–78.4)	75.1 (73.1–77.0)	75.7 (73.5–77.8)
Champlain	77.1 (76.0–78.2)	77.6 (76.5–78.8)	78.7 (77.4–80.0)	79.4 (78.0–80.8)
North Simcoe Muskoka	75.3 (73.5–77.1)	74.9 (73.0–76.6)	75.6 (73.5–77.6)	76.9 (74.6–79.1)
North East	67.6 (65.8–69.3)	67.5 (65.5–69.3)	70.4 (68.3–72.4)	74.1 (71.8–76.3)
North West	66.9 (64.4–69.3)	68.0 (65.4–70.4)	68.2 (65.3–71.1)	66.4 (63.1–69.5)

Data sources: OHIP CHDB, CytoBase, OCR, RPDB, PCCF+ version 6a.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

Table 23 Cervical cancer screening follow-up (high-grade Pap tests)

Percentage of Ontario screen-eligible women, ages 21–69, 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

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario	**79.7 (78.7–80.7)**	**80.4 (79.4–81.4)**	**82.7 (81.6–83.9)**	**84.0 (82.8–85.2)**
Erie St. Clair	64.6 (60.7–68.4)	63.6 (59.8–67.2)	66.6 (62.0–70.9)	71.6 (66.3–76.6)
South West	77.5 (73.7–81.1)	80.8 (77.0–84.3)	85.0 (80.6–89.1)	84.0 (79.3–88.3)
Waterloo Wellington	81.0 (77.1–84.7)	77.2 (72.8–81.3)	80.7 (75.8–85.2)	83.6 (78.3–88.4)
Hamilton Niagara Haldimand Brant	83.2 (80.4–86.0)	84.1 (81.3–86.8)	82.4 (78.6–85.9)	82.2 (78.4–85.8)
Central West	82.3 (77.5–86.8)	83.7 (79.2–87.9)	81.4 (75.3–86.9)	84.3 (78.9–89.2)
Mississauga Halton	82.0 (78.2–85.7)	87.2 (83.9–90.3)	91.9 (88.3–95.1)	85.7 (81.1–89.9)
Toronto Central	84.5 (81.3–87.6)	83.9 (80.5–87.1)	86.2 (82.3–89.8)	89.3 (85.9–92.4)
Central	79.2 (75.9–82.3)	82.8 (79.7–85.6)	83.9 (80.1–87.4)	87.1 (83.7–90.2)
Central East	83.7 (80.8–86.5)	85.2 (82.3–87.9)	86.0 (82.6–89.2)	87.1 (83.3–90.5)
South East	86.5 (82.9–89.8)	83.9 (79.8–87.7)	88.0 (83.3–92.2)	85.8 (79.5–91.4)
Champlain	76.1 (72.6–79.4)	80.3 (76.7–83.7)	85.2 (81.5–88.7)	84.3 (80.3–88.0)
North Simcoe Muskoka	83.1 (78.4–87.4)	82.7 (77.7–87.3)	87.2 (82.0–91.8)	90.3 (85.3–94.6)
North East	80.0 (75.1–84.5)	77.5 (72.3–82.3)	87.3 (82.5–91.5)	86.2 (80.4–91.3)
North West	75.0 (68.2–81.3)	71.7 (64.0–78.7)	66.4 (57.1–74.7)	67.9 (58.6–76.3)

Data sources: OHIP CHDB, CytoBase, OCR, RPDB, PCCF+ version 6a.

Table 24 Pap test positive predictive value

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

Local Health Integration Network	Percentage (95% confidence interval)			
	2010	2011	2012	2013
Ontario	**4.7 (4.5–4.9)**	**4.6 (4.5–4.8)**	**4.9 (4.7–5.0)**	**6.6 (6.3–6.8)**
Erie St. Clair	2.3 (1.8–2.7)	2.6 (2.1–3.0)	2.7 (2.2–3.2)	3.5 (2.8–4.1)
South West	4.5 (4.0–5.1)	4.8 (4.2–5.4)	5.0 (4.4–5.7)	7.2 (6.3–8.2)
Waterloo Wellington	5.7 (5.0–6.4)	5.3 (4.6–6.0)	4.6 (3.9–5.3)	6.9 (6.0–7.9)
Hamilton Niagara Haldimand Brant	4.9 (4.4–5.4)	5.9 (5.3–6.4)	5.2 (4.7–5.7)	6.3 (5.6–7.0)
Central West	3.8 (3.1–4.4)	4.5 (3.8–5.3)	4.5 (3.8–5.3)	6.3 (5.2–7.3)
Mississauga Halton	4.2 (3.6–4.8)	4.0 (3.4–4.5)	5.1 (4.5–5.7)	6.7 (5.9–7.6)
Toronto Central	5.2 (4.7–5.8)	3.9 (3.4–4.4)	5.2 (4.6–5.8)	7.6 (6.7–8.4)
Central	3.9 (3.5–4.4)	3.8 (3.3–4.2)	4.5 (4.0–5.0)	6.5 (5.8–7.1)
Central East	6.4 (5.8–7.0)	5.9 (5.4–6.5)	5.9 (5.3–6.4)	7.3 (6.6–8.1)
South East	4.9 (4.2–5.7)	3.7 (3.0–4.3)	4.1 (3.4–4.8)	6.2 (5.1–7.2)
Champlain	4.7 (4.2–5.2)	4.6 (4.0–5.1)	5.2 (4.6–5.8)	6.1 (5.4–6.9)
North Simcoe Muskoka	4.6 (3.8–5.4)	5.6 (4.6–6.4)	5.4 (4.5–6.3)	8.2 (6.9–9.4)
North East	4.6 (3.9–5.3)	4.8 (4.0–5.6)	5.4 (4.5–6.2)	6.8 (5.7–7.9)
North West	5.4 (4.1–6.6)	5.9 (4.7–7.0)	3.6 (2.6–4.6)	5.6 (4.2–6.9)

Data sources: OHIP CHDB, CytoBase, OCR, RPDB, PCCF+ version 6a.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

Table 25 Pap test negative predictive value

Probability of remaining free of carcinoma in situ within 3 years of a negative Pap test

Age group	Percentage		
	2008	2009	2010
21–69	**99.80**	**99.85**	**99.85**
21–29	99.59	99.60	99.60
30–39	99.81	99.81	99.80
40–49	99.90	99.91	99.92
50–59	99.96	99.97	99.97
60–69	99.98	99.98	99.98

Data sources: OHIP CHDB, CytoBase, OCR, RPDB, PCCF+ version 6a.

Table 26 Cervical cancer and pre–cancer detection rate

Proportion of Ontario women, ages 21–69, with a screen-detected invasive cervical cancer or pre-cancer, per 1,000 screened using a Pap test

Local Health Integration Network	Rate per 1,000 screened (95% confidence interval)			
	2010	2011	2012	2013
Ontario	**2.3 (2.2–2.3)**	**2.2 (2.1–2.3)**	**2.5 (2.4–2.6)**	**3.8 (3.7–4.0)**
Erie St. Clair	1.5 (1.2–1.8)	1.7 (1.4–2.0)	1.9 (1.5–2.2)	2.8 (2.2–3.4)
South West	2.5 (2.1–2.8)	2.6 (2.2–2.9)	2.8 (2.4–3.2)	4.3 (3.7–4.9)
Waterloo Wellington	3.2 (2.8–3.6)	2.9 (2.5–3.3)	2.6 (2.2–3.0)	4.5 (3.8–5.1)
Hamilton Niagara Haldimand Brant	2.6 (2.4–2.9)	2.9 (2.6–3.1)	2.8 (2.5–3.0)	4.0 (3.6–4.5)
Central West	1.4 (1.1–1.7)	1.6 (1.4–1.9)	1.8 (1.5–2.1)	2.8 (2.3–3.3)
Mississauga Halton	1.6 (1.4–1.8)	1.6 (1.4–1.8)	2.1 (1.9–2.4)	3.3 (2.9–3.7)
Toronto Central	2.4 (2.1–2.7)	1.8 (1.5–2.0)	2.5 (2.2–2.8)	4.1 (3.6–4.5)
Central	1.4 (1.3–1.6)	1.4 (1.2–1.6)	1.9 (1.7–2.1)	3.1 (2.7–3.4)
Central East	2.7 (2.4–2.9)	2.4 (2.2–2.7)	2.7 (2.4–2.9)	3.8 (3.4–4.2)
South East	3.1 (2.6–3.6)	2.4 (2.0–2.8)	2.9 (2.4–3.4)	4.7 (3.9–5.5)
Champlain	2.1 (1.9–2.4)	2.0 (1.8–2.3)	2.5 (2.2–2.7)	3.6 (3.2–4.0)
North Simcoe Muskoka	2.6 (2.1–3.0)	3.1 (2.5–3.6)	3.3 (2.8–3.9)	6.0 (5.0–6.9)
North East	3.6 (3.0–4.1)	3.2 (2.7–3.7)	3.7 (3.1–4.3)	5.2 (4.3–6.0)
North West	3.2 (2.4–3.9)	4.3 (3.4–5.2)	2.8 (2.0–3.6)	5.0 (3.7–6.2)

Data sources: OHIP CHDB, CytoBase, OCR, RPDB, PCCF+ version 6a.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

ColonCancerCheck (CCC)

Table 27 Percentage overdue for colorectal cancer screening

Age-adjusted percentage of Ontario screen-eligible people, ages 50–74, who were overdue for colorectal cancer screening in a calendar year

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario	**43.5 (43.5–43.6)**	**41.9 (41.9–42.0)**	**41.4 (41.4–41.5)**	**39.9 (39.9–40.0)**
Erie St. Clair	44.9 (44.7–45.2)	43.4 (43.1–43.6)	42.2 (41.9–42.4)	40.2 (40.0–40.4)
South West	45.8 (45.6–46.0)	44.3 (44.2–44.5)	44.0 (43.9–44.2)	42.7 (42.5–42.9)
Waterloo Wellington	42.0 (41.8–42.2)	41.4 (41.1–41.6)	41.6 (41.4–41.8)	40.9 (40.7–41.1)
Hamilton Niagara Haldimand Brant	45.4 (45.2–45.5)	43.7 (43.6–43.9)	43.5 (43.3–43.6)	42.3 (42.2–42.4)
Central West	47.8 (47.6–48.0)	45.5 (45.3–45.7)	44.6 (44.4–44.8)	41.9 (41.7–42.1)
Mississauga Halton	43.3 (43.2–43.5)	41.6 (41.5–41.8)	41.1 (41.0–41.3)	39.3 (39.2–39.5)
Toronto Central	45.1 (45.0–45.3)	43.9 (43.7–44.0)	43.3 (43.1–43.5)	41.5 (41.3–41.7)
Central	39.6 (39.5–39.7)	38.2 (38.0–38.3)	37.8 (37.7–37.9)	36.2 (36.1–36.4)
Central East	41.2 (41.1–41.4)	39.8 (39.7–40.0)	39.5 (39.4–39.7)	38.0 (37.9–38.2)
South East	45.9 (45.7–46.2)	44.2 (44.0–44.5)	43.8 (43.6–44.1)	43.0 (42.8–43.2)
Champlain	42.8 (42.6–42.9)	40.9 (40.8–41.1)	40.4 (40.3–40.6)	39.0 (38.8–39.1)
North Simcoe Muskoka	40.1 (39.9–40.4)	38.2 (38.0–38.5)	37.4 (37.2–37.7)	36.1 (35.8–36.3)
North East	44.3 (44.1–44.6)	42.8 (42.6–43.0)	41.8 (41.5–42.0)	40.6 (40.4–40.8)
North West	48.8 (48.4–49.1)	47.4 (47.0–47.8)	46.2 (45.9–46.6)	44.2 (43.9–44.5)

Data sources: OHIP CHDB, LRT, CIRT, OCR, RPDB, PCCF+ version 6a.

Table 28 Guaiac fecal occult blood test (gFOBT) abnormal results

Percentage of Ontario screen-eligible people, ages 50–74, with an abnormal gFOBT result (program screening data only)

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario	**4.2 (4.1–4.3)**	**4.0 (4.0–4.1)**	**4.0 (4.0–4.1)**	**4.0 (3.9–4.0)**
Erie St. Clair	4.4 (4.2–4.7)	4.8 (4.5–5.1)	4.5 (4.2–4.7)	4.3 (4.1–4.6)
South West	3.7 (3.5–3.9)	3.8 (3.6–4.0)	3.8 (3.6–4.0)	3.7 (3.5–3.8)
Waterloo Wellington	3.8 (3.5–4.0)	3.6 (3.4–3.8)	3.5 (3.3–3.7)	3.2 (3.0–3.4)
Hamilton Niagara Haldimand Brant	4.0 (3.8–4.1)	3.9 (3.7–4.1)	4.1 (3.9–4.2)	3.8 (3.6–3.9)
Central West	4.3 (4.1–4.6)	3.9 (3.6–4.1)	3.8 (3.5–4.0)	3.8 (3.6–4.0)
Mississauga Halton	4.1 (3.9–4.3)	3.9 (3.7–4.1)	3.9 (3.6–4.1)	4.0 (3.8–4.2)
Toronto Central	4.3 (4.0–4.5)	4.1 (3.9–4.3)	4.2 (3.9–4.4)	4.1 (3.8–4.3)
Central	4.9 (4.8–5.1)	4.4 (4.2–4.6)	4.4 (4.2–4.5)	4.5 (4.3–4.7)
Central East	4.5 (4.3–4.7)	4.3 (4.1–4.4)	4.2 (4.0–4.4)	4.4 (4.3–4.6)
South East	3.9 (3.7–4.2)	4.0 (3.8–4.3)	4.1 (3.8–4.4)	3.9 (3.7–4.2)
Champlain	3.9 (3.7–4.0)	3.4 (3.2–3.5)	3.5 (3.4–3.7)	3.6 (3.4–3.7)
North Simcoe Muskoka	3.7 (3.4–4.0)	3.8 (3.5–4.1)	3.8 (3.5–4.1)	3.7 (3.4–4.0)
North East	4.7 (4.4–5.0)	4.9 (4.6–5.2)	4.8 (4.5–5.1)	4.3 (4.0–4.6)
North West	4.4 (3.9–4.8)	4.5 (4.1–5.0)	4.8 (4.3–5.3)	4.2 (3.7–4.6)

Data Sources: OHIP CHDB, LRT, OCR, RPDB, PCCF+ version 6a.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

Table 29 Colonoscopy within 6 months of abnormal guaiac fecal occult blood test (gFOBT) result

Percentage of Ontario screen-eligible people, ages 50–74, with an abnormal gFOBT result who underwent colonoscopy within 6 months of the date of the abnormal gFOBT result

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario	**74.6 (74.0-75.2)**	**75.9 (75.3-76.5)**	**77.5 (77.0-78.1)**	**77.1 (76.5-77.7)**
Erie St. Clair	74.2 (71.5-76.7)	78.4 (75.9-80.7)	79.8 (77.3-82.2)	78.3 (75.8-80.7)
South West	74.1 (71.9-76.3)	77.8 (75.8-79.9)	80.8 (78.8-82.8)	80.9 (78.8-82.8)
Waterloo Wellington	84.6 (82.4-86.6)	81.2 (78.8-83.6)	82.2 (79.7-84.5)	82.2 (79.7-84.6)
Hamilton Niagara Haldimand Brant	79.7 (78.1-81.3)	79.6 (77.9-81.3)	81.4 (79.7-83.0)	79.7 (78.0-81.4)
Central West	70.6 (67.8-73.3)	71.8 (68.9-74.6)	74.7 (71.9-77.4)	77.4 (74.9-79.8)
Mississauga Halton	70.8 (68.5-73.1)	72.3 (69.9-74.7)	75.5 (73.2-77.8)	76.8 (74.6-78.9)
Toronto Central	67.5 (65.0-69.9)	66.5 (63.9-69.1)	65.6 (63.0-68.1)	68.9 (66.5-71.3)
Central	72.6 (71.0-74.2)	75.0 (73.2-76.6)	75.7 (74.0-77.3)	72.3 (70.6-74.0)
Central East	74.8 (73.1-76.4)	74.9 (73.2-76.6)	77.6 (75.9-79.3)	76.5 (74.8-78.1)
South East	77.2 (74.4-79.9)	78.5 (75.9-81.1)	80.6 (78.0-83.1)	79.6 (77.0-82.2)
Champlain	74.1 (72.3-75.9)	74.7 (72.8-76.6)	77.9 (76.1-79.7)	79.6 (77.8-81.2)
North Simcoe Muskoka	78.9 (75.5-82.2)	82.0 (78.7-85.1)	80.8 (77.5-84.0)	79.7 (76.3-82.9)
North East	73.2 (70.3-76.0)	77.1 (74.4-79.6)	76.7 (73.9-79.3)	75.9 (73.1-78.7)
North West	77.3 (72.7-81.5)	78.0 (73.5-82.2)	80.9 (76.9-84.7)	82.4 (78.3-86.3)

Data sources: OHIP CHDB, LRT, CIRT, OCR, RPDB, PCCF+ version 6a.

Table 30 Colonoscopy within 8 weeks of abnormal guaiac fecal occult blood test (gFOBT) result

Percentage of Ontario screen-eligible people, ages 50–74, with an abnormal gFOBT result who underwent colonoscopy within 8 weeks of the date of the abnormal gFOBT result

Local Health Integration Network	Percentage (95% confidence interval)			
	2011	2012	2013	2014
Ontario	**38.3 (37.6–39.0)**	**41.7 (41.0–42.4)**	**46.4 (45.6–47.1)**	**45.5 (44.8–46.2)**
Erie St. Clair	34.7 (31.8–37.5)	39.3 (36.4–42.1)	41.8 (38.8–44.8)	41.8 (38.8–44.7)
South West	30.5 (28.1–32.7)	38.0 (35.5–40.3)	45.0 (42.5–47.5)	44.6 (42.0–47.1)
Waterloo Wellington	54.7 (51.8–57.6)	50.7 (47.6–53.7)	49.2 (46.0–52.3)	52.0 (48.7–55.2)
Hamilton Niagara Haldimand Brant	41.1 (39.1–43.0)	45.8 (43.7–47.9)	49.6 (47.5–51.6)	46.2 (44.1–48.3)
Central West	34.8 (31.9–37.6)	39.7 (36.6–42.8)	48.8 (45.5–51.9)	50.1 (47.1–53.0)
Mississauga Halton	35.3 (32.9–37.7)	38.9 (36.3–41.5)	47.9 (45.2–50.6)	47.9 (45.3–50.4)
Toronto Central	36.1 (33.6–38.6)	38.5 (35.8–41.1)	41.3 (38.6–43.9)	36.4 (33.9–38.9)
Central	47.1 (45.3–48.8)	51.3 (49.3–53.2)	53.7 (51.7–55.6)	48.4 (46.5–50.2)
Central East	39.4 (37.5–41.3)	38.9 (37.0–40.9)	46.5 (44.5–48.6)	45.5 (43.6–47.4)
South East	28.7 (25.8–31.6)	34.9 (31.8–37.9)	43.8 (40.5–46.9)	41.4 (38.2–44.6)
Champlain	35.8 (33.8–37.7)	36.9 (34.8–39.0)	40.1 (37.9–42.3)	45.0 (42.9–47.1)
North Simcoe Muskoka	42.7 (38.5–46.7)	50.6 (46.4–54.7)	49.5 (45.2–53.6)	43.9 (39.7–47.9)
North East	23.7 (20.9–26.3)	35.5 (32.4–38.4)	40.2 (37.0–43.3)	45.7 (42.4–48.9)
North West	35.9 (30.6–40.8)	41.4 (36.1–46.5)	43.6 (38.5–48.4)	42.1 (36.7–47.1)

Data sources: OHIP CHDB, LRT, CIRT, OCR, RPDB, PCCF+ version 6a.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

Table 31 Guaiac fecal occult blood test (gFOBT) positive predictive value

Percentage of Ontario screen-eligible people, ages 50–74, with an abnormal gFOBT result who were diagnosed with colorectal cancer*

Local Health Integration Network	Percentage (95% confidence interval)			
	2010	2011	2012	2013
Ontario	**5.2 (4.8–5.6)**	**4.4 (4.0–4.7)**	**4.2 (3.9–4.5)**	**4.4 (4.1–4.8)**
Erie St. Clair	3.6 (2.0–5.1)	4.4 (3.0–5.9)	4.1 (2.7–5.4)	4.2 (2.8–5.6)
South West	6.5 (5.0–8.1)	5.3 (4.0–6.7)	3.6 (2.6–4.7)	5.1 (3.9–6.4)
Waterloo Wellington	6.3 (4.6–8.0)	6.1 (4.5–7.6)	5.2 (3.7–6.8)	4.5 (3.0–6.0)
Hamilton Niagara Haldimand Brant	6.7 (5.4–7.9)	6.0 (4.9–7.1)	5.1 (4.0–6.1)	5.7 (4.6–6.8)
Central West	4.7 (2.9–6.5)	3.4 (2.0–4.7)	5.0 (3.3–6.7)	4.7 (3.1–6.3)
Mississauga Halton	5.1 (3.6–6.6)	5.5 (4.1–6.9)	4.8 (3.4–6.2)	4.1 (2.8–5.4)
Toronto Central	4.5 (3.0–6.0)	4.4 (3.1–5.8)	3.8 (2.4–5.1)	3.3 (2.1–4.5)
Central	2.5 (1.7–3.2)	2.8 (2.1–3.5)	3.3 (2.4–4.1)	3.4 (2.6–4.2)
Central East	4.6 (3.5–5.6)	3.1 (2.3–3.8)	3.9 (2.9–4.8)	3.9 (3.0–4.8)
South East	5.3 (3.3–7.2)	4.5 (2.9–6.1)	5.0 (3.4–6.6)	6.6 (4.7–8.4)
Champlain	6.7 (5.3–8.1)	4.7 (3.6–5.7)	4.7 (3.6–5.8)	4.8 (3.7–5.9)
North Simcoe Muskoka	7.1 (4.4–9.9)	4.3 (2.3–6.3)	4.1 (2.2–6.0)	4.2 (2.2–6.1)
North East	6.0 (4.0–8.0)	3.7 (2.3–5.2)	2.9 (1.7–4.2)	4.0 (2.6–5.5)
North West	7.1 (3.7–10.4)	2.6 (0.5–4.7)	4.1 (1.5–6.6)	2.8 (0.9–4.8)

Data sources: OHIP CHDB, LRT, OCR, RPDB, PCCF+ version 6a.

*Colorectal cancers were defined as "screen-detected" if the person had:

- An abnormal gFOBT followed up by a large bowel endoscopy or colonic surgical resection within 183 days, and
- Date of colorectal cancer in OCR occurred between seven days before and up to 91 days after large bowel endoscopy or within ±7 days of surgery, and
- Date of colorectal cancer in OCR occurred up to 190 days after the abnormal gFOBT result.

Table 32 Interval colorectal cancer incidence rate

Number of Ontario screen-eligible people, ages 50–74, who were diagnosed with colorectal cancer in the 2 years following a normal guaiac fecal occult blood test (gFOBT) result, per 1,000 normal gFOBTs

Local Health Integration Network	Rate per 1,000 normal gFOBTs (95% confidence interval)			
	2009	2010	2011	2012
Ontario	**1.7 (1.5–1.8)**	**1.7 (1.5–1.8)**	**1.6 (1.5–1.8)**	**1.3 (1.2–1.4)**
Erie St. Clair	1.5 (0.8–2.3)	2.3 (1.4–3.1)	2.1 (1.4–2.8)	1.8 (1.1–2.5)
South West	1.6 (1.1–2.2)	1.5 (1.1–2.0)	2.2 (1.7–2.7)	1.6 (1.1–2.0)
Waterloo Wellington	1.6 (1.0–2.3)	1.8 (1.2–2.4)	1.7 (1.1–2.2)	1.1 (0.6–1.6)
Hamilton Niagara Haldimand Brant	1.9 (1.4–2.3)	1.8 (1.4–2.3)	1.9 (1.5–2.3)	1.3 (0.9–1.6)
Central West	1.4 (0.7–2.1)	1.4 (0.8–2.0)	1.4 (0.8–1.9)	1.0 (0.5–1.5)
Mississauga Halton	1.5 (0.9–2.0)	1.1 (0.7–1.6)	1.6 (1.1–2.1)	1.0 (0.5–1.4)
Toronto Central	1.5 (0.9–2.2)	1.7 (1.0–2.3)	0.9 (0.5–1.3)	1.1 (0.6–1.5)
Central	1.1 (0.7–1.4)	1.5 (1.1–1.9)	1.5 (1.1–1.8)	0.7 (0.4–0.9)
Central East	1.7 (1.2–2.2)	1.5 (1.1–2.0)	1.2 (0.9–1.6)	1.3 (0.9–1.7)
South East	2.2 (1.4–3.0)	1.7 (1.0–2.4)	2.1 (1.4–2.7)	1.7 (1.1–2.3)
Champlain	1.8 (1.4–2.3)	1.8 (1.4–2.2)	1.4 (1.1–1.8)	1.7 (1.3–2.1)
North Simcoe Muskoka	2.3 (1.2–3.4)	2.1 (1.1–3.0)	1.9 (1.0–2.8)	1.6 (0.8–2.4)
North East	2.3 (1.3–3.3)	2.2 (1.3–3.0)	1.7 (1.0–2.5)	1.8 (1.1–2.5)
North West	1.5 (0.2–2.8)	1.7 (0.4–2.9)	2.7 (1.2–4.1)	1.9 (0.6–3.1)

Data sources: OHIP CHDB, LRT, OCR, RPDB, PCCF+ version 6a.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

Coverage
Participation
Retention

Follow-up
Proportion of abnormal results
Follow-up of abnormal results
Diagnostic interval

Quality of screening
Sensitivity
Positive predictive value

Detection
Pre-cancer detection rate
Invasive cancer detection rate
Interval cancer detection rate

Disease extent at diagnosis
Early stage invasive cancer detection rate

Table 33 Invasive colorectal cancer detection rate for guaiac fecal occult blood test (gFOBT)

Number of Ontario screen-eligible people, ages 50–74, with a detected invasive colorectal cancer, per 1,000 screened using ColonCancerCheck program gFOBTs

Local Health Integration Network	Rate per 1,000 screened (95% confidence interval)			
	2010	2011	2012	2013
Ontario	**1.5 (1.4–1.6)**	**1.3 (1.2–1.5)**	**1.3 (1.2–1.4)**	**1.4 (1.3–1.5)**
Erie St. Clair	1.0 (0.6–1.5)	1.3 (0.8–1.7)	1.5 (1.0–2.0)	1.5 (1.0–2.0)
South West	1.7 (1.3–2.2)	1.4 (1.0–1.8)	1.1 (0.8–1.5)	1.5 (1.1–1.8)
Waterloo Wellington	1.7 (1.2–2.2)	1.8 (1.3–2.2)	1.5 (1.0–2.0)	1.5 (1.0–2.0)
Hamilton Niagara Haldimand Brant	2.1 (1.7–2.5)	1.9 (1.5–2.3)	1.5 (1.2–1.8)	1.9 (1.5–2.2)
Central West	1.4 (0.9–2.0)	1.0 (0.6–1.4)	1.4 (0.9–1.9)	1.3 (0.8–1.7)
Mississauga Halton	1.5 (1.0–1.9)	1.6 (1.1–2.0)	1.3 (0.9–1.7)	1.2 (0.8–1.6)
Toronto Central	1.3 (0.8–1.7)	1.3 (0.9–1.7)	1.0 (0.6–1.4)	0.8 (0.5–1.1)
Central	0.8 (0.6–1.1)	1.0 (0.7–1.2)	1.0 (0.8–1.3)	1.1 (0.8–1.4)
Central East	1.4 (1.1–1.8)	1.1 (0.8–1.3)	1.3 (1.0–1.6)	1.2 (0.9–1.5)
South East	1.5 (0.9–2.0)	1.4 (0.9–1.9)	1.5 (1.0–2.1)	2.2 (1.6–2.9)
Champlain	1.6 (1.2–1.9)	1.3 (1.0–1.6)	1.1 (0.8–1.4)	1.3 (1.0–1.6)
North Simcoe Muskoka	1.9 (1.1–2.7)	1.3 (0.7–1.9)	1.2 (0.6–1.8)	1.3 (0.7–2.0)
North East	1.7 (1.1–2.3)	1.3 (0.8–1.8)	1.1 (0.6–1.6)	1.5 (0.9–2.0)
North West	2.7 (1.4–4.0)	0.9 (0.2–1.6)	1.5 (0.5–2.4)	1.0 (0.2–1.8)

Data sources: OHIP CHDB, LRT, OCR, RPDB, PCCF+ version 6a.

Table 34 Invasive colorectal cancer detection rate (family history of colorectal cancer)

Percentage of Ontario screen-eligible people, ages 50–74, with family history who had a colonoscopy diagnosed with invasive colorectal cancer, per 1,000 screened

Local Health Integration Network	Rate per 1,000 screened (95% confidence interval)			
	2010	2011	2012	2013
Ontario	**4.6 (3.7-5.4)**	**4.5 (3.7-5.4)**	**4.2 (3.5-5.0)**	**3.9 (3.1-4.7)**
Erie St. Clair	1.9 (0.0-4.1)	6.5 (2.6-10.4)	4.3 (1.2-7.3)	6.2 (2.4-9.9)
South West	0.7 (0.0-2.5)	3.2 (0.4-6.0)	3.8 (1.1-6.4)	3.4 (0.6-6.1)
Waterloo Wellington	4.5 (1.1-7.8)	6.9 (2.7-11.2)	4.0 (0.5-7.6)	4.8 (0.6-9.1)
Hamilton Niagara Haldimand Brant	3.3 (1.3-5.3)	3.9 (1.8-6.0)	4.1 (2.2-6.0)	3.2 (1.4-5.0)
Central West	7.2 (0.0-19.1)	3.3 (0.0-11.3)	0.0 (0.0-0.6)	8.1 (0.2-16.0)
Mississauga Halton	7.4 (2.5-12.4)	5.6 (1.1-10.2)	6.1 (2.0-10.2)	1.7 (0.0-4.4)
Toronto Central	4.3 (0.0-9.1)	3.1 (0.0-7.2)	3.7 (0.1-7.3)	5.7 (0.7-10.7)
Central	4.2 (0.8-7.6)	4.6 (1.4-7.9)	3.2 (0.9-5.4)	3.0 (0.6-5.4)
Central East	6.0 (3.2-8.9)	3.8 (1.6-6.1)	6.1 (3.5-8.7)	3.3 (1.3-5.3)
South East	4.3 (1.0-7.5)	1.9 (0.0-4.1)	6.0 (2.5-9.5)	4.9 (1.6-8.2)
Champlain	5.9 (3.1-8.6)	6.1 (3.3-8.9)	4.0 (1.8-6.2)	4.8 (2.2-7.4)
North Simcoe Muskoka	7.9 (0.9-14.8)	6.2 (0.2-12.2)	2.5 (0.0-5.8)	1.0 (0.0-3.5)
North East	6.4 (1.2-11.7)	5.8 (1.1-10.6)	2.4 (0.0-5.6)	3.0 (0.0-6.8)
North West	2.9 (0.0-7.5)	0.0 (0.0-0.8)	4.8 (0.0-11.1)	3.6 (0.0-9.5)

Data sources: OHIP, CIRT, LRT, OCR, RPDB, PCCF+ version 6a.

Cancer screening program evaluation framework (Screening Performance Measures Group) [13]

- **Coverage**
  - Participation
  - Retention
- **Follow-up**
  - Proportion of abnormal results
  - Follow-up of abnormal results
  - Diagnostic interval
- **Quality of screening**
  - Sensitivity
  - Positive predictive value
- **Detection**
  - Pre-cancer detection rate
  - Invasive cancer detection rate
  - Interval cancer detection rate
- **Disease extent at diagnosis**
  - Early stage invasive cancer detection rate

APPENDICES

APPENDIX I: SUMMARY OF COMPLETED CORRESPONDENCE EVALUATIONS

Evaluation objectives	Study design and population	Key findings
Ontario Cervical Screening Program (OCSP) invitation letter evaluation [74]		
• **To determine the factors associated with screening and screening patterns of eligible women who were mailed an OCSP invitation letter** • **To evaluate the impact of OCSP invitation letters on screening participation**	A cross-sectional design was used to determine the factors associated with screening and screening patterns for eligible women who were sent an invitation letter from November 2013 to April 2014. A historical cohort design was used to evaluate the impact of invitation letters on screening participation. A selected sample of screen-eligible women who were sent invitation letters were compared to a historical and equivalent group of women who were not sent invitation letters at the time of their eligibility (January 2013). Pap test uptake was assessed nine months after letter send-out.	Overall, 1,150,783 screen-eligible women were mailed an invitation letter from November 2013–April 2014 and 153,617 (13%) women were screened within the first nine months after letter send-out. Women who were sent an invitation letter were significantly more likely to have a Pap test than women who were not sent an invitation letter (AOR=1.74, 95% CI 1.69–1.79), after controlling for relevant confounding variables. Pap test screening uptake was higher among women who had a recent Pap test (three–five years prior), women who were rostered to patient enrolment model (PEM) physicians and younger women.
OCSP recall letter evaluation [88]		
• **To evaluate the impact of OCSP recall letters on women due to return for screening**	A historical cohort design was used to evaluate the impact of recall letters on return to screening. Screen-eligible women who were due for screening and sent recall letters in November 2013 were compared to a historical and equivalent group of women who did not receive recall letters, but would have been eligible to receive it exactly one year earlier (November 2012). Pap test uptake was assessed nine months after letter send-out.	Among women who were sent recall letters, 2,226 of 5,182 of them (43%) completed a Pap test within nine months of follow-up, compared to only 1,198 of 4,223 women (28%) who were not sent recall letters and completed a Pap test within nine months of follow-up. Being sent a recall letter was significantly associated with a greater likelihood of return for screening (AOR=1.82, 95% CI 1.66–1.99) after controlling for relevant confounding variables. Women were more likely to return for screening if they have had more Pap tests in the past and if they were rostered to a PEM physician.
ColonCancerCheck (CCC) invitation letter evaluation [75]		
• **To evaluate the impact of CCC invitation letters on screening participation** • **To evaluate the effect of tailored CCC invitation letters (gender-neutral and male-specific) ompared to standard invitation letters on screening participation**	Two multi-arm randomized controlled trials (one male, one female) were conducted: • Screen-eligible men were randomly assigned to one of four groups: male-specific invitation letter, gender-neutral invitation letter, standard CCC invitation[†††] letter and no invitation (invitation delayed until after trial completion). • Screen-eligible women were randomly assigned to one of three groups: gender-neutral invitation letter, standard CCC invitation letter and no invitation[‡‡‡]. Letters were sent in February 2014. Colorectal cancer screening participation was assessed five months after letter send-out.	There were 39,493 screen-eligible men and 35,824 screen-eligible women included in the trials. Overall, sending any type of invitation letter significantly increased guaiac fecal occult blood test (gFOBT) participation for men and women (AOR ranging from 6.0 [95% CI 4.77–7.55] to 7.23 [95% CI 5.76–9.07]), compared to no letter. For men, gFOBT uptake was 0.95%, 5.43%, 6.08% and 6.49% in the no letter, standard, gender neutral and male-specific letter groups, respectively. All letter types were found to be significantly more effective than no letter sent. The male-specific letter was found to be significantly more effective in men than the standard letter (OR=1.21, 95% CI 1.07–1.36). The number of male-specific letters that needed to be sent before one person got screened was 18, compared to 22 of the standard letters. For women, gFOBT uptake was 1.11%, 7.06% and 7.37% in the no letter, standard and gender neutral letter groups, respectively. The standard and gender neutral letters were found to be significantly more effective than no letter sent. No significant difference was observed between the letter types. The number of standard letters that needed to be sent before one person got screened was 17, compared to 16 of the gender-neutral letters (not significantly different).
Ontario Breast Screening Program (OBSP) invitation letter evaluation [59]		
• **To evaluate the impact of OBSP invitation letters on screening participation for women who recently turned 50**	A two-arm randomized controlled trial was conducted. Screen-eligible women who recently turned 50 and eligible to receive OBSP invitation letters were randomly assigned to an intervention or control group. The intervention group was sent an invitation letter from October to December 2014, while invitation letters were withheld from the control group for four months. Breast cancer screening participation was assessed four months after letter send-out. An additional time-series analysis was done to compare breast cancer screening participation in years before and after the introduction of the OBSP invitation campaign.	There were 5,719 and 5,502 screen-eligible women randomly assigned to the intervention group and control group, respectively. In the intervention group, 981 (17.2%) women were screened with mammography within four months of being mailed an invitation letter, compared to 704 (12.8%) women who were screened in the control group. Women who were sent an invitation letter were significantly more likely to screen with mammography within the first four months of being mailed the letter (RR=1.34, 95% CI 1.23–1.47) than women who were not sent a letter. Twelve months after March 2014 (when OBSP invitation letters were officially launched), breast cancer screening participation had increased to 27.7% among 50-year old screen-eligible women, compared to 23% over the previous 12 months.

[†††] The standard CCC invitation letter was the original letter template used in CCC. In 2013, Cancer Care Ontario conducted expert assessments and focus group testing of the standard letter to improve the quality of CCC correspondence. Based on focus group testing results and expert recommendations, two new versions of invitation letter were developed: gender-neutral and male-specific letters.

[‡‡‡] A female-specific letter was not developed because prior focus group testing did not identify any messages that appealed to women only.

Notes: AOR: adjusted odds ratio, CI: confidence interval, RR: rate ratio

APPENDIX II: INDICATOR METHODOLOGIES

Ontario Breast Screening Program (OBSP): Average Risk

Table 35 **Breast cancer screening participation**

Average risk indicator	Breast cancer screening participation	
Indicator definitio	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 a given 30-month period	X100 = Mammogram Participation
Denominator	Total number of Ontario screen-eligible women, 50–74 years old, in a given 30-month period • Ontario screen-eligible women ages 50–74 at the index date • Index date was defined as the midpoint in the reporting period, e.g. Jan 1st 2012 for 2011-2012 • The 2011 Canadian population was used as the standard population for calculating age-standardized rates • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN • Neighbourhood income quintile was determined using PCCF+, version 6A; this indicator was based on income quintiles developed by Statistics Canada; income quintiles range from 1 to 5 (low to high) • Rural or urban residence was determined using PCCF+, version 6A. This indicator was based on whether people lived within a census metropolitan area (CMA), census agglomeration (CA) or Influenced Zones (MIZ) which takes into account population size, distance and commuting flow between rural and small towns and larger centres. - Urban: CMAs or CAs with a core population of 10,000 or more and 50+% of the population commute to a CMA/CA. - Rural: Areas with a core population of <10,000 and 30-49% of the population commute to an urban area (referred to as strong MIZ in Statistics Canada's classification)	- Rural-Remote: Areas with a core population of <10,000 and 5-29% of the population commute to an urban area (referred to as Moderate MIZ in Statistics Canada's classification) - Rural-Very Remote: Areas with a core population of <10,000 and 0-4% of the population commute to an urban area, also includes non-urban parts of Territories (referred to as Weak MIZ, No MIZ, Territories outside CAs in Statistics Canada's classification) • Neighbourhood percent immigrant was determined using PCCF+, version 6A; this indicator divides DAs into three categories according to the percentage of immigrants: low immigrant (≤ 27% immigrant population), moderate immigrant (27.1-51.8% immigrant population), and high immigrant (≥ 51.9% immigrant population) • Public health unit data was determined using PCCF+, version 6A **Exclusions:** • Women with a missing or invalid HIN, date of birth, postal code or LHIN • Women with a prior diagnosis of invasive or 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 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: - X178 (screening bilateral mammogram) - 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 • OHIP CHDB (Claims History Database) - Non-OBSP mammogram and mastectomy claims • OCR (Ontario Cancer Registry) - Invasive and in situ breast cancers	• RPDB (Registered Persons Database) – Demographics • PCCF+, version 6A - Residence and socio-demographic information

Table 35 **Breast cancer screening participation - *continued***

Average risk indicator	Breast cancer screening participation	
Other jurisdictions	• International Agency for Research on Cancer (IARC): Participation rate: Proportion of women who are invited that attend for screening (IARC Handbook of Cancer Prevention, Volume 7, 2002) • Public Health Agency of Canada (PHAC): Participation rate: Percentage of women who have a screening mammogram (within a 30-month period) as a proportion of the target population (Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Screening Program Performance – Third Edition, 2013)	• Canadian Partnership Against Cancer (CPAC): Participation rate: The percentage of women ages 50 to 69 who were screened for breast cancer in an organized provincial breast cancer screening program in the past two years (The 2012 Cancer System Performance Report, December 2012)
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 • CHDB code X178 for screening bilateral mammography was introduced in October 2010	• CHDB 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

Table 36 Breast cancer screening retention

Average risk indicator	Breast cancer screening retention	
Indicator definitio	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 a program mammogram in a given calendar year	X100 = Mammogram Retention
Denominator	Total number of Ontario screen-eligible women, 50–72 years old, with a program mammogram in a given calendar year • Average risk women ages 50–72 at the index date, who had an OBSP screening mammogram in a given calendar year • Index date was defined as the first OBSP screen date per person in ICMS in a given year • Mammograms were identified by OBSP mammogram records in the Integrated Client Management System (ICMS) for screening purposes • Each woman was counted once regardless of the number of mammograms performed; if a woman had multiple mammograms in a given year, the first test date was selected • All mammograms were counted, including those with partial views • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN. • Neighbourhood income quintile was determined using PCCF+, version 6A; this indicator was based on income quintiles developed by Statistics Canada; income quintiles range from 1 to 5 (low to high) • Rural or urban residence was determined using PCCF+, version 6A. This indicator was based on whether people lived within a census metropolitan area (CMA), census agglomeration (CA) or Influenced Zones (MIZ) which takes into account population size, distance and commuting flow between rural and small towns and larger centres. - Urban: CMAs or CAs with a core population of 10,000 or more and 50+% of the population commute to a CMA/CA. - Rural: Areas with a core population of <10,000 and 30-49% of the population commute to an urban area (referred to as strong MIZ in Statistics Canada's classification)	- Rural-Remote: Areas with a core population of <10,000 and 5-29% of the population commute to an urban area (referred to as Moderate MIZ in Statistics Canada's classification) - Rural-Very Remote: Areas with a core population of <10,000 and 0-4% of the population commute to an urban area, also includes non-urban parts of Territories (referred to as Weak MIZ, No MIZ, Territories outside CAs in Statistics Canada's classification) • Neighbourhood percent immigrant was determined using PCCF+, version 6A; this indicator divides DAs into three categories according to the percentage of immigrants: low immigrant (≤ 27% immigrant population), moderate immigrant (27.1-51.8% immigrant population), and high immigrant (≥ 51.9% immigrant population) • Public health unit data was determined using PCCF+, version 6A **Exclusions:** • Women with a missing or invalid HIN, date of birth, postal code or LHIN • Women with a prior diagnosis of invasive or in situ breast cancer before the index date; prior diagnosis of breast cancer was defined as: ICD-O-3 codes: C50, a morphology indicative of breast invasive or in situ cancer, microscopically confirmed with a path report from OCR or screen-detected breast cancer from ICMS • Women with a mastectomy before the index date; mastectomy was defined in OHIP by fee codes E505, E506, E546, R108, R109, and R117 • 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 in a given calendar year	• 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, address at time of screening and date of death • OHIP CHDB (Claims History Database) - Mastectomy claims	• OCR (Ontario Cancer Registry) - Invasive and in situ breast cancers • PCCF+, version 6A - Residence and socio-demographic information
Other jurisdictions	• Public Health Agency of Canada (PHAC): Retention rate: The estimated percentage of women age 50–67 who returned for screening within 30 months (Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Screening Program Performance - Third Edition, 2013)	• Canadian Partnership Against Cancer (CPAC): Retention rate: The percentage of people who are re-screened within the recommended screening interval (Guidelines on Performance Measurement for Organized Cancer Screening Programs, Screening Performance Measures Group, April 2008)
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

Table 37 Breast cancer screening abnormal call rate

Average risk indicator	Breast cancer screening abnormal call rate	
Indicator Definitio	Percentage of Ontario screen-eligible women, 50–74 years old, who were referred for further testing because of an abnormal OBSP screening mammogram result	
Calculation	$\frac{\text{Total number of Ontario screen-eligible women, 50–74 years old, who were referred for further testing because of an abnormal OBSP screening mammogram result}}{\text{Total number of Ontario screen-eligible women, 50–74 years old, who had an OBSP screening mammogram in a given calendar year}}$	X100 = Abnormal Call Rate
Denominator	Total number of Ontario screen-eligible women, 50–74 years old, who had an OBSP screening mammogram in a given calendar year • Average risk women, ages 50–74 at the index date, who had an OBSP screening mammogram • Index date was defined as the first program screen date per person in ICMS in each calendar year • Mammograms were identified by OBSP mammogram records in ICMS for screening purposes • All mammograms in ICMS were counted, including those with partial views • Each woman was counted once regardless of the number of screening mammograms performed; if a woman had multiple screening mammograms in a given year, the first screening mammogram date was selected • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN.	**Exclusions:** • Women with a missing or invalid HIN, date of birth, postal code or LHIN • Women with a prior diagnosis of invasive or in situ breast cancer before the index date; prior diagnosis of breast cancer was defined as: ICD-O-3 codes: C50, a morphology indicative of breast invasive or in situ cancer, microscopically confirmed with a path report • Women with a mastectomy before the index date; mastectomy was defined in OHIP by fee codes E546, R108, R109, E505, E506 and R117
Numerator	Total number of Ontario screen-eligible women, 50–74 years old, who were referred for further testing because of an abnormal OBSP screening mammogram result	• An abnormal screening mammogram result was defined as an OBSP screening mammogram referred for further testing by the screening radiologist in ICMS
Data sources	• ICMS (Integrated Client Management System) - OBSP mammograms, residence and demographics • OHIP CHDB (Claims History Database) - mastectomy claims	• OCR (Ontario Cancer Registry) - Invasive and in situ breast cancers • PCCF+, version 6A - Residence and socio-demographic information
Other jurisdictions	• Public Health Agency of Canada (PHAC): Abnormal rate • Canadian Partnership Against Cancer (CPAC): Abnormal rate	• European Union: Abnormal rate
Data availability and limitations	• This indicator includes OBSP mammograms only • There is at least an one month reporting lag for this indicator as the regions have up to and including one month to enter the mammogram screening result (normal or abnormal) into the Integrated Client Management System (ICMS)	

Table 38 Breast cancer screening 6 month follow-up

Average risk indicator	Breast cancer screening 6 month follow-up	
Indicator definitio	Percentage of Ontario screen-eligible women with an abnormal OBSP screening mammogram result, 50-74 years old, who were diagnosed (benign or cancer) within 6 months of the abnormal screen date	
Calculation for the indicator	Total number of women with an abnormal OBSP screening mammogram result, 50–74 years old, who were diagnosed (benign or cancer) within 6 months of the abnormal screen date / Total number of women, 50–74 years old, with an abnormal OBSP screening mammogram result in a given calendar year	X100 = Abnormal Follow-Up (6 months)
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 50–74 at the index date, who had an abnormal program mammogram result in Integrated Client Management System (ICMS) • Index date was defined as the first abnormal program screen date per person in ICMS in each calendar year • Mammograms were identified by OBSP mammogram records in ICMS for screening purposes • Women with abnormal screening mammograms (OBSP) 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 • Each woman was counted once regardless of the number of mammograms performed; if a woman had multiple abnormal mammograms in a given year, the first abnormal test date was selected • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN	**Exclusions:** • Women with a missing or invalid HIN, date of birth, postal code or LHIN • Women with a prior diagnosis of invasive or in situ breast cancer before the index date; prior diagnosis of breast cancer was defined as: ICD-O-3 codes: C50, a morphology indicative of breast invasive or in situ cancer, microscopically confirmed with a path report • Women with a mastectomy before the index date; mastectomy was defined in OHIP by fee codes E546, R108, R109, E505, E506 and R117
Numerator	Total number of Ontario screen-eligible women with an abnormal OBSP screening mammogram result, 50–74 years old, who were diagnosed (benign or cancer) within 6 months of the abnormal screen date • Women with an abnormal program screening mammogram who obtained their diagnosis within 6 months of the abnormal screen date • Date of diagnosis for benign cases was defined as (in order of preference): - Date of the last benign biopsy, or - Date of the last benign procedure, or - Date of the last procedure prior to a recommendation to return to regular screening	• Date of diagnosis for breast cancer cases was defined as: - Date of the first cytologic or pathologic diagnosis of breast cancer (in situ or invasive) • For cases that were diagnosed as ductal carcinoma in situ (DCIS) breast cancer on core biopsy but as invasive breast carcinoma on surgical biopsy, the date of diagnosis was defined as the earlier date (date of the core biopsy), provided that the invasive diagnosis was within 60 days of the DCIS diagnosis
Data sources	• ICMS (Integrated Client Management System) - OBSP mammograms and demographics, breast assessments	• PCCF+, version 6a - Residence and socio-demographic info
Other jurisdictions	• N/A	
Data availability and limitations	• This indicator does not include OHIP billings for women screened outside of the OBSP since the OHIP database does not contain information about the results of the screening test or the results of the follow-up diagnostic work-up and final definitive diagnosis	• There is at least an eight-month reporting lag for this indicator as the regions have up to and including eight months to close off assessment cases and enter the information to the Integrated Client Management System (ICMS)

Table 39 Breast cancer screening diagnostic interval

Average risk indicator	Breast cancer screening diagnostic interval	
Indicator definitio	Percentage of Ontario screen-eligible women with an abnormal OBSP screening mammogram result, 50–74 years old, who were diagnosed (benign or cancer) within the recommended time interval: • ≤5 weeks without tissue biopsy, OR • ≤7 weeks with tissue biopsy	
Calculations for the indicator	Total number of screen-eligible women with an abnormal OBSP screening mammogram result, 50–74 years old, who were diagnosed within the recommended time interval (within 5 or 7 weeks of the abnormal mammogram result) ÷ Total number of screen-eligible women, 50–74 years old, with an abnormal OBSP screening mammogram result in a given calendar year	X100 = Diagnostic Interval
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 50–74 at the index date, who had an abnormal OBSP screening mammogram result • Index date was defined as the first abnormal program screen date per person in ICMS in each calendar year • 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 • Each woman was counted once regardless of the number of mammograms performed; if a woman had multiple abnormal mammograms in a given year, the first abnormal test date was selected • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN	**Exclusions:** • Women with a missing or invalid HIN, date of birth, postal code or LHIN • Women with a prior diagnosis of invasive or in situ breast cancer before the index date; prior diagnosis of breast cancer was defined as: ICD-O-3 codes: C50, a morphology indicative of breast invasive or in situ cancer, microscopically confirmed with a path report • Women with a mastectomy before the index date; mastectomy was defined in OHIP by fee codes E546, R108, R109, E505, E506 and R117 • Women lost to follow-up or final diagnosis is unknown
Numerator	Total number of Ontario screen-eligible women, 50–74 years old, with an abnormal program screening mammogram result in a given calendar year, who were diagnosed within the recommended time interval (within 5 or 7 weeks of the abnormal mammogram result) • Women with an abnormal program screening mammogram who obtained their diagnosis within the recommended time interval: - Within 5 weeks of abnormal screen date if without a tissue (core or surgical) biopsy, OR - Within 7 weeks of abnormal screen date if with a tissue biopsy	• Date of diagnosis for benign cases was defined as (in order of preference): - Date of the last benign biopsy, or - Date of the last benign procedure, or - Date of the last procedure prior to a recommendation to return to regular screening • Date of diagnosis for breast cancer cases was defined as: - Date of the first cytologic or pathologic diagnosis of breast cancer (in situ or invasive) • For cases that were diagnosed as ductal carcinoma in situ (DCIS) breast cancer on core biopsy but as invasive breast carcinoma on surgical biopsy, the date of diagnosis was defined as the earlier date (date of the core biopsy), provided that the invasive diagnosis was within 60 days of the DCIS diagnosis
Data sources	• ICMS (Integrated Client Management System) - OBSP mammograms, residence and demographics and breast assessments • OHIP CHDB (Claims History Database) - mastectomy claims	• OCR (Ontario Cancer Registry) - Invasive and in situ breast cancers • PCCF+, version 6a - Residence and socio-demographic info
Other jurisdictions	• Canadian Partnership Against Cancer (CPAC): Diagnostic interval: Duration of time from an abnormal (positive) screen to diagnosis (Guidelines on Performance Measurement for Organized Cancer Screening Programs, Screening Performance Measures Group, April 2008)	• European Union (EU): Interval between screening test and issue of test result, interval between screening test and initial day of assessment, interval between screening test and final assessment/ surgery (European guidelines for quality assurance in breast cancer screening and diagnosis, Fourth Edition, 2006)
Data availability and limitations	• This indicator includes OBSP mammograms only • There is at least an eight-month reporting lag for this indicator as the regions have up to and including eight months to close off assessment cases and enter the information to the Integrated Client Management System (ICMS)	

Table 40 Mammography positive predictive value

Average risk indicator	Mammography positive predictive value	
Indicator definitio	Percentage of Ontario screen-eligible women with an abnormal OBSP screening mammogram result, 50–74 years old, who were diagnosed with breast cancer (DCIS or invasive) after diagnostic work-up	
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	X100 = Positive Predictive Value
Denominator	Total number of screen-eligible women, 50–74 years old, with an abnormal program screening mammogram result in a given calendar year • Average risk women, ages 50–74 at the index date, who had an abnormal OBSP screening mammogram result • Index date was defined as the first abnormal program screen date per person in ICMS in each calendar year • 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 • Each woman was counted once regardless of the number of mammograms performed; if a woman had multiple abnormal mammograms in a given year, the first abnormal test date was selected • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN	**Exclusions:** • Women with a missing or invalid HIN, date of birth, postal code or LHIN • Women with a prior diagnosis of invasive or in situ breast cancer before the index date; prior diagnosis of breast cancer was defined as: ICD-O-3 codes: C50, a morphology indicative of breast invasive or in situ cancer, microscopically confirmed with a path report • Women with a mastectomy before the index date; mastectomy was defined in OHIP by fee codes E546, R108, R109, E505, E506 and R117 • Women lost to follow-up or final diagnosis is unknown
Numerator	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) • Date of diagnosis for breast cancer cases was defined as: - Date of the first cytologic or pathologic diagnosis of breast cancer (in situ or invasive)	• For cases that were diagnosed as ductal carcinoma in situ (DCIS) breast cancer on core biopsy but as invasive breast carcinoma on surgical biopsy, the date of diagnosis was defined as the earlier date (date of the core biopsy), provided that the invasive diagnosis was within 60 days of the DCIS diagnosis
Data sources	• ICMS (Integrated Client Management System) - OBSP mammograms and demographics, assessments • OHIP CHDB (Claims History Database) - mastectomy claims	• OCR (Ontario Cancer Registry) - Invasive and in situ breast cancers • PCCF+, version 6a - Residence and socio-demographic info
Other jurisdictions	• Public Health Agency of Canada (PHAC): Positive predictive value • Canadian Partnership Against Cancer (CPAC): Positive predictive value	• European Union: Positive predictive value of screening test, recall, FNA and core biopsy
Data availability and limitations	• This indicator includes OBSP mammograms only. • There is at least an eight-month reporting lag for this indicator as the regions have up to and including eight months to close off assessment cases and enter the information to the Integrated Client Management System (ICMS)	

Table 41 Mammography sensitivity

Average risk indicator	Mammography sensitivity
Indicator definitio	Percentage of Ontario screen-eligible women diagnosed with breast cancer (DCIS or invasive) within a year of the mammogram, 50–74 years old, who had an abnormal OBSP screening mammogram result followed by a final diagnosis of breast cancer after completion of diagnostic assessment
Calculations for the indicator	<table><tr><td rowspan="2">OBSP Screening Mammogram Result</td><td colspan="2">DCIS/Invasive Breast Cancer</td></tr><tr><td>Present</td><td>Absent</td></tr><tr><td>Abnormal</td><td>True-Positive</td><td>False-Positive</td></tr><tr><td>Normal</td><td>False-Negative</td><td>True-Negative</td></tr></table> $\frac{\text{Number of true-positives}}{\text{Number of true-positives and false-negatives}}$ X100 = Sensitivity
Denominator	Total number of Ontario screen-eligible women who had an OBSP screening mammogram, 50–74 years old, who were diagnosed with breast cancer (DCIS or invasive) within one year of the index date • Average risk women, ages 50–74 at the index date, who had an OBSP screening mammogram • Index date was defined as the first program screen date per person in ICMS in each calendar year • Women with a breast cancer diagnosis were identified as those women with a screen-detected or post-screen cancer. • Post-screen cancers were defined as any cancer diagnosed before the next scheduled screening mammogram visit after a previous normal or benign screening episode. - A normal screening episode was defined as a normal screening mammogram. - A benign screening episode was defined as an abnormal screening mammogram followed by diagnostic assessment, resulting in a final benign diagnosis. • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN	**Exclusions:** • Women with a missing or invalid HIN, date of birth, postal code or LHIN • Women with a prior diagnosis of invasive or in situ breast cancer before the index date; prior diagnosis of breast cancer was defined as: ICD-O-3 codes: C50, a morphology indicative of breast invasive or in situ cancer, microscopically confirmed with a path report • Women with a mastectomy before the index date; mastectomy was defined in OHIP by fee codes E546, R108, R109, E505, E506 and R117
Numerator	Total number of Ontario screen-eligible women, 50–74 years old, who had an abnormal OBSP screening mammogram result and who, after completion of diagnostic assessment, were diagnosed with breast cancer (DCIS or invasive) within one year of the index date	• An abnormal screening mammogram result was defined as an OBSP screening mammogram referred for further testing by the screening radiologist in ICMS
Other Jurisdictions	• Public Health Agency of Canada (PHAC): Interval cancer rate • Canadian Partnership Against Cancer (CPAC): Sensitivity	• European Union: Interval cancer rate, Specificity of the screening test
Data Sources	• ICMS (Integrated Client Management System) - OBSP mammograms, residence and demographics and breast assessments • OHIP CHDB (Claims History Database) - mastectomy claims	• OCR (Ontario Cancer Registry) - Invasive and in situ breast cancers • PCCF+, version 6a - Residence and socio-demographic info
Data availability and limitations	• This indicator includes OBSP mammograms only	

Table 42 Mammography specificity

Average risk indicator	Mammography specificity
Indicator definitio	Percentage of Ontario screen-eligible women without a breast cancer diagnosis (DCIS or invasive) within a year of the mammogram, 50–74 years old, who had a normal OBSP screening mammogram result
Calculations for the indicator	<table><tr><td rowspan="2">OBSP Screening Mammogram Result</td><td colspan="2">DCIS/Invasive Breast Cancer</td></tr><tr><td>Present</td><td>Absent</td></tr><tr><td>Abnormal</td><td>True-Positive</td><td>False-Positive</td></tr><tr><td>Normal</td><td>False-Negative</td><td>True-Negative</td></tr></table> $\frac{\text{Number of true-negatives}}{\text{Number of true-negatives and false-positives}}$ X100 = Specificity
Denominator	Total number of Ontario screen-eligible women who had an OBSP screening mammogram, 50–74 years old, who were not diagnosed with breast cancer (DCIS or invasive) within one year of the index date • Average risk women, ages 50–74 at the index date, who had an OBSP screening mammogram • Index date was defined as the first program screen date per person in ICMS in each calendar year • Women with a breast cancer diagnosis were defined as those women with a screen-detected or post-screen cancer • Post-screen cancers were defined as any cancer diagnosed before the next scheduled screening mammogram visit after a previous normal or benign screening episode. - A normal screening episode was defined as a normal screening mammogram. - A benign screening episode was defined as an abnormal screening mammogram followed by diagnostic assessment, resulting in a final benign diagnosis. • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN **Exclusions:** • Women with a missing or invalid HIN, date of birth, postal code or LHIN • Women with a prior diagnosis of invasive or in situ breast cancer before the index date; prior diagnosis of breast cancer was defined as: ICD-O-3 codes: C50, a morphology indicative of breast invasive or in situ cancer, microscopically confirmed with a path report • Women with a mastectomy before the index date; mastectomy was defined in OHIP by fee codes E546, R108, R109, E505, E506 and R117 • Women lost to follow-up or final diagnosis is unknown
Numerator	Total number of Ontario screen-eligible women, 50–74 years old, who had a normal OBSP screening mammogram result and who were not diagnosed with breast cancer (DCIS or invasive) within one year of the index date • 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.
Other jurisdictions	• Public Health Agency of Canada (PHAC): Interval cancer rate • Canadian Partnership Against Cancer (CPAC): Sensitivity • European Union: Interval cancer rate, Specificity of the screening test
Data sources	• ICMS (Integrated Client Management System) - OBSP mammograms, residence and demographics and breast assessments • OHIP CHDB (Claims History Database) - mastectomy claims • OCR (Ontario Cancer Registry) - Invasive and in situ breast cancers • PCCF+, version 6a - Residence and socio-demographic info
Data availability and limitations	• This indicator includes OBSP mammograms only

Table 43 Invasive breast cancer detection rate

Average risk indicator	Invasive breast cancer detection rate
Indicator definitio	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	$\frac{\text{Total number of Ontario screen-eligible women who had an OBSP screening mammogram, 50–74 years old, with a screen-detected invasive breast cancer diagnosis}}{\text{Total number of Ontario screen-eligible women who had an OBSP screening mammogram, 50–74 years old}}$ X1,000 = Invasive Cancer Detection Rate
Denominator	Total number of Ontario screen-eligible women who had an OBSP screening mammogram, 50–74 years old • Average risk women, ages 50–74 at the index date, who had an OBSP screening mammogram, • Index date was defined as the first program screen date per person in ICMS in each calendar year • Each woman was counted once regardless of the number of screening mammograms performed; if a woman had multiple screening mammograms in a given year, the first screening mammogram date was selected • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN **Exclusions:** • Women with a missing or invalid HIN, date of birth, postal code or LHIN • Women with a prior diagnosis of invasive or in situ breast cancer before the index date; prior diagnosis of breast cancer was defined as: ICD-O-3 codes: C50, a morphology indicative of breast invasive or in situ cancer, microscopically confirmed with a path report • Women with a mastectomy before the index date; mastectomy was defined in OHIP by fee codes E546, R108, R109, E505, E506 and R117 • Women lost to follow-up or final diagnosis is unknown
Numerator	Total number of Ontario screen-eligible women who had an OBSP screening mammogram, 50–74 years old, with a screen-detected invasive breast cancer diagnosis
Data sources	• ICMS (Integrated Client Management System) - OBSP mammograms, residence and demographics and assessments • OHIP CHDB (Claims History Database) - mastectomy claims • OCR (Ontario Cancer Registry) - Invasive and in situ breast cancers • PCCF+, version 6a - Residence and socio-demographic info
Other jurisdictions	• Public Health Agency of Canada (PHAC): In situ and invasive cancer detection rate • Canadian Partnership Against Cancer (CPAC): Pre-cancer and cancer detection rate • European Union: Proportion of screen-detected cancers that are invasive versus in situ
Data availability and limitations	• This indicator includes OBSP mammograms only. • Breast cancer staging details are obtained from annual data linkages with the OCR Registry

Table 44 Early stage invasive breast cancer detection rate

Average risk indicator	Early stage invasive breast cancer detection rate	
Indicator definitio	Percentage of invasive screen-detected breast cancers detected at an early stage (stage I)	
Calculations for the indicator	$\frac{\text{Total number of Ontario screen-eligible women who had an OBSP screening mammogram, 50–74 years old, with an early stage (Stage I) screen-detected invasive breast cancer}}{\text{Total number of Ontario screen-eligible women who had an OBSP screening mammogram, 50–74 years old, with a screen-detected invasive breast cancer}}$	X100 = Early Stage Invasive Breast Cancer Detection Rate
Denominator	Total number of Ontario screen-eligible women who had an OBSP screening mammogram, 50–74 years old, with a screen-detected invasive breast cancer • Average risk women who had an OBSP screening mammogram, ages 50–74 at the index date, with a screen-detected invasive breast cancer • Index date was defined as the first program screen date per person in ICMS in each calendar year • Each woman was counted once regardless of the number of mammograms performed; if a woman had multiple screening mammograms in a given year, the first screening mammogram date was selected • Invasive breast cancer was defined based on the behaviour code (5th digit of morphology code). • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN	**Exclusions:** • Women with a missing or invalid HIN, date of birth, postal code or LHIN • Women with a prior diagnosis of invasive or in situ breast cancer before the index date; prior diagnosis of breast cancer was defined as: ICD-O-3 codes: C50, a morphology indicative of breast invasive or in situ cancer, microscopically confirmed with a path report • Women with a mastectomy before the index date; mastectomy was defined in OHIP by fee codes E546, R108, R109, E505, E506 and R117 • Women with invasive cancer with unknown TNM stage group.
Numerator	Total number of Ontario screen-eligible women who had an OBSP screening mammogram, 50–74 years old, with an early stage (Stage I) screen-detected invasive breast cancer	
Data sources	• ICMS (Integrated Client Management System) - OBSP mammograms, residence and demographics, assessments • OHIP CHDB (Claims History Database) - mastectomy claims	• OCR (Ontario Cancer Registry) - Invasive and in situ breast cancers • PCCF+, version 6a - Residence and socio-demographic info
Other jurisdictions	• Public Health Agency of Canada (PHAC): In situ and invasive cancer detection rate • Canadian Partnership Against Cancer (CPAC): Pre-cancer and cancer detection rate	• European Union: Proportion of screen-detected cancers that are invasive versus in situ
Data availability and limitations	• OBSP data are available from 1990 • This indicator includes OBSP mammograms and OBSP breast assessment procedures/Final Diagnosis only (not OHIP mammograms). Breast cancer staging details are obtained from annual data linkages with the OCR Registry	

Ontario Breast Screening Program (OBSP): High Risk

Table 45 Percentage of Category B women confirmed high risk

Indicator	Percentage of Category B women confirmed high risk	
Indicator Definitio	Percentage of Ontario women (Category B) confirmed to be at high risk by genetic assessment (counselling and/or testing)	
Calculations for the indicator	$\frac{\text{Total number of Ontario women, 30–69 years old, confirmed to be at high risk by genetic assessment (counselling and/or testing)}}{\text{Total number of Ontario women, 30–69 years old, who completed genetic assessment}}$	X100 = Percentage Women Confirmed to be at High Risk
Denominator	Total number of Ontario women, 30–69 years, who completed genetic assessment • Women (category B), 30–69 years old, who completed genetic assessment • Category B is defined as women who are referred to genetic assessment to determine their eligibility for the High Risk OBSP • Age is based on the OBSP registration date. • Women with a valid date per below criteria were included: - Women with a valid OBSP registration date (date the high risk referral information was entered) AND - Women with a valid initial primary care provider visit date AND - Women with a valid genetic counselling date and genetic testing date, if done • LHIN assignment was determined using PCCF+, version 6A; client postal code at the time of High Risk OBSP registration was used to identify LHIN. If client residential postal code was missing, the LHIN of the High Risk OBSP registration centre was selected.	**Exclusions:** • Women with a missing or invalid HIN or date of birth • Women who completed genetic assessment but for whom eligibility is unknown
Numerator	Total number of Ontario women, 30–69 years old, confirmed to be at high risk by genetic assessment (counselling and/or testing) • Women, 30–69 years old, confirmed high risk	• Confirmation date of high risk status for women referred to genetic assessment (Category B) is defined as the most recent of either the genetic assessment date or the update date (update date is selected only if it is before the High Risk OBSP screening episode date)
Data sources	• ICMS (Integrated Client Management System)	
Other jurisdictions	• None	
Data availability and limitations	• High Risk OBSP data are available from July 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 is up to a year reporting lag for this indicator as data are based on the registration date (date the requisition form data were entered into the ICMS). Women may take up to one year from being referred to the High Risk OBSP to completion of genetic assessment

Table 46 Women referred and registered for the High Risk OBSP

Indicator	Women referred and registered for the High Risk OBSP	
Indicator definitio	Number of Ontario women referred and registered to the High Risk OBSP (Category A and B Combined)	
Calculations for the indicator	The number of Ontario women, 30–69 years old, who were referred and registered to the High Risk OBSP	
Numerator	Total number of Ontario women, 30–69 years old, who were referred and registered to the High Risk OBSP in a given year • Women (category A and B combined), 30–69 years old, who completed a Risk Assessment and Referral Form • Category A is defined as women who are referred directly to the High Risk OBSP by a physician • Category B is defined as women who are referred to genetic assessment to determine their eligibility for the High Risk OBSP • Age is based on OBSP registration date • Include women with a valid OBSP registration date (date the high risk referral information was entered into the ICMS) and a valid initial primary care provider visit date • LHIN assignment was determined using PCCF+, version 6A; client postal code at the time of High Risk OBSP registration was used to identify LHIN. If client residential postal code was missing, the LHIN of the High Risk OBSP registration centre was selected.	**Exclusions:** • Women with a missing or invalid HIN or date of birth
Other jurisdictions	• None	
Data sources	• ICMS (Integrated Client Management System)	
Data availability and limitations	• High Risk OBSP data are available from July 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 is up to a year reporting lag for this indicator as data are based on the registration date. Women may take up to one year from being referred to the High Risk OBSP to completion of genetic assessment

Table 47 Abnormal call rate (High Risk OBSP)

Indicator	Abnormal call rate (High Risk OBSP)	
Indicator definitio	Percentage of high risk screened women, 30–69 years old, referred for further testing because of an abnormal screen result	
Calculations for the indicator	$\frac{\text{Total number of high risk screened women, 30–69 years old, referred for further testing because of an abnormal screen result}}{\text{Total number of women, 30–69 years old, who had a High Risk OBSP screen}}$	X100 = Abnormal Call Rate
Denominator	Total number of women, 30–69 years old, who had a High Risk OBSP screen • Women, 30–69 years old, 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, both High Risk OBSP screening episodes were selected • Includes partial screens where there was a normal complementary screening test performed within the previous 7 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 or postal code • MRI only screens where no mammogram was done were excluded when calculating modality of referral where mammogram alone was abnormal or both mammogram and MRI (or ultrasound) were abnormal
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, 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)	
Other jurisdictions	• Public Health Agency of Canada (PHAC): Abnormal call rate • Canadian Partnership Against Cancer (CPAC): Abnormal rate	• European Union: Abnormal rate
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 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 High Risk OBSP screening episode and the two high risk screening tests can be up to 7 months apart

Table 48 Breast cancer detection rate (ductal carcinoma in situ [DCIS] and invasive, High Risk OBSP)

Indicator	Breast cancer detection rate (DCIS and invasive, High Risk OBSP)	
Indicator definitio	Number of high risk screened women, 30–69 years old, with breast cancer (DCIS or invasive) per 1,000 women screened	
Calculations for the indicator	$\frac{\text{Total number of high risk screened women, 30–69 years old, with a screen-detected breast cancer (DCIS or invasive) following an abnormal screen result and after completion of diagnostic work-up}}{\text{Total number of women, 30–69 years old, who had a High Risk OBSP screen}}$	X1,000 = Cancer Detection Rate
Denominator	Total number of women, 30–69 years old, who had a High Risk OBSP screen • Women, 30–69 years old, 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, both High Risk OBSP screening episodes were selected • Includes partial screens where there was a normal complementary screening test performed within the previous 7 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 or postal code • MRI only screens where no mammogram was done were excluded when calculating cancer detection rate by modality of referral where mammogram alone was abnormal or both mammogram and MRI (or ultrasound) were abnormal • Women lost to follow-up or final diagnosis is unknown
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 after completion of diagnostic work-up.	
Data sources	• ICMS (Integrated Client Management System)	
Other jurisdictions	• Public Health Agency of Canada (PHAC): In situ cancer detection rate; invasive cancer detection rate. • Canadian Partnership Against Cancer (CPAC): Pre-cancer detection rate; invasive cancer detection rate.	• European Union: Combined (in situ plus invasive) breast cancer detection rate
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

Table 49 Positive predictive value (High Risk OBSP)

Indicator	Positive predictive value (High Risk OBSP)	
Indicator definitio	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 work-up	
Calculations for the indicator	$\frac{\text{Total number of high risk screened women, 30–69 years old, with a screen-detected breast cancer (DCIS or invasive) following an abnormal screen result and after completion of diagnostic work-up}}{\text{Total number of high risk screened women, 30–69 years old, referred for further testing because of an abnormal screen result}}$	X100 = Positive Predictive Value
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, 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, both abnormal High Risk OBSP screening episodes were selected • Includes partial screens where there was a normal complementary screening test performed within the previous 7 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 or postal code • MRI only screens where no mammogram was done were excluded when calculating PPV by modality of referral where mammogram alone was abnormal or both mammogram and MRI (or ultrasound) were abnormal • Women lost to follow-up or final diagnosis is unknown
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 work-up.	
Data sources	• ICMS (Integrated Client Management System)	
Other jurisdictions	• Public Health Agency of Canada (PHAC): Positive predictive value • Canadian Partnership Against Cancer (CPAC): Positive predictive value	• European Union: Positive predictive value of screening test, recall FNA and core biopsy
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)

Table 50 **Cervical cancer screening participation**

Average risk indicator	Cervical cancer screening participation
Indicator definitio	Age-adjusted percentage of Ontario screen-eligible women, 21–69 years old, who completed at least one Pap test in a given 42-month period
Calculations for the indicator	$\frac{\text{Total number of Ontario screen-eligible women, 21–69 years old, who have completed at least one Pap test in a given 42-month period}}{\text{Total number of Ontario screen-eligible women, 21–69 years old in a given 42-month period}}$ X100 = Participation
Denominator	Total number of Ontario screen-eligible women, 21–69 years old, in a given 42-month period • Ontario screen-eligible women ages 21–69 at the index date • Index date was defined as the midpoint in a reporting period, e.g. July 1st 2013 for 2012-2014 • 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 • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN and people with unknown/missing LHINs were excluded from the analysis • Neighbourhood income quintile was determined using PCCF+, version 6A; this indicator was based on income quintiles developed by Statistics Canada; income quintiles range from 1 to 5 (low to high) • Rural or urban residence was determined using PCCF+, version 6A. This indicator was based on whether people lived within a census metropolitan area (CMA), census agglomeration (CA) or Influenced Zones (MIZ) which takes into account population size, distance and commuting flow between rural and small towns and larger centres. - Urban: CMAs or CAs with a core population of 10,000 or more and 50+% of the population commute to a CMA/CA. - Rural: Areas with a core population of <10,000 and 30-49% of the population commute to an urban area (referred to as strong MIZ in Statistics Canada's classification) - Rural-Remote: Areas with a core population of <10,000 and 5-29% of the population commute to an urban area (referred to as Moderate MIZ in Statistics Canada's classification) - Rural-Very Remote: Areas with a core population of <10,000 and 0-4% of the population commute to an urban area, also includes non-urban parts of Territories (referred to as Weak MIZ, No MIZ, Territories outside CAs in Statistics Canada's classification) • Neighbourhood percent immigrant was determined using PCCF+, version 6A; this indicator divides DAs into three categories according to the percentage of immigrants: low immigrant (≤ 27% immigrant population), moderate immigrant (27.1-51.8% immigrant population), and high immigrant (≥ 51.9% immigrant population). • Public health unit data was determined using PCCF+, version 6A	**Exclusions:** • Women with a missing or invalid HIN, date of birth, LHIN or postal code • Women diagnosed with an invasive cervical cancer prior to January 1st of the reporting period, e.g. January 1st 2012 for 2012-2014; 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 with a hysterectomy prior to January 1st of the reporting period, e.g. January 1st 2012 for 2012-2014 • Women with a hysterectomy were identified through CHDB, using the following fee codes: - E862A: When hysterectomy is performed laparoscopically, or with laparoscopic assistance - P042A: Obstetrics – labour – delivery – caesarean section including hysterectomy - Q140A: Exclusion code for enrolled female patients ages 35-70 with hysterectomy - S710A: Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy - S727A: Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy - S757A: Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal - 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 - 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 - S762A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection - S763A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection - S765A: Amputation of cervix - S766A: Cervix uteri - Exc - cervical stump – abdominal - S767A: Cervix uteri - exc - Cervical stump – vaginal - S816A: Hysterectomy - with or without adnexa (unless otherwise specified) - vaginal

Table 50 Cervical cancer screening participation - *continued*

Average risk indicator	Cervical cancer screening participation	
Numerator	Total number of Ontario screen-eligible women, 21–69 years old, who have completed at least one Pap test in a given 42-month period • Identifying Pap tests: Pap tests were identified in CytoBase Pap tests were also identified using fee codes in 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 - L643A: Lab Med - Microbiol - Microscopy - Smear Only, Gram/Pap Stain • 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 (e.g. Jan 2012 to June 2015)
Data sources	• CytoBase - Pap tests • OHIP's CHDB (Claims History Database) – Pap tests, hysterectomy claims • OCR (Ontario Cancer Registry) - Resolved invasive cervical cancers	• RPDB (Registered Persons Database) - Demographics • PCCF+, version 6A - Residence and socio-demographic information
Other jurisdictions	• International Agency for Research on Cancer (IARC): Participation rate: Proportion of those screened among those invited according to the scheduled policy (organized screening); in a program not based on invitations, participation has the same meaning as coverage (Cervix Cancer Screening, IARC Handbook of Cancer Prevention, Volume 10, 2005) • Public Health Agency of Canada (PHAC): Participation rate: Percentage of eligible women in the target population (20-69 years of age) with at least one Pap test in a three-year period (Performance monitoring for cervical cancer screening programs in Canada, January 2009) • Canadian Partnership Against Cancer (CPAC): Participation rate: Percentage of women ages 20-69 who had at least one Pap smear (The 2012 Cancer System Performance Report)	• European Union (EU): Participation Rate: Number of women screened at least once in a defined interval (3-5 years) divided by the Number of resident women in the target population; they calculate separately by invitation status (personally invited, not, unknown); programme status (within or without or unknown), stratify by 5 years age groups, and with eligible women as denominator calculated separately (Arbyn M, Antilla A, Jordan J et al. European Guidelines for Quality Assurance in Cervical Cancer Screening. 2nd ed. Summary document. Ann Oncol. 2010;21(3):448-58) • New Zealand National Cervical Screening Programme: Participation rates are currently reported in Ireland, Nova Scotia and PEI; in New Zealand, Ontario and B.C., the rates are hysterectomy adjusted (Comparison of the performance indicators used in the New Zealand national cervical screening programme and other programmes internationally: A report to the Independent Monitoring Group of the National Cervical Screening Programme. Technical Report No 11. March 2006)
Data availability and limitations	• A small proportion of Pap tests performed as a diagnostic test could not be excluded from the analysis	

Table 51 Cervical cancer screening retention

Indicator	Cervical cancer screening retention
Indicator definitio	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	$\frac{\text{Total number of Ontario screen-eligible women, 21–66 years old, who had a subsequent Pap test within 42 months of a previous normal Pap test result in a given year}}{\text{Total number of Ontario screen-eligible women, 21–66 years old, who had a normal Pap test in a given year}}$ X100 = Retention
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 as NILM (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 tests performed • If a woman had multiple normal tests in a given year, the specimen date of the last normal test was chosen as the index date • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN and people with unknown/missing LHINs were excluded from the analysis • Neighbourhood income quintile was determined using PCCF+, version 6A; this indicator was based on income quintiles developed by Statistics Canada; income quintiles range from 1 to 5 (low to high) • Rural or urban residence was determined using PCCF+, version 6A. This indicator was based on whether people lived within a census metropolitan area (CMA), census agglomeration (CA) or Influenced Zones (MIZ) which takes into account population size, distance and commuting flow between rural and small towns and larger centres. - Urban: CMAs or CAs with a core population of 10,000 or more and 50+% of the population commute to a CMA/CA. - Rural: Areas with a core population of <10,000 and 30-49% of the population commute to an urban area (referred to as strong MIZ in Statistics Canada's classification) - Rural-Remote: Areas with a core population of <10,000 and 5-29% of the population commute to an urban area (referred to as Moderate MIZ in Statistics Canada's classification) - Rural-Very Remote: Areas with a core population of <10,000 and 0-4% of the population commute to an urban area, also includes non-urban parts of Territories (referred to as Weak MIZ, No MIZ, Territories outside CAs in Statistics Canada's classification) • Neighbourhood percent immigrant was determined using PCCF+, version 6A; this indicator divides DAs into three categories according to the percentage of immigrants: low immigrant (≤ 27% immigrant population), moderate immigrant (27.1-51.8% immigrant population), and high immigrant (≥ 51.9% immigrant population). • Public health unit data was determined using PCCF+, version 6A	**Exclusions:** • Women with a missing or invalid HIN, date of birth, LHIN or postal code • Women who died during the follow-up period • Women diagnosed with an invasive cervical cancer before the subsequent Pap date or during the follow-up interval (for cases where there was no subsequent Pap); 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 (for cases where there was no subsequent Pap) • Women with a hysterectomy were identified through CHDB, using the following fee codes: - E862A: When hysterectomy is performed laparoscopically, or with laparoscopic assistance - P042A: Obstetrics – labour – delivery – caesarean section including hysterectomy - Q140A: Exclusion code for enrolled female patients ages 35-70 with hysterectomy - S710A: Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy - S727A: Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy - S757A: Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal - 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 - 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 - S762A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection - S763A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection - S765A: Amputation of cervix - S766A: Cervix uteri - Exc - cervical stump – abdominal - S767A: Cervix uteri - exc - Cervical stump – vaginal - S816A: Hysterectomy - with or without adnexa (unless otherwise specified) - vaginal

Table 51 Cervical cancer screening retention - *continued*

Indicator	Cervical cancer screening retention	
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 in a given year	• Subsequent Pap tests were identified through CytoBase • All tests were considered, regardless of test result
Data sources	• CytoBase - Pap tests • OHIP's CHDB (Claims History Database) – Hysterectomy claims • OCR (Ontario Cancer Registry) - Resolved invasive cervical cancers	• RPDB (Registered Persons Database) - Demographics • PCCF+, version 6A - Residence and socio-demographic information
Other jurisdictions	• Public Health Agency of Canada (PHAC): Retention rate: Percentage of eligible women re-screened within three years after a negative Pap test in a 12 month period (Performance Monitoring for Cervical Cancer Screening Programs in Canada)	• Canadian Partnership Against Cancer (CPAC): Retention rate: The percentage of women ages 20 to 69 who had a Pap test within three years after a negative Pap test (The 2012 Cancer System Performance Report)
Data availability and limitations	• Only CytoBase data was used for these analyses as there were no results for OHIP data • CytoBase data is limited to community-based laboratories • Successful and timely calculation of this indicator is dependent on timely receipt of Pap data from community-based laboratories; the accuracy and completeness of data presented is dependent on the accuracy and completeness of the source data	• Some women with a scheduled Pap test (follow-up) may be included in this cohort • It is difficult to determine whether a Pap test was done for screening or diagnostic purposes; a small proportion of tests included in our analyses may have been performed for diagnostic purposes

Table 52 Cervical cancer screening abnormal results

Indicator	Cervical cancer screening abnormal results	
Indicator definitio	Percentage of Ontario screen-eligible women ages 21–69 years with an abnormal Pap test result in a given time period	
Calculations for the indicator	$\frac{\text{Total number of Ontario screen-eligible women, 21–69 years old, with an abnormal Pap test result}}{\text{Total number of Ontario screen-eligible women, 21–69 years old, who had a Pap test}}$	X100 = Abnormal results
Denominator	Total number of Ontario screen-eligible women, 21–69 years old, who had a Pap test in a given time period • Women, ages 21–69 at the index date, who had a Pap test in Cytobase, regardless of result • Index date was defined as the date of specimen collection in CytoBase in each calendar year - 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 missing or invalid HIN,, date of birth or postal code • Women with an invasive cervical cancer before the index Pap date; diagnosis of cervical cancer was defined as ICD-O-3 code C53 • Women with an unsatisfactory Pap test result • Women with a hysterectomy before the index Pap date	• Women with a hysterectomy were identified through CHDB, using the following fee codes: - E862A: When hysterectomy is performed laparoscopically, or with laparoscopic assistance - P042A: Obstetrics – labour – delivery – caesarean section including hysterectomy - Q140A: Exclusion code for enrolled female patients ages 35-70 with hysterectomy - S710A: Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy - S727A: Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy - S757A: Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal - 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 - 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 - S762A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection - S763A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection - S765A: Amputation of cervix - S816A: Hysterectomy - with or without adnexa (unless otherwise specified) - vaginal - If one of E862, P042, Q140, S710, S727, S757, S758, S759, S816, S763A and one of S765, S762 OR - If one of E862, P042, Q140, S710, S727, S757, S758, S759, S816, S763A without any of S765, S762
Numerator	Total number of Ontario screen-eligible women, 21–69 years old, with an abnormal Pap test result in a given time period	• Women with an abnormal Pap test result in CytoBase • Abnormal Pap tests include both low grade and high grade Pap tests
Data Source	• Cytobase – Pap tests • OHIP's CHDB – hysterectomy • OCR (Ontario Cancer Registry) – Resolved cancer cases	• RPDB (Registered Persons Database) – Patient demographics • PCCF+, version 6A - Residence and socio-demographic information
Other jurisdictions	• CPAC –Abnormal rate: Percentage of women ages 20–69 screened who are referred for further testing because of an abnormal (positive) screening test from 2006 to 2008 (The 2011 Cancer System performance report, 2011)	
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 was done for screening or diagnostic purposes, and therefore, some Pap tests included in these analyses may have been performed for diagnostic purposes • Southeastern Ontario Academic Medical Organization and Alternative Funding Plans gynecologic oncology billings may not be complete because many procedures could have been shadow billed

Table 53 Cervical cancer screening follow-up (low-grade Pap tests)

Indicator	Cervical cancer screening follow-up (low-grade Pap tests)	
Indicator definitio	Percentage of Ontario screen-eligible women with a low-grade cervical abnormality on a Pap test, 21–69 years old, who underwent a repeat Pap, colposcopy or definitive treatment within 9 months of the low-grade abnormal screen test	
Calculations for the indicator	Total number of Ontario screen-eligible women, 21–69 years old, with a low-grade cervical abnormality on a Pap test, who underwent a repeat Pap, colposcopy or definitive treatment within 9 months of the low-grade abnormal Pap test ÷ Total number of Ontario screen-eligible women, 21–69 years old, with a low-grade cervical abnormality on a Pap test in a given calendar year	X100 =Follow-up
Denominator	Total number of Ontario screen-eligible women, 21–69 years old, with a low-grade cervical abnormality on a Pap test in a given calendar year • Women, ages 21–69 at the index date, who had a low-grade cervical abnormality on a Pap test in Cytobase • Index date was defined as the most severe screen date per person by date of specimen collection in CytoBase in each calendar year - If a woman had multiple Pap tests of the same abnormality in a given year, the date of the first test was taken as the index date • Low-grade cervical dysplasia include ASC and LSIL • 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, LHIN or postal code • Women who died during the follow-up period • Women with an invasive cervical cancer before the index Pap date; diagnosis of cervical cancer was defined as ICD-O-3 code C53 • Women with a hysterectomy before the index Pap date	• Women with a hysterectomy were identified through CHDB, using the following fee codes: - E862A: When hysterectomy is performed laparoscopically, or with laparoscopic assistance - P042A: Obstetrics – labour – delivery – caesarean section including hysterectomy - Q140A: Exclusion code for enrolled female patients ages 35-70 with hysterectomy - S710A: Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy - S727A: Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy - S757A: Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal - 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 - 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 - S762A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection - S763A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection - S765A: Amputation of cervix - S766A: Cervix uteri - Exc - cervical stump – abdominal - S767A: Cervix uteri - exc - Cervical stump – vaginal - S816A: Hysterectomy - with or without adnexa (unless otherwise specified) – vaginal • LHIN assignment was determined using PCCF+, version 6a; residential postal code was used to identify LHIN, and people with unknown/missing LHINs were excluded from the analysis
Numerator	Total number of Ontario screen-eligible women, 21–69 years old, with a low-grade cervical abnormality on a Pap test in a given calendar year, who underwent a repeat Pap, colposcopy or definitive treatment within 9 months of the low-grade abnormal Pap test • Women with a low-grade cervical abnormality on Pap test who underwent a repeat Pap, colposcopy or definitive treatment within 9 months of the low-grade abnormal Pap test • The following codes were used to identify Pap tests through OHIP claims: - 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 - L643A: Lab Med - Microbiol - Microscopy - Smear Only, Gram/Pap Stain For those cases that we did not find a repeat Pap we searched for a colposcopy or other definitive treatment • Colposcopy was defined using the following fee codes in OHIP: - 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	- Z787: Follow-up colposcopy with biopsy(ies) with or without endocervical curetting - Z730: Follow-up colposcopy without biopsy with or without endocervical curetting • If no record was found for a subsequent colposcopy after the low-grade cervical abnormality Pap test, other definitive procedures were included; these procedures were identified through OHIP claims as: - Z732: Cryotherapy - Z724: Electro - Z766: Electrosurgical Excision Procedure (LEEP) - S744: Cervix - cone biopsy - any technique, with or without D&C - Z720: Cervix Biopsy - with or without fulguration - 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 that a hysterectomy was performed within 9 months following the low-grade abnormal Pap test • If a woman had multiple colposcopies or multiple procedures, the earliest colposcopy or procedure was selected • If a woman had colposcopy within +/- 7 days of her Pap test, preceding tests in Cytobase and OHIP up to six months before were used to verify if this colposcopy might have been associated with a previous Pap test; if there was a previous Pap test in the specified time period, that Pap test would be used as the index Pap.

Table 53 Cervical cancer screening follow-up (low-grade Pap tests) - *continued*

Indicator	Cervical cancer screening follow-up (low-grade Pap tests)
Data source	• OHIP's CHDB (Claims History Database) – hysterectomy claims , Pap tests, colposcopies, treatment claims • CytoBase – Pap tests • OCR (Ontario Cancer Registry) - Resolved invasive cervical cancers • RPDB (Registered Persons Database) – Demographics • PCCF+, version 6a - Residence and socio-demographic info
Other jurisdictions	None
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

Table 54 Cervical cancer screening follow-up (high-grade Pap tests)

Indicator	Cervical cancer screening follow-up (high-grade Pap tests)
Indicator definitio	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 6 months of the high-grade abnormal screen date
Calculations for the indicator	$\frac{\text{Total number of Ontario screen-eligible women with a high-grade cervical abnormality on a Pap test in a given calendar year, 21–69 years old, who underwent colposcopy or definitive treatment within 6 months of the high-grade abnormal screen date}}{\text{Total number of Ontario screen-eligible women, 21–69 years old, with a high-grade cervical abnormality on a Pap test in a given calendar year}}$ X100 = Follow-up
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 in CytoBase • 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:

Pap test category	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
Adeno in situ	4.5.8, 4.6
HSIL	4.8
Carcinoma	4.9
Squamous cell carcinoma	4.9.1
Adenocarcinoma	4.9.2, 4.9.3
Other malignancy	4.10

- 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
- LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN and people with unknown/missing LHINs were excluded from the analysis
- Neighbourhood income quintile was determined using PCCF+, version 6A; this indicator was based on income quintiles developed by Statistics Canada; income quintiles range from 1 to 5 (low to high)
- Rural or urban residence was determined using PCCF+, version 6A. This indicator was based on whether people lived within a census metropolitan area (CMA), census agglomeration (CA) or Influenced Zones (MIZ) which takes into account population size, distance and commuting flow between rural and small towns and larger centres.
  - Urban: CMAs or CAs with a core population of 10,000 or more and 50+% of the population commute to a CMA/CA.
  - Rural: Areas with a core population of <10,000 and 30-49% of the population commute to an urban area (referred to as strong MIZ in Statistics Canada's classification)
  - Rural-Remote: Areas with a core population of <10,000 and 5-29% of the population commute to an urban area (referred to as Moderate MIZ in Statistics Canada's classification)
  - Rural-Very Remote: Areas with a core population of <10,000 and 0-4% of the population commute to an urban area, also includes non-urban parts of Territories (referred to as Weak MIZ, No MIZ, Territories outside CAs in Statistics Canada's classification)
- Neighbourhood percent immigrant was determined using PCCF+, version 6A; this indicator divides DAs into three categories according to the percentage of immigrants: low immigrant (≤ 27% immigrant population), moderate immigrant (27.1-51.8% immigrant population), and high immigrant (≥ 51.9% immigrant population).

Exclusions:

- Women with a missing or invalid HIN, date of birth, LHIN or postal code
- Women who died during the follow-up period
- Women diagnosed with an invasive cervical cancer before the index Pap date; 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 CHDB, using the following fee codes:
  - E862A: When hysterectomy is performed laparoscopically, or with laparoscopic assistance
  - P042A: Obstetrics – labour – delivery – caesarean section including hysterectomy
  - Q140A: Exclusion code for enrolled female patients ages 35-70 with hysterectomy
  - S710A: Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy
  - S727A: Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy
  - S757A: Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal
  - 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
  - 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
  - S762A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection
  - S763A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection
  - S765A: Amputation of cervix
  - S766A: Cervix uteri - Exc - cervical stump – abdominal
  - S767A: Cervix uteri - exc - Cervical stump – vaginal
  - S816A: Hysterectomy - with or without adnexa (unless otherwise specified) – vaginal

Table 54 Cervical cancer screening follow-up (high-grade Pap tests) - *continued*

Indicator	Cervical cancer screening follow-up (high-grade Pap tests)	
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: - 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 - Z787: Follow-up colposcopy with biopsy(ies) with or without endocervical curetting - 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: - Z732: Cryotherapy - Z724: Electro - Z766: Electrosurgical Excision Procedure (LEEP) - S744: Cervix - cone biopsy - any technique, with or without D&C - Z720: Cervix Biopsy - with or without fulguration - 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 that a hysterectomy was performed within six months following the high-grade abnormal Pap test	• If a woman had multiple colposcopies or multiple procedures, the earliest colposcopy or procedure was selected • If a woman had colposcopy within +/- 7 days of her Pap test, preceding tests in Cytobase and OHIP up to six months before were used to verify if this colposcopy might have been associated with a previous Pap test. If there was a previous Pap test in the specified time period, that Pap test would be used as the index Pap. • The following codes were used to identify Pap tests through OHIP claims: - 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 - L643A: Lab Med - Microbiol - Microscopy - Smear Only, Gram/Pap Stain
Data sources	• CytoBase - Pap tests • OHIP's 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 • PCCF+, version 6A - Residence and socio-demographic information
Other jurisdictions	• Public Health Agency of Canada (PHAC): Time to colposcopy: Percentage of women with a positive Pap test (HSIL+/ASC-H) who had follow-up colposcopy within 3, 6, 9 and 12 months subsequent to the index Pap test (Performance Monitoring for Cervical Cancer Screening Programs in Canada)	
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 • Successful and timely calculation of this indicator is dependent on timely receipt of Pap data from community-based laboratories; the accuracy and completeness of data presented is dependent on the accuracy and completeness of the source data	• Colposcopy activity data can be identified in several ways: 1) through NACRS, or 2) through OHIP claims. A combination of these data sets would be required to capture all colposcopy activity, however this analysis only explored OHIP claims • It is difficult to determine whether a Pap test in Cytobase was done for screening or diagnostic purposes, and therefore, some Pap tests included in these analyses may have been performed for diagnostic purposes

Table 55 Pap test positive predictive value

Indicator	Pap test positive predictive value	
Indicator definitio	Percentage of Ontario screen-eligible women with an abnormal Pap test result, 21–69 years old, who were diagnosed with an invasive cervical cancer or in situ cancer after a followed up colposcopy or a surgical procedure involving the cervix	
Calculations for the indicator	$\frac{\text{Total number of women with invasive cervical cancer or in situ cancer}}{\text{Total number of women who had an abnormal Pap test followed by a colposcopy or a surgical procedure in each time period}}$	X100 = Positive predictive value
Denominator	Total number of screen-eligible Ontario women, ages 21–69, who had an abnormal Pap test result followed by a colposcopy or a surgical procedure involving the cervix within 6 months of the 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 • Abnormal Pap tests include both low grade and high grade Pap tests • 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 through OHIP as the earliest date of: - 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 - Z787: Follow-up colposcopy with biopsy(ies) with or without endocervical curetting - Z730: Follow-up colposcopy without biopsy with or without endocervical curetting • Cervical surgical procedures were defined through OHIP as the earliest date of: - Z732: Cryotherapy - Z724: Electro - Z766: Electrosurgical Excision Procedure (LEEP) - S744: Cervix - cone biopsy - any technique, with or without D&C - Z720: Cervix - Biopsy - with or without fulguration - 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, LHIN or postal code • Women who died during the follow-up period • Women with an invasive cervical cancer before the Pap 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 date • Women with a hysterectomy were identified through OHIP, using the following fee codes: - E862A: When hysterectomy is performed laparoscopically, or with laparoscopic assistance - P042A: Obstetrics – labour – delivery – caesarean section including hysterectomy - Q140A: Exclusion code for enrolled female patients ages 35-70 with hysterectomy - S710A: Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy - S727A: Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy - S757A: Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal - 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 - 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 - S762A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection - S763A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection - S765A: Amputation of cervix - S766A: Cervix uteri - Exc - cervical stump – abdominal - S767A: Cervix uteri - exc - Cervical stump – vaginal - 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 an invasive cervical cancer or in situ cancer after a followed up colposcopy or a surgical procedure involving the cervix • Women with an invasive cervical cancer - Defined as ICD-O-3 code C53 with a behaviour code=3	• Women with an in situ cancer - Defined as ICD-O-3 code C53 with a behaviour code=2 • Cervical cancers will be counted if date of cervical 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 source	• Cytobase – Pap tests • OHIP's CHDB – Colposcopy and surgical procedures involving the cervix • OCR (Ontario Cancer Registry) – Resolved cancer cases	• RPDB (Registered Persons Database) – Patient demographics • PCCF+, version 6A - Residence and socio-demographic information
Other jurisdictions	• PHAC: Cytology-Histology Agreement – Proportion of positive PAP tests with histological work-up found to have a pre-cancerous lesion or invasive cervical cancer in a 12 month period	
Data availability and limitations	• Cytobase data is limited to community-based laboratories • It is difficult to determine whether a Pap test was done for screening or diagnostic purposes; a small proportion of tests included in our analyses may have been performed for diagnostic purposes	

Table 56 Pap test negative predictive value

Indicator	Pap test negative predictive value	
Indicator definitio	Number of Ontario screen-eligible women, 21–69 years old, who were diagnosed with in situ cervical cancer within 3 years of a normal Pap test result, per 10,000 Pap tests	
Calculations for the indicator	$\frac{\text{Total Number of Ontario screen-eligible women, 21–69 years old, with in-situ cervical cancer within 3 years of a normal Pap test}}{\text{Total number of Ontario screen-eligible women, 21–69 years old, who had a normal Pap test in a given calendar year}}$	X10, 000 = Negative Predictive Value
Denominator	Total number of Ontario screen-eligible women, 21–69 years old, who had a normal Pap test in a given calendar year • Ontario screen-eligible women 21–69 years old who had a normal Pap test result in a given year • If a woman had multiple normal tests in a given year, the specimen date of the last normal test was chosen as the index date • Normal Pap tests were defined through CytoBase as NILM (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 tests performed • The RPDB address closest to the index date was used to assign postal code • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN and people with unknown/missing LHINs were excluded from the analysis **Exclusions:** • Women with a missing or invalid HIN, date of birth, LHIN or postal code • Women with an abnormal Pap test result before the Index Pap date • Women with a colposcopy before the Index Pap date • Women diagnosed with an invasive cervical cancer before the Index Pap 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 CHDB, using the following fee codes: - E862A: When hysterectomy is performed laparoscopically, or with laparoscopic assistance - P042A: Obstetrics – labour – delivery – caesarean section including hysterectomy - Q140A: Exclusion code for enrolled female patients ages 35-70 with hysterectomy - S710A: Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy - S727A: Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy - S757A: Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal - 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 - 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 - S762A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection - S763A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection - S765A: Amputation of cervix - S766A: Cervix uteri - Exc - cervical stump – abdominal - S767A: Cervix uteri - exc - Cervical stump – vaginal - S816A: Hysterectomy - with or without adnexa (unless otherwise specified) – vaginal
Numerator	Total number of Ontario screen-eligible women, 21–69 years old, with in situ cervical cancer within 3 years of a normal Pap test result	• Diagnosis of in situ cervical cancer were defined as: ICD-O-3 codes C53, a morphology indicative of in situ cancer, microscopically confirmed with a pathology report
Data sources	• CytoBase - Pap tests • OHIP's CHDB (Claims History Database) – Colposcopy, hysterectomy claims • OCR (Ontario Cancer Registry) - In situ cervical cancers	• RPDB (Registered Persons Database) - Demographics • PCCF+, version 6A - Residence and socio-demographic information
Other jurisdictions	None	
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	• Successful and timely calculation of this indicator is dependent on timely receipt of Pap data from community-based laboratories; the accuracy and completeness of data presented is dependent on the accuracy and completeness of the source data • It is difficult to determine whether a Pap test in Cytobase was done for screening or diagnostic purposes, and therefore, some Pap tests included in these analyses may have been performed for diagnostic purposes

Table 57 Cervical cancer and pre-cancer detection rate

Indicator	Cervical cancer and pre-cancer detection rate
Indicator definitio	Number of Ontario women, 21–69 years old, with a screen-detected invasive cervical cancer or in situ cancer per 1,000 screened using a Pap test
Calculation for the indicator	$\frac{\text{Total number of screen-eligible women, 21–69 years old, with a screen-detected invasive cervical cancer or in-situ cancer}}{\text{Total number of screen-eligible Ontario women, 21–69 years old, screened using a Pap test in a given time period}}$ X1,000 = Cancer Detection Rate per 1,000
Denominator description	Total number of screen-eligible Ontario women, 21–69 years old, screened using a Pap test in a given time period • Women ages 21–69 at the index date who had a Pap test in a given year in Cytobase • Index date was defined as the specimen date of the Pap test • 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, LHIN or postal code • Women who died during the follow-up period • Women diagnosed with an invasive cervical cancer before the index Pap date; 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 date • Women with a hysterectomy were identified through OHIP, using the following fee codes: - E862A: When hysterectomy is performed laparoscopically, or with laparoscopic assistance - P042A: Obstetrics – labour – delivery – caesarean section including hysterectomy - Q140A: Exclusion code for enrolled female patients ages 35-70 with hysterectomy - S710A: Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy - S727A: Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy - S757A: Hysterectomy – with or without adnexa (unless otherwise specified) – abdominal – total or subtotal - 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 - 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 - S762A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection - S763A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection - S765A: Amputation of cervix - S766A: Cervix uteri - Exc - cervical stump – abdominal - S767A: Cervix uteri - exc - Cervical stump – vaginal - 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.
Numerator	Total number of screen-eligible women, 21–69 years old, with a screen-detected invasive cervical cancer or in situ cancer • Women with a screen-detected in situ cancer - Defined as ICD-O-3 code C53 with a behaviour code=2 • Women with a screen-detected invasive cervical cancer - Defined as ICD-O-3 code C53 with a behaviour code=3 • In situ cancers/invasive cancers will be counted as "detected" by the Pap test if - 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, and - Date of in situ cancer/cancer diagnosis in OCR occurred between 7 days before and up to 3 months after colposcopy or within ± 7 days of the surgical procedure - If a woman has both an in situ cancer and a cancer take whichever one happened first • If a woman had colposcopy within +/- 7 days of her Pap test, - Check for preceding tests in Cytobase and OHIP up to six months before were used to verify if this colposcopy might have been associated with a previous Pap test; if there was a previous Pap test in the specified time period, that Pap test would be used as the index Pap. - If no preceeding Pap test was found those women would be excluded from numerator and denominator.	• 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. • Colposcopy was defined through OHIP as the earliest date of: - 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 - Z787: Follow-up colposcopy with biopsy(ies) with or without endocervical curetting - Z730: Follow-up colposcopy without biopsy with or without endocervical curetting • Cervical surgical procedures were defined through OHIP as the earliest date of: - Z732: Cryotherapy - Z724: Electro - Z766: Electrosurgical Excision Procedure (LEEP) - S744: Cervix - cone biopsy - any technique, with or without D&C - Z720: Cervix - Biopsy - with or without fulguration - Z729: Cryoconization, electroconization or CO2 laser therapy with or without curettage for premalignant lesion (dysplasia or carcinoma in situ), out-patient procedure
Considerations	None

Table 57 Cervical cancer and pre-cancer detection rate - *continued*

Indicator	Cervical cancer and pre-cancer detection rate	
Data sources	• CytoBase - Pap tests • OHIP's CHDB (Claims History Database) – previous Pap tests, colposcopies, definitive procedure claims, hysterectomy claims	• OCR (Ontario Cancer Registry) - Resolved cervical cancer cases • RPDB (Registered Persons Database) - Demographics • PCCF+, version 6A - Residence and socio-demographic information
Other jurisdictions	• Public Health Agency of Canada (PHAC) 2009: Pre-cancer detection rate – Number of pre-cancerous lesions detected per 1,000 women who had a Pap test in a 12 month period • CPAC: Precancer detection rate is the number of precancerous lesions detected during a screening episode per persons screened	• IARC 2008: Number of precancerous lesions detected per 1,000 women who had a cervical cancer screening test in a 12 month period • CPAC: Cancer detection rate is the number of invasive cancers detected during a screening episode per person screened
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 was done for screening or diagnostic purposes, and therefore, some Pap tests included in these analyses may have been performed for diagnostic purposes

Table 58 Percentage overdue for colorectal cancer screening

Calculations for the indicator	Number of Ontario screen-eligible people, 50–74 years old, who were overdue for colorectal screening by the end of the calendar year / Total number of Ontario screen-eligible people, 50–74 years old, in a given calendar year	X100 = Percentage Overdue for Screening
Denominator description	Total number of Ontario screen-eligible people, 50–74 years old in a given calendar year - Ontario residents ages 50–74 at the index date - Index date was defined as Jan 1 of a given year • The 2011 Canadian population was used as the standard population for calculating age-standardized rates • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN and people with unknown/missing LHINs were excluded from the analysis • Neighbourhood income quintile was determined using PCCF+, version 6A; this indicator was based on income quintiles developed by Statistics Canada; income quintiles range from 1 to 5 (low to high) • Rural or urban residence was determined using PCCF+, version 6A. This indicator was based on whether people lived within a census metropolitan area (CMA), census agglomeration (CA) or Influenced Zones (MIZ) which takes into account population size, distance and commuting flow between rural and small towns and larger centres. - Urban: CMAs or CAs with a core population of 10,000 or more and 50+% of the population commute to a CMA/CA. - Rural: Areas with a core population of <10,000 and 30-49% of the population commute to an urban area (referred to as strong MIZ in Statistics Canada's classification)	- Rural-Remote: Areas with a core population of <10,000 and 5-29% of the population commute to an urban area (referred to as Moderate MIZ in Statistics Canada's classification) - Rural-Very Remote: Areas with a core population of <10,000 and 0-4% of the population commute to an urban area, also includes non-urban parts of Territories (referred to as Weak MIZ, No MIZ, Territories outside CAs in Statistics Canada's classification) - Neighbourhood percent immigrant was determined using PCCF+, version 6A; this indicator divides DAs into three categories according to the percentage of immigrants: low immigrant (≤ 27% immigrant population), moderate immigrant (27.1-51.8% immigrant population), and high immigrant (≥ 51.9% immigrant population) - Public health unit data was determined using PCCF+, version 6A **Exclusions:** • People with a missing or invalid HIN, date of birth, sex or postal code • People with an invasive colorectal cancer prior to Jan 1 of the calendar year of interest - 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 • People with a total colectomy prior to Jan 1 of the calendar year of interest - Total colectomy was defined in OHIP by fee codes S169A, S170A, S172A
Numerator	Total number of Ontario screen-eligible people, 50–74 years old, who were overdue for colorectal cancer screening by the end of the calendar year • People were considered overdue for colorectal cancer screening if they: - did not return a program gFOBT kit within the last two years (Jan 1 of the previous year to Dec 31st of the calendar year of interest) AND - did not have a colonoscopy in the last 10 years (Jan 1 nine years prior to the calendar year of interest to Dec 31st of the calendar year of interest) AND - did not have a flexible sigmoidoscopy in the last five years (Jan 1 four years prior to the calendar year of interest to Dec 31st of the calendar year of interest) For example: at the end of 2013, an individual would be considered overdue for colorectal cancer screening if he or she did not have an gFOBT test in 2012-2013, or flexible sigmoidoscopy in 2009-2013, or a colonoscopy in 2004-2013	• Identifying gFOBTs: Program CCC gFOBT was identified in LRT Non-program gFOBT was identified using fee codes in OHIP: - G004 Lab.med.in office - Occult blood - L179 ColonCancerCheck Fecal Occult Blood Testing - L181 Lab Med - Biochem - Occult Blood • Colonoscopies were identified using fee code Z551A, Z491A- Z499A in OHIP • Flexible sigmoidoscopies were identified using fee code Z580A in OHIP • Multiple claims with the same Health Insurance Number (HIN) and service date were assumed to be a single claim • Each individual was counted once regardless of the number of tests performed
Data sources	• OHIP's CHDB (Claims History Database) – Colectomy claims, non-CCC gFOBT, colonoscopy, flexible sigmoidoscopy • CIRT (Colonoscopy Interim Reporting Tool) – CCC colonoscopy records • LRT (Laboratory Reporting Tool) – CCC gFOBTs	• OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers • RPDB (Registered Persons Database) – Demographics • PCCF+, version 6A - Residence and socio-demographic info
Other jurisdictions	• Canadian Partnership Against Cancer (CPAC): Utilization (note: inverse of overdue for screening): Percentage of target population considered up to date for CRC screening, including those who do not participate in an organized program and who have been screened using other acceptable screening modalities (Quality Determinants for Colorectal Cancer Screening in Canada, September 2009)	
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 in hospital labs could not be captured	• Only gFOBT as a primary screening test could be assessed; gFOBT is recommended for those at average risk of colorectal cancer, while those at increased risk (1st degree relative with colorectal cancer) were not assessed as they could not be accurately identified • A small proportion of gFOBTs performed as diagnostic tests could not be excluded from the analysis • OHIP data may include (CCC) rejected kits

Table 59 Guaiac fecal occult blood test (gFOBT) abnormal results

Indicator	ColonCancerCheck gFOBT abnormal results	
Indicator definitio	Percentage of Ontario screened people, 50–74 years old, with an abnormal gFOBT result	
Calculations for the indicator	Total number of Ontario screen-eligible people, 50–74 years old, with an abnormal program gFOBT result in a given calendar year ÷ Total number of Ontario screen-eligible people, 50–74 years old, who had a program gFOBT in a given calendar year	X100 = Abnormal results
Denominator	Total number of Ontario screen-eligible people, 50–74 years old, who had a program gFOBT in a given calendar year • People ages 50–74 at the index date • Each individual was counted once regardless of the number of tests performed • Index date was defined as the gFOBT date in LRT. If a person had multiple tests in a given period, an index date was the Kit receipt date of the first gFOBT • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN and people with unknown/missing LHINs were excluded from the analysis	**Exclusions:** • People with a missing or invalid HIN, date of birth, sex or postal code • People with an invasive colorectal cancer prior to Jan 1 of the calendar year of interest • 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 • People with a previous colectomy before the index date • Colectomy was identified in OHIP by fee codes S169A, S170A, S172A • People who returned kits that were rejected or indeterminate
Numerator	Total number of Ontario screen-eligible people, 50–74 years old, with an abnormal program gFOBT result in a given calendar year • People, ages 50–74, who had an abnormal program gFOBT result in LRT	• Abnormal gFOBT results were defined as at least one abnormal flap out of three flaps • Each individual was counted once regardless of the number of tests performed
Data sources	• LRT (Laboratory Reporting Tool) – CCC gFOBTs • OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers • RPDB (Registered Persons Database) – Demographics	• OHIP's CHDB (Claims History Database) – Colectomy claims • RPDB (Registered Persons Database) – Demographics • PCCF+, version 6A - Residence and socio-demographic info
Other jurisdictions	• CPAC: Positivity rate = (Number with abnormal gFOBT/Number with an adequate test returned and processed) (Quality Determinants for Colorectal Cancer Screening in Canada, Sept 30 2009) • EU: Positivity rate (Number with abnormal gFOBT/Number with an adequate test) (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010)	• Definition of an abnormal result for a kit may not be consistent across jurisdictions: Ontario uses one or more abnormal windows, regardless of the number of windows containing a stool sample
Data availability and limitations	• Result information on program-branded kits available to Cancer Care Ontario through LRT, for participating 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

Table 60 Colonoscopy within 6 months of abnormal guaiac fecal occult blood test (gFOBT) result

Indicator	gFOBT 6 month follow-up	
Short description of indicator	Percentage of Ontario screen-eligible people with an abnormal gFOBT result, 50–74 years old, who underwent colonoscopy within six months of the abnormal gFOBT result	
Calculations for the indicator	Number of Ontario screen-eligible people, 50–74 years old, with an abnormal CCC gFOBT result, who underwent colonoscopy within six months of the abnormal FOBT result / Total number of Ontario screen-eligible people, 50–74 years old, with an abnormal CCC gFOBT result in a given calendar year	X100 = Abnormal Follow-Up
Denominator description	Total number of Ontario screen-eligible people, 50–74 years old, with an abnormal CCC gFOBT result in a given calendar year • People, ages 50–74 at the index date, who had an abnormal program gFOBT result in LRT • Index date was defined as the first abnormal screen date per person by kit receipt date in LRT in each calendar year • gFOBTs were identified by CCC gFOBT records in LRT • Abnormal gFOBT results were defined as at least one abnormal flap out of three flaps • Each individual was counted once regardless of the number of tests performed • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN and people with unknown/missing LHINs were excluded from the analysis	**Exclusions:** • People with a missing or invalid HIN, date of birth, sex or postal code • People with an invasive colorectal cancer before the index date - 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 • People with a total colectomy before the index date - Total colectomy was defined in OHIP by fee codes S169A, S170A, S172A
Numerator	Total number of Ontario screen-eligible people, 50–74 years old, with an abnormal program gFOBT result in a given calendar year, who underwent colonoscopy within six months of the abnormal gFOBT result • People with an abnormal program gFOBT result who had a colonoscopy within six months of the abnormal gFOBT result	• Colonoscopy was defined as a record in CIRT or in OHIP by the fee codes Z555A, Z491A- Z499A • If an individual had multiple abnormal gFOBT results in a given calendar year, the six-month follow-up period started from the first abnormal gFOBT result date
Data sources	• LRT (Laboratory Reporting Tool) – CCC gFOBTs • OHIP's CHDB (Claims History Database) – Colonoscopy claims • CIRT (Colonoscopy Interim Reporting Tool) – CCC colonoscopy records	• OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers • RPDB (Registered Persons Database) – Demographics • PCCF+, version 6A - Residence and socio-demographic info
Other jurisdictions	• Canadian Partnership Against Cancer (CPAC): Follow-up completion: Percentage of participants with abnormal screen test result undergoing recommended diagnostic follow-up within program-defined interval (Quality Determinants for Colorectal Cancer Screening in Canada, September 2009)	• European Union (EU): Follow-up colonoscopy compliance rate: Number of people having attended a colonoscopy examination during a time frame/Number of people with an abnormal screening test and referred during the same time frame (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010)
Data availability and limitations	• Only CCC gFOBT data are included in the calculation • Historical RPDB address information is incomplete; therefore, the most recent primary address was selected for reporting, even for historical study periods	• Number of persons who completed a CCC gFOBT kit is available in LRT starting from April 1, 2008

Table 61 Colonoscopy within 8 weeks of abnormal guaiac fecal occult blood test (gFOBT) result

Indicator	gFOBT 8 week follow-up	
Indicator definitio	Percentage of Ontario screen-eligible people with an abnormal gFOBT result, 50–74 years old, who underwent colonoscopy within eight weeks of the abnormal gFOBT result	
Calculations for the indicator	Number of Ontario screen-eligible people, 50–74 years old, with an abnormal CCC gFOBT result, who underwent colonoscopy within eight weeks of the abnormal gFOBT result ÷ Total number of Ontario screen-eligible people, 50–74 years old, with an abnormal CCC gFOBT result in a given calendar year	X100 = Colonoscopy within 8 week Benchmark
Denominator	Total number of Ontario screen-eligible people, 50–74 years old, with an abnormal CCC gFOBT result in a given calendar year • People, ages 50–74 at the index date, who had an abnormal program gFOBT result in LRT • Index date was defined as the first abnormal screen date per person by kit receipt date in LRT in each calendar year • gFOBTs were identified by CCC gFOBT records in LRT • Abnormal gFOBT results were defined as at least one abnormal flap out of three flaps • Each individual was counted once regardless of the number of tests performed • LHIN assignment was determined using PCCF+, version 6A; residential postal code was used to identify LHIN and people with unknown/missing LHINs were excluded from the analysis	**Exclusions:** • People with a missing or invalid HIN, date of birth, sex or postal code • People with an invasive colorectal cancer before the index date - 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 • People with a total colectomy before the index date - Total colectomy was defined in OHIP by fee codes S169A, S170A, S172A
Numerator	Total number of Ontario screen-eligible people, 50–74 years old, with an abnormal program gFOBT result in a given calendar year, who underwent colonoscopy within eight weeks of the abnormal gFOBT result • People with an abnormal program gFOBT result who had a colonoscopy within eight weeks of the abnormal gFOBT result - Colonoscopy was defined as a record in CIRT or in OHIP by the fee codes Z555A, Z491A- Z499A	• If an individual had multiple abnormal gFOBT results in a given calendar year, the eight weeks follow-up period started from the first abnormal gFOBT result date
Data sources	• LRT (Laboratory Reporting Tool) – CCC gFOBTs • OHIP's CHDB (Claims History Database) – Colonoscopy claims • CIRT (Colonoscopy Interim Reporting Tool) – CCC colonoscopy records	• OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers • RPDB (Registered Persons Database) – Demographics • PCCF+, version 6A - Residence and socio-demographic info
Other jurisdictions	• Canadian Partnership Against Cancer (CPAC): Follow-up completion: Percentage of participants with abnormal screen test result undergoing recommended diagnostic follow-up within program-defined interval (Quality Determinants for Colorectal Cancer Screening in Canada, September 2009)	• European Union (EU): Follow-up colonoscopy compliance rate: Number of people having attended a colonoscopy examination during a time frame/Number of people with an abnormal screening test and referred during the same time frame (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010)
Data availability and limitations	• Only CCC gFOBT data are included in the calculation • Historical RPDB address information is incomplete; therefore, the most recent primary address was selected for reporting, even for historical study periods	• Number of persons who completed a CCC gFOBT kit is available in LRT starting from April 1, 2008

Table 62 Guaiac fecal occult blood test (gFOBT) positive predictive value (PPV)

Indicator	gFOBT PPV	
Indicator definitio	Percentage of Ontario screen-eligible people with an abnormal gFOBT result, 50–74 years old, who were diagnosed with colorectal cancer	
Calculations for the indicator	$\frac{\text{Total number of Ontario screen eligible people, ages 50–74, with a program screen detected invasive colorectal cancer among those who had an abnormal gFOBT result in the year and followed by large bowel endoscopy or surgical resection}}{\text{Total number of Ontario screen eligible people, ages 50–74, who had an abnormal gFOBT result followed by large bowel endoscopy or colonic surgical resection within 183 days of the abnormal gFOBT date}}$ X100 = PPV	
Denominator	Total number of Ontario screen eligible people, ages 50–74, who had an abnormal gFOBT result followed by large bowel endoscopy or colonic surgical resection within 183 days of the abnormal gFOBT date in a reporting period. • Index date was defined as the first abnormal gFOBT screen date per person by gFOBT kit receipt date in the year. • People, ages 50–74 at the index date, who had an abnormal gFOBT result in LRT • Abnormal gFOBT result was followed by large bowel endoscopy or colonic surgical resection within 183 days • Large bowel endoscopy was defined as a record in CIRT or in OHIP by fee code: Z555A, Z491A-Z499A and Z580A • Each individual was counted once regardless of the number of tests performed. If an individual had multiple abnormal gFOBT results, the date of the first abnormal result was selected	• Colonic surgical resections were defined through CIHI's DAD and NACRS as resection with or without stoma, bypass or local excisions of colon and rectum by selected CCI codes from ICES's technical appendix: http://www.ices.on.ca/~/media/Files/Atlases-Reports/2008/Cancer-surgery-in-Ontario-2008-edition/Technical%20Appendix%20Full.ashx. Admission date was used as proxy of surgical date if surgical date was missing in CIHI database • LHIN assignment was based on PCCF+, version 6A. Residential postal code was used to identify LHIN **Exclusions:** • People with a missing or invalid HIN, date of birth, sex, LHIN or postal code • People with a previous invasive colorectal cancer before the index date - Invasive colorectal cancer was defined in OCR as: ICD-O-3 codes C18.0, C18.2-C18.9, C19.9, C20.9, a morphology indicative of colorectal cancer, with microscopically confirmed or a path report • People with a previous total colectomy before the index date - Total colectomy was identified in OHIP by fee codes S169A, S170A, S172A
Numerator	Total number of Ontario screen eligible people, ages 50–74, with a program screen detected invasive colorectal cancer among those who had an abnormal gFOBT result in the year and followed by large bowel endoscopy or surgical resection • 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 • Only colorectal cancers detected as a result of an abnormal program gFOBT result were counted	• Colorectal cancers were defined as "screen-detected" if the individual had: - An abnormal gFOBT was followed by large bowel endoscopy or colonic surgical resection within 183 days, and - Date of colorectal cancer in OCR occurred between 7 days before and up to 91 days after large bowel endoscopy or within ± 7 days of surgery, and - Date of colorectal cancer in OCR occurred up to 190 days after the abnormal gFOBT result
Data source	• OHIP – large bowel endoscopy claims and total colectomy • CIHI DAD and NACRS – Colorectal related surgery records • CIRT – CCC colonoscopy records • LRT (Laboratory Reporting Tool) – CCC gFOBTs	• OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers • RPDB (Registered Personal Database) – Demographics • PCCF+, version 6A - Residence and socio-demographic info
Other jurisdictions	• Canadian Partnership Against Cancer (CPAC): PPV CRC: Percentage of people with abnormal FT result diagnosed with CRC (Colorectal Cancer Screening in Canada, Program performance results report, 2009-2011)	
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 analyzed in hospital labs could not be captured	• Only gFOBT as a primary screening test could be assessed; gFOBT is recommended for those at average risk of colorectal cancer, while those at increased risk (1st degree relative with colorectal cancer) were not assessed as they could not be accurately identified • A small proportion of gFOBTs performed as diagnostic tests could not be excluded from the analysis

Table 63 Interval colorectal cancer rate

Indicator	Interval colorectal cancer rate	
Indicator definitio	Number of Ontario screen-eligible people, 50–74 years old, who developed invasive colorectal cancer in the two years following a normal gFOBT result, per 1,000 normal gFOBTs	
Calculations for the indicator	$\frac{\text{Total number of Ontario screen-eligible people, ages 50–74, who developed invasive colorectal cancer in the two years following a normal gFOBT result}}{\text{Total number of Ontario screen-eligible people, ages 50–74, who had a normal gFOBT result}}$	X1,000 = Interval Colorectal Cancer Rate per 1,000
Denominator	Total number of Ontario screen-eligible people, ages 50–74, who had a normal gFOBT result in the reporting period • People, ages 50-74, who had completed a program branded kit with a normal gFOBT result in the reporting period • If there was more than one gFOBT in a given period, the date of the first normal result was selected. • LHIN assignment was based on PCCF+, version 6A. Residential postal code was used to identify LHIN	**Exclusions:** • People with a missing or invalid HIN, date of birth, sex or postal code • People with a diagnosis of colorectal cancer prior to the gFOBT date - Invasive colorectal cancer was defined in OCR as: ICD-O-3 codes C18.0, C18.2-C18.9, C19.9, C20.9, a morphology indicative of colorectal cancer, with microscopically confirmed or a path report • People who had a total colectomy prior to the gFOBT date - Total colectomy was defined as a record in OHIP by the fee codes S169A, S170A, S172A • People who had an abnormal gFOBT result in the 2 years prior to the gFOBT date • People who had a colonoscopy in the 10 years prior to the gFOBT date - Colonoscopy was defined as a record in CIRT or in OHIP by the fee code: Z555A, Z491A-Z499A • People who had a flex sigmoidoscopy in the 5 years prior to the gFOBT date - Flex sigmoidoscopy was defined as a record in OHIP by the fee code Z580A
Numerator	Total number of Ontario screen-eligible people, ages 50–74, who developed invasive colorectal cancer in the two years following a normal gFOBT result • People with a diagnosis of colorectal cancer in OCR in the two-year period following the date of the normal gFOBT result	• 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
Data sources	• OHIP's CHDB (Claims History Database) – Colonoscopy, flex sigmoidoscopy and total colectomy claims • CIRT (Colonoscopy Interim Reporting Tool) – CCC colonoscopy records • LRT (Laboratory Reporting Tool) – CCC gFOBTs	• OCR (Ontario Cancer Registry) - Resolved invasive colorectal cancers • RPDB (Registered Persons Database) – Demographics • PCCF+, version 6A - Residence and socio-demographic info
Other jurisdictions	• CPAC: Interval CRC: Percentage of people with normal FT screening results who were subsequently diagnosed with colorectal cancer before their next scheduled screening test (Colorectal Cancer Screening in Canada, Monitoring & Evaluation of Quality Indicators – Results Report, 2011-2012) • EU:Number of colorectal cancers occurring following a negative screening episode before next invitation is due, adjusted for background incidence rates by age/sex group (European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis, First Edition, February 2010)	• U.K. Bowel Cancer Screening Programme: gFOBT interval cancer – a cancer diagnosed in the two year interval between a negative gFOBT result and the next proposed gFOBT. If the individual is 70 (later to be 75 or over) an interval cancer will be defined as a cancer diagnosed within two years of their last screening episode (Quality Assurance Guideline for Colonoscopy, NHS BCSP Publication No. 6, March 2010)
Data availability and limitations	• CCC gFOBT data are available from April 2008 • gFOBTs analyzed in hospital labs could not be captured	• Only gFOBT as a primary screening test could be assessed; gFOBT is recommended for those at average risk of colorectal cancer, while those at increased risk (1st degree relative with colorectal cancer) were not assessed as they could not be accurately identified

Table 64 Invasive colorectal cancer detection rate (Guaiac fecal occult blood test [gFOBT])

Indicator	Invasive colorectal cancer detection rate (gFOBT)	
Indicator definitio	Number of Ontario screen-eligible people, 50–74 years old, with a detected invasive colorectal cancer per 1,000 screened using CCC gFOBTs	
Calculations for the indicator	$\frac{\text{Total number of Ontario screen-eligible people, 50–74 years old, with a detected invasive colorectal cancer among those screened using CCC gFOBTs}}{\text{Total number of Ontario screen-eligible people, 50–74 years old, screened using a CCC gFOBT}}$	X1,000 = Invasive CRC rate per 1,000 FOBTs
Denominator	Total number of Ontario screen-eligible people, 50–74 years old, screened using a CCC gFOBT • People, ages 50-74, who were screened using a CCC gFOBT • Index date was defined as the first screen date per person by gFOBT kit receipt date • People who had completed both a gFOBT and a FH colonoscopy were counted in the FH colonoscopy group • Each individual was counted once regardless of the number of tests performed • Include people who completed a program gFOBT • LHIN assignment was based on PCCF+, version 6A. Residential postal code was used to identify LHIN. People with unknown/missing LHINs are excluded	**Exclusions:** • People with a missing or invalid HIN, date of birth, sex or postal code • People with rejected or indeterminate gFOBT results • People with a previous invasive colorectal cancer before the index date - 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 • People with a previous total colectomy before the index date - Total colectomy was identified in OHIP by fee codes S169A, S170A, S172A
Numerator	Total number of Ontario screen-eligible people, 50–74 years old, with a detected invasive colorectal cancer among those screened using CCC gFOBTs • Only colorectal cancers detected as a result of screening for a CCC 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: - An abnormal gFOBT was followed by large bowel endoscopy or colonic surgical resection within 183 days, and - Date of colorectal cancer in OCR occurred between 7 days before and up to 91 days after large bowel endoscopy or within ± 7 days of surgery, and - 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 or defined by OHIP fee codes Z555A, Z491A-Z499A and Z580A through OHIP data - Colonic surgical resections were defined in CIHI as resection with or without stoma, bypass or local excisions of colon and rectum, using the relevant Canadian Classification of Health Interventions (CCI) codes developed by the Canadian Institute for Health Information (CIHI). The codes used are listed in the Technical Appendix to Urbach DR, Simunovic M, Schultz SE, editors. Cancer Surgery in Ontario: ICES Atlas. Toronto: Institute for Clinical Evaluative Sciences, 2008. The Technical Appendix is located at - http://www.ices.on.ca/~/media/Files/Atlases-Reports/2008/Cancer-surgery-in-Ontario-2008-edition/Technical%20Appendix%20Full.ashx . Admission date was used as proxy of surgical date if surgical date was missing in CIHI database
Data source	• OHIP – large bowel endoscopy claims and total colectomy • CIHI DAD and NACRS – Colorectal related surgery records • CIRT – CCC colonoscopy records • LRT (Laboratory Reporting Tool) – CCC gFOBTs	• OCR - Resolved invasive colorectal cancers • RPDB- person table from Hub – Demographics • PCCF+, version 6A - Residence and socio-demographic info
Other jurisdictions	• Canadian Partnership Against Cancer (CPAC): CRC Detection Rate: Number of people with CRC confirmed by pathology from follow-up colonoscopy (performed within 180 days of abnormal screening FT) per 1,000 screened (Colorectal Cancer Screening in Canada, Program performance results report, 2009-2011)	
Data availability and limitations	• Result information on program-branded kits available to Cancer Care Ontario through LRT, for participating 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

Table 65 Invasive colorectal cancer detection rate (family history of colonoscopy)

Indicator	Invasive colorectal cancer detection rate (family history of colonoscopy)	
Indicator definitio	Number of Ontario screen-eligible people, 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 people with a detected invasive colorectal cancer among those screened for CCC indications, ages 50–74 for family history colonoscopy ————————————————————— Total number of Ontario screen-eligible people screened for CCC indications, ages 50–74 for family history colonoscopy	X1,000 = Invasive CRC Rate Per 1,000 Colonoscopies
Denominator	Total number of Ontario screen-eligible people screened for CCC indications, ages 50–74 for family history colonoscopy • People 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 screen date per person by FH colonoscopy date • People who had completed both a gFOBT and a FH colonoscopy were counted in the FH colonoscopy group • Each individual was counted once regardless of the number of tests performed • LHIN assignment was based on PCCF+, version 6A. Residential postal code was used to identify LHIN. People with unknown/missing LHINs are excluded	**Exclusions:** • People with a missing or invalid HIN, date of birth, sex or postal code • People with a previous invasive colorectal cancer before the index date, with the exception of those diagnosed with colorectal cancer 7 days before FH colonoscopy - 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 • People with a previous total colectomy before the index date - Total colectomy was identified in OHIP by fee codes S169A, S170A, S172A
Numerator	Total number of Ontario screen-eligible people with a detected invasive colorectal cancer among those screened for CCC indications, ages 50–74 for family history colonoscopy • Only colorectal cancers detected as a result of screening for a CCC indication (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: - Date of colorectal cancer in OCR occurred between 7 days before and up to 91 days after FH colonoscopy
Other jurisdictions	None	
Data source	• OHIP – large bowel endoscopy claims and colectomy • CIRT – CCC FH colonoscopy records • OCR – Resolved invasive colorectal cancers	• RPDB – Demographics • PCCF+, version 6A - Residence and socio-demographic info
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 III: TECHNICAL SPECIFICATIONS

Table 66 **Ontario Breast Screening Program (OBSP) participation gap**

Definition	Percentage of Ontario screen-eligible women, 52-74 years old, who were overdue for breast cancer screening tests	
Calculations	$\frac{\text{Total number of Ontario screen-eligible women ages 52-74, who were overdue for breast cancer screening tests}}{\text{Total number of Ontario screen-eligible women ages 52-74}}$	X100 = OBSP Overdue Rate
Denominator	Total number of Ontario screen eligible women, 52-74 years old • Ontario women ages 52-74 at the index date • Index date was defined as July 1, 2015 • The RPDB address closest to the index date was used to assign postal code - Neighbourhood income quintile was determined using PCCF+, version 6A; this indicator was based on income quintiles developed by Statistics Canada; income quintiles range from 1 to 5 (low to high) - Neighbourhood percent immigrant was determined using PCCF+, version 6A; this indicator divides DAs into three categories according to the percentage of immigrants: low immigrant (≤ 27% immigrant population), moderate immigrant (27.1-51.8% immigrant population), and high immigrant (≥ 51.9% immigrant population) - Census Subdivision (CSD) was spatially joined to the data at latitude and longitude locations determined by PCCF+, version 6A - Census Tract (CT) was spatially joined to the data at latitude and longitude locations determined by PCCF+, version 6A • PEM status and enrolment was determined at the index date - Physician in a PEM practice was determined using CPDB (Corporate Provider Database) using the B28 affiliation; patient enrolment status was determined using CAPE (Client Agency Program Enrolment database); analyses were stratified by patients' enrolment status with a PEM physician's gender.	**Exclusions:** • People with a missing or invalid HIN, date of birth, sex, or postal code • People with a primary address outside of Ontario • People with a primary address outside of Ontario • Women with a prior diagnosis of invasive or in situ breast cancer before index date; prior diagnosis of breast cancer was defined as: ICD-O-3 codes: C50, a morphology indicative of breast invasive or in situ cancer, microscopically confirmed with a path report • Women with a mastectomy before index date. Mastectomy was defined in OHIP by fee codes E505, E506, E546, R108, R109, and R117 • Women confirmed to be at high risk of breast cancer by genetic assessment (counselling and/or testing) before index date - Confirmation date of high risk status for women referred to genetic assessment (Category B) is defined as the most recent of either the genetic assessment date or the update date.
Numerator	Total number of Ontario screen eligible women, ages 52–74, who had no Mammogram in previous 30 months as of index date. • 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: - X178 (screening bilateral mammogram) - X185 (diagnostic bilateral mammogram)	• Each individual was counted once regardless of the number of tests performed • If a woman had multiple Mammograms, the most recent test was selected • Multiple OHIP claims for the same patient, same test and on the same day were assumed to be a single claim • All mammograms in ICMS were counted, including those with partial views
Data sources	• OHIP CHDB (Claims History Database) – Mastectomy, and non-OBSP mammograms • ICMS (Integrated Client Management System) - OBSP mammograms • OCR (Ontario Cancer Registry) - resolved in situ and invasive breast cancers • RPDB (Registered Persons Database) – Demographics	• PCCF+, version 6A - Residence and socio-demographic information • CAPE (Client Agency Program Enrolment database) – Physician/patient enrolment information • CPDB (Corporate Providers Database) - Physician PEM status
Data availability and limitations	• Historical RPDB address information is incomplete; therefore, the most recent primary address was selected for reporting • CHDB code X178 for screening bilateral mammography was introduced in October 2010 • CHDB 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	• Some family physician groups, e.g., community health centres (CHC), Northern Physician Retention Initiative (NPRI) and Nurse Practitioner-Led Clinics, are also considered comprehensive models of primary care, but are not considered PEM practices as they do not enroll patients to a family doctor; patients seen in those groups were not included in the PEM enrolled category • High risk data are available from July 2011; there is up to a year reporting for high risk. Because for women, it may take up to one year from being referred to the High Risk OBSP to completion of genetic assessment

Table 67 Ontario Cervical Screening Program (OCSP) participation gap

Definition	Percentage of Ontario screen-eligible women, 24-69 years old, who were overdue for cervical cancer screening tests	
Calculations	$\frac{\text{Total number of Ontario screen-eligible women ages 24-69, who were overdue for cervical cancer screening test}}{\text{Total number of Ontario screen-eligible women ages 24-69}}$ X100 = OCSP Overdue Rate	
Denominator	Total number of Ontario screen eligible women, 24-69 years old • Ontario women ages 24-69 at the index date • Index date was defined as July 1, 2015 • The RPDB address closest to the index date was used to assign postal code - Neighbourhood income quintile was determined using PCCF+, version 6A; this indicator was based on income quintiles developed by Statistics Canada; income quintiles range from 1 to 5 (low to high) - Neighbourhood percent immigrant was determined using PCCF+, version 6A; this indicator divides DAs into three categories according to the percentage of immigrants: low immigrant (≤ 27% immigrant population), moderate immigrant (27.1-51.8% immigrant population), and high immigrant (≥ 51.9% immigrant population) - Census Subdivision (CSD) was spatially joined to the data at latitude and longitude locations determined by PCCF+, version 6A. - Census Tract (CT) was spatially joined to the data at latitude and longitude locations determined by PCCF+, version 6A. • PEM status and enrolment was determined at the index date - Physician in a PEM practice was determined using CPDB (Corporate Provider Database) using the B28 affiliation; patient enrolment status was determined using CAPE (Client Agency Program Enrolment database); analyses were stratified by patients' enrolment status with a PEM physician's gender. **Exclusions:** • People with a missing or invalid HIN, date of birth, sex, or postal code • People with a primary address outside of Ontario • Women diagnosed with an invasive cervical cancer before 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 • Women with a hysterectomy before index date	• Women with a hysterectomy were identified through CHDB, using the following fee codes: - E862A: When hysterectomy is performed laparoscopically, or with laparoscopic assistance - P042A: Obstetrics – labour – delivery – caesarean section including hysterectomy - Q140A: Exclusion code for enrolled female patients ages 35-70 with hysterectomy - S710A: Hysterectomy - with or without adnexa (unless otherwise specified) – with omentectomy for malignancy - S727A: Ovarian debulking for stage 2C, 3B or 4 ovarian cancer and may include hysterectomy - Q140A: Exclusion code for enrolled female patients ages 35-70 with hysterectomy or tested for cervical diseases that preclude regular screening Pap tests - 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 - 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 - S762A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical trachelectomy - excluding node dissection - S763A: Hysterectomy - with or without adnexa (unless otherwise specified) – radical (Wertheim or Schauta) - includes node dissection - S765A: Amputation of cervix - S766A: Cervix uteri - Exc - cervical stump – abdominal - S767A: Cervix uteri - exc - Cervical stump – vaginal - S767A: Cervix uteri - exc - Cervical stump – vaginal - S816A: Hysterectomy - with or without adnexa (unless otherwise specified) – vaginal • Women with cervical assessment procedures in 36 months before index date; If a woman had multiple cervical assessment procedures, the most recent procedure was selected; these procedures were identified through OHIP claims as: - Z730A: Follow up colposcopy without biopsy with or without endocervical curetting - Z731A: Initial investigation of abnormal cytology of vulva and/or vagina or cervix under colposcopic technique with or without biopsy(ies) and/or endocervical curetting - Z787A: Follow-up colposcopy with biopsy(ies) with or without endocervical curetting - Z725A: Dilatation and cauterization under general anaesthesia - Z720A: Biopsy - with or without fulguration - Z770A: Endometrial sampling
Numerator	Total number of Ontario screen eligible women, ages 24–69, who had no Pap test in previous 42- months as of index date. • Identifying Pap tests: OCSP Pap tests were identified in CytoBase Non-OCSP Pap tests were identified using fee codes in OHIP: - E430: D/T proc-Pap smear performed outside of hosp-add - G365: D/T proc-Gynaecology-Papanicolaou smear	- G394: Add. Pap smear for follow-up of abnormal or inadequate smears - L713: Gynaecological specimen - L733: Cervicovaginal specimen - L812: Cervical Vaginal specimen - E431: When Papanicolaou smear is performed outside of hospital, to G394 - L643: Lab. Med.-Microbiol.-Microscopy-Smear Only, Gram/Pap Stain. - Q678: Gynaecology – Pap smear – periodic – nurse practitioners
Data sources	• CytoBase – Pap tests • OHIP CHDB (Claims History Database) – Hysterectomies, assessment procedure, and Pap tests • OCR (Ontario Cancer Registry) - invasive cervical cancers, resolved in situ and invasive breast cancers	• RPDB (Registered Persons Database) – Demographics • PCCF+, version 6A - Residence and socio-demographic information • CAPE (Client Agency Program Enrolment database) – Physician/patient enrolment information • CPDB (Corporate Providers Database) - Physician PEM status
Data availability and limitations	• Historical RPDB address information is incomplete; therefore, the most recent primary address was selected for reporting • A small proportion of Pap tests performed as a diagnostic test could not be excluded from the analysis	• Some family physician groups, e.g., community health centres (CHC), Northern Physician Retention Initiative (NPRI) and Nurse Practitioner-Led Clinics, are also considered comprehensive models of primary care, but are not considered PEM practices as they do not enroll patients to a family doctor; patients seen in those groups were not included in the PEM enrolled category

Table 68 Guaiac fecal occult blood test (gFOBT) volumes (2003–2014)

Definition	Number of gFOBTs performed in Ontario for people ages 50–74 in a given calendar year.	
Technical notes	Number of gFOBTs performed in Ontario for people ages 50–74 in a given calendar year: • FOBT records were extracted from OHIP using fee codes L179A, L181A, G004A and from LRT. • Total colectomy records were extracted from OHIP using fee codes S170A, S169A, S172A. • Colorectal cancer diagnosis information was extracted from the HUB program profiles using program key 7001 and 7002. • Participant date of birth was extracted from RPDB. Age was defined as the age at time of screening.	**Exclusions:** • Missing or invalid HINs were excluded. • Duplicate entries on the same day for the same individual were only counted once. • Duplicate records were excluded if LRT and OHIP service dates were identical or within +/- 2 days for the same individual, in which case the OHIP record was selected and the duplicate LRT record was excluded. • gFOBT records with a prior colorectal cancer diagnosis or total colectomy record was excluded.
Data sources	OHIP CHDB (Claims History Database) – gFOBT, total colectomy LRT (Laboratory Reporting Tool) – CCC gFOBT	RPDB (Registered Persons Database) – Date of Birth Screening Hub – Colorectal cancer diagnosis

Table 69 Colonoscopy volumes (2003–2014)

Definition	Number of colonoscopies performed in Ontario for people ages 50–74 in a given calendar year.	
Technical notes	Number of colonoscopies performed in Ontario for people ages 50–74 in a given calendar year: • Colonoscopy records were extracted from OHIP using fee codes Z555A, Z496A, Z497A, Z498A, Z499A, Z491A, Z492A, Z493A, Z494A, Z495A and from CIRT. • Total colectomy records were extracted from OHIP using fee codes S170A, S169A, S172A. • Colorectal cancer diagnosis information was extracted from the HUB program profiles using program key 7001 and 7002. • Participant date of birth was extracted from RPDB. Age was defined as the age at time of screening.	**Exclusions:** • Missing or invalid HINs were excluded. • Duplicate entries on the same day for the same individual were only counted once. • Duplicate records were excluded if CIRT and OHIP service dates were identical or within +/- 2 days for the same individual, in which case the OHIP record was selected and the duplicate CIRT record was excluded. • Colonoscopy records with a prior colorectal cancer diagnosis or total colectomy record was excluded.
Data sources	OHIP CHDB (Claims History Database) – Colonoscopy, total colectomy CIRT (Colonoscopy Interim Reporting Tool) – CCC colonoscopy	RPDB (Registered Persons Database) – Date of Birth Screening Hub – Colorectal cancer diagnosis

APPENDIX IV: LIST OF ABBREVIATIONS AND ACRONYMS

AGC	atypical glandular cells
AOR	adjusted odds ratio
ASC-H	atypical squamous cells, cannot exclude high-grade squamous intraepithelial lesion
BRCA	breast cancer susceptibility gene
CA	census agglomeration
CAPE	Client Agency Program Enrolment database
CAR-MAP	Canadian Association of Radiologists' Mammography Accreditation Program
CCC	ColonCancerCheck
CCI	Canadian Classification of Health Interventions
CHC	community health centre
CHDB	Claims History Database
CI	confidence interval
CIHI	Canadian Institute for Health Information
CIRT	Colonoscopy Interim Reporting Tool
CMA	census metropolitan area
CPAC	Canadian Partnership Against Cancer
CPDB	Corporate Provider Database
CRC	colorectal cancer
CSD	census subdivision
CT	census tract
DAD	Discharge Abstract Database
DCIS	ductal carcinoma in situ
EMR	electronic medical record
EU	European Union
FH	family history
FIT	fecal immunochemical test
FNA	fine needle aspiration
FOBT	fecal occult blood test
gFOBT	guaiac fecal occult blood test
GIS	Geographic Information Systems
HIN	health insurance number

HPV	human papillomavirus
HSIL	high-grade squamous intraepithelial lesion
IARC	International Agency for Research on Cancer
ICD-O	International Classification of Diseases for Oncology
ICES	Institute for Clinical Evaluative Sciences
ICMS	Integrated Client Management System
LEEP	loop electrosurgical excision procedure
LHIN	Local Health Integration Network
LRT	Laboratory Reporting Tool
LSIL	low-grade squamous intraepithelial lesion
MIZ	metropolitan influenced zones
MRI	magnetic resonance imaging
NACRS	National Ambulatory Care Reporting System
NHS	National Health Service (United Kingdom)
NILM	negative for intraepithelial lesion or malignancy
NPRI	Northern Physician Retention Initiative
OBSP	Ontario Breast Screening Program
OCR	Ontario Cancer Registry
OCSP	Ontario Cervical Screening Program
OHIP	Ontario Health Insurance Plan
PCCF	postal code conversion file
PC SAR	Primary Care Screening Activity Report
PEM	patient enrollment model
PHAC	Public Health Agency of Canada
PIMS	Pathology Information Management System
PPV	positive predictive value
RPDB	Registered Persons Database
RR	rate ratio
SAR	Screening Activity Report
TNM	tumour, node, metastases
U.K.	United Kingdom

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