



BC Cancer Breast Screening 2018 Program Results

September 2019

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1 – MESSAGE



Message from the Medical Director

Each year the Annual Report stems from a small team within the central program office. This is just one example of program collaboration, with several others extending beyond the office to further breast health across the province. Of particular note is the ongoing work to address the risks of breast density, and disseminate understanding thereof to allow for informed decision making. Notification of breast density through screen reports to patients and providers began in the fall of 2018. Tools have subsequently been developed to educate and guide both groups in breast health choices. This progress has depended on the collaboration of numerous program staff with patients, primary care providers, public advocates, mammographers, radiologists and the Ministry of Health.

The topic of breast density also appears in the research interests of the program. The utilization of both internal and external research expertise continues, with the aim of better understanding the risks associated with breast density. We are particularly excited about recent personnel and IT infrastructure developments which will facilitate investigation of new areas, including artificial intelligence.

Collaboration has also occurred at the chief screener level, including a working group to revise the annual statistics package created for each screener. This contains key metrics of quality, and the new format was designed to promote their interpretation and use in professional development. We look forward to sharing this new tool with all screeners shortly.

A final example is particularly noteworthy for its wide scope. The Breast Imaging Electronic Reporting Solution is well into implementation, and has required input from all sections of the program in addition to all screening centres and their respective health authorities and community imaging clinics. This project will improve service to all screening participants, either in their return to screening, or along a diagnostic pathway.

And now back to this report. Program invasive cancer detection continues to exceed national targets at 9.4 per 1000 for initial screens and 3.9 per 1000 for subsequent screens. The program average for abnormal call rate has stabilized at 9.2% overall, and we continue to participate in national strategies to optimize this.

Thank you for all your contributions to the teamwork described here, and to the numerous other projects underway. We look forward to further exciting developments in the upcoming months.

– Dr. Colin Mar

Message from the Screening Operations Director



We are pleased to provide our annual report which includes both program results as well as initiatives the program undertook in order to improve and promote the services we provide.

In 2018 the program began including breast density assessments with both provider and patient screening results letters. BC was the first breast screening program in Canada to include breast density assessments for all women with their results.

In the Fall the program held a successful promotions campaign with the launch of its *Mammolanche – A Movement for Mammograms*. BC Cancer partnered with Corus Entertainment and Global BC to increase screening awareness and mammography appointments across BC. The campaign included a commercial on Global, Public Service Announcements featuring Global BC personalities, and patient stories on Facebook and Twitter. The *Mammolanche* campaign was successful in helping the Breast Screening Program meet its goal of achieving 48,000 screening appointments in October and November 2018.

In 2018 the program undertook a tender process for an electronic reporting solution to replace its current paper based reporting practice. In collaboration with the health authorities a vendor was identified and work is now underway to integrate the solution across the province. The new solution will provide significant advantages for the program, including the elimination of paper reporting practices and manual data entry, as well as improved report turnaround time.

Janette Sam
September, 2019



2 – EXECUTIVE SUMMARY

BC Cancer is proud of the achievements of the Breast Screening Program. The population based breast cancer screening program was the first of its kind in Canada and is in its 31st year of operation. Since the inception of the program in 1988 to the end of 2018, the program has provided over 6,123,553 screening mammograms and detected 26,693 (breast) cancers.

The Breast Screening Program has a participation target of 70% of eligible 50-69 year old women to have a screen every two years. The number of women 50-69 eligible for a screening mammogram grows each year as the population ages and this cohort increases in size. The overall participation remained steady at 53%.

3 – SCREENING RECOMMENDATIONS FOR WOMEN IN BRITISH COLUMBIA

BC's provincial breast screening recommendations are consistent with current evidence-based research findings, effective Feb 4, 2014. Recommendations encompass the use of mammography, MRI, breast self-examination, and clinical breast examination to screen for breast cancer. Information about the BC breast screening recommendations may be found in appendix 2, 2018 Breast Screening Program Screening Recommendations, and online at www.bccancer.bc.ca/screening/breast.

3.1 Breast Density Update

The Breast Screening Program completed a review of its protocols related to breast density and screening mammography in 2018. Given the complexity of the topic BC Cancer commissioned Dr. Andrew Coldman, Emeritus Scientist in Cancer Control Research, to conduct an external review. The Coldman review evaluated evidence regarding breast density and breast cancer risk including the scientific literature and Breast Screening Program data.

As a result of the review, three recommendations were made to BC Cancer:

- Develop a plan to communicate breast density results to providers and patients in British Columbia.
- Continuously assess the performance of the Breast Imaging Reporting and Data System (BIRADS) density scoring within the BC Cancer Breast Screening Program and monitor the scientific literature for opportunities for improvement.
- Monitor ongoing results of randomized controlled trials of supplemental screening in women with negative screening mammography.

B.C. adopted all three recommendations to empower women with greater information about their breast health. Beginning mid-October 2018 all screening mammogram results sent to both B.C. women and their primary care providers include BI-RADS breast density assessments.

4 – ABOUT THE BREAST SCREENING PROGRAM

Regular breast cancer screening is an important part of a women’s health routine. Here in BC we have some of the best survival outcomes in Canada for those women who do get breast cancer. This success is largely due to improved cancer treatments and participation in breast cancer screening.

Obtaining a regular mammogram is a key component of early detection – regular breast cancer screening can find cancer when it is small, which means:

- There may be more treatment options.
- It is less likely to spread.
- There is a better chance of treating the cancer successfully.

A woman’s risk of breast cancer increases as she ages; over 80% of breast cancers in BC are found in women 50 years and older. BC Cancer is committed to finding breast cancers early through breast cancer screening by its population based program. The Breast Screening Program utilizes standard two-view bilateral mammography (x-ray of the breast) for breast cancer screening. Women ages 40-74 may self-refer to the program; however it is recommended that by age 50 average risk women have a screening mammogram every two years. Women are not eligible for a screening mammogram in BC if they have had breast cancer or breast implants, or if they currently have breast symptoms requiring a diagnostic investigation. These women must speak with their primary care provider and may be referred for a diagnostic mammogram.

4.1 Centres and Mobile Services

There are 36 fixed centres across the province, and three mobile vans that visit over 170 smaller BC communities, including many First Nations communities. Mobile schedules are posted on the Breast Screening Program website (www.bccancer.bc.ca/screening/breast) and are sent to local health professionals.

4.2 The Screening Process

The Screening Process is illustrated in Figure 3.1 at the end of this section. The process consists of four stages:

1. Identify and invite the target population for screening.
2. Conduct the screening examination.
3. Investigate any abnormalities identified on screening.
4. Issue a screening reminder at the appropriate interval.

4.3 FAST TRACK – Facilitated Referral to Diagnostic Imaging

On average approximately 9% of women who attend for screening will require additional diagnostic testing. Recognizing the importance of timely follow up, the Fast Track Referral System was established in 1999. The Fast Track system facilitates referral for women who require further testing.

4.4 Fast Track Overview

- At the time of screening, women are informed that if further tests are required, they will be called directly by a diagnostic facility to book their appointment.
- If further testing is required i.e. additional mammographic views or breast ultrasound, the woman is booked at the Fast Track diagnostic clinic closest to the screening site, usually at the same location.
- The Breast Screening Program images and results are transferred to the diagnostic office prior to the appointment.
- Breast Screening Program notifies the woman’s health care provider where their patient has been referred for additional testing.
- The diagnostic facility makes every effort to provide an appointment within one week of receiving the referral.
- Standardization of the Fast Track referral system ensures that all women benefit from the shortened time between an initial abnormal screening result and the first appointment for diagnostic assessment.

4.5 Program Evaluation

Data is collected and analyzed on an ongoing basis to monitor the program’s effectiveness and to identify areas for improvement. Breast Screening Program evaluation indicators, quality standards and systems are based on national and international guidelines and recommendations, including the 3rd edition of the *Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Cancer Screening Program Performance*, published in February 2013¹.

Results of this analysis are presented in the “PROGRAM RESULTS” section of this report (Section 5). Age-specific breast cancer incidence and mortality rates are provided by the BC Cancer Registry.

¹ Canadian Partnership against Cancer. Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Cancer Screening Program Performance (3rd edition). Toronto: Canadian Partnership Against Cancer; February, 2013

4.6 Quality Assurance

A team of Medical Physicists, a Provincial Professional Practice Leader for Mammography Technologists, and a Quality Management Coordinator are dedicated to quality assurance at all Breast Screening Program centres. This team supports imaging quality assurance and provides professional direction in equipment selection, acceptance testing, troubleshooting, quality control testing and accreditation at screening centres around the province. The Program also supports continuing education for radiologists and technologists.

The breast screening workforce is comprised of certified technologists from across BC who are trained and experienced in breast imaging. The Provincial Professional Practice Leader for Breast Screening Technologists has developed various initiatives to support the professional development of our dedicated technologists, including:

- Certificate in Breast Imaging scholarship program;
- Educational Webinars throughout the year;
- A Quarterly Technologist Newsletter;
- An educational event at the biennial Breast Screening Program Forum with continuing medical education (CME) credits that is also open to BCIT students comprised of up-to-date topics and speakers that are relevant to the profession;
- Breast Screening Program Mammography Teaching Sets for Technologists for CME credits;
- Mammography and Patient Care In-Service presentations (CME credits) at the centres;
- A comprehensive Breast Screening Program Technologist Manual with information to support a technologist's day-to-day duties.

Quality assurance and monitoring is a critical component of an organized screening program. Standards and systems in the Breast Screening Program are developed based on guidelines and recommendations from the Canadian Association of Radiologists (CAR), Public Health Agency of Canada (PHAC), the Canadian Association of Medical Radiation Technologists (CAMRT), the Breast Screening Program Quality Assurance Support Group, and the scientific literature.

Accreditation: Accreditation is the certification of competence in an area of expertise. CAR Mammography Accreditation is mandatory for all Breast Screening Program Centres. Centres participate in accreditation renewals every three years and are required to have an annual update. The team provides support and guidance for centres as they pursue accreditation. Accredited sites display a certificate for all women attending the service to view.

Image Quality Assurance: The Breast Screening Program Quality Assurance Support Group provides leadership and technical support to centres for their quality control practices which are standardized and monitored regularly. All centres undergo regular annual equipment testing and are also supported through site visits, training, and comprehensive manuals. The team also provides support for centres during equipment replacement.

4.6 Quality Assurance (continued)

Based upon best practices, the program has developed and implemented a comprehensive, harmonized quality control program specific for digital mammography equipment, as well as digital mammography-specific phantoms and a web based 'mQc' program. Technologists are trained to perform these quality control tests through site visit demonstrations. Access to the QC website allows technologists and physicists to review test results on site or remotely. The Breast Screening Program continues to work with other provinces to champion standardization of quality control programs for digital mammography.

4.7 Regular Promotion and Education Activities

Ongoing promotion activities include:

- Production of new promotional tools, such as brochures, posters, marketing giveaways, bookmarks and postcards that effectively communicate the benefits of mammography.
- Working with ethnic and First Nations groups to develop customized materials and culturally-sensitive approaches to increase understanding and interest in screening.
- Regular media advertisements to promote the mobile mammography service.
- A “@BCCancer” Twitter account that promotes relevant information about cancer screening including upcoming mobile visits in communities around the province.
- A Facebook page (@BCCancerScreening) that promotes relevant information about breast screening including upcoming mobile visits, an open platform for information sharing and video promotions.
- A website (www.bccancer.bc.ca/screening/breast) to support informed decision making about screening.
- Regular presence at health fairs and events throughout the province by the BC Cancer Prevention group.

4.8 Client Satisfaction Surveys

Each year the program performs a client satisfaction survey to ask women their feedback about the program and their screening visit experience. The survey consists of 1000 surveys sent each month to women randomly selected from across the province that have attended the program.

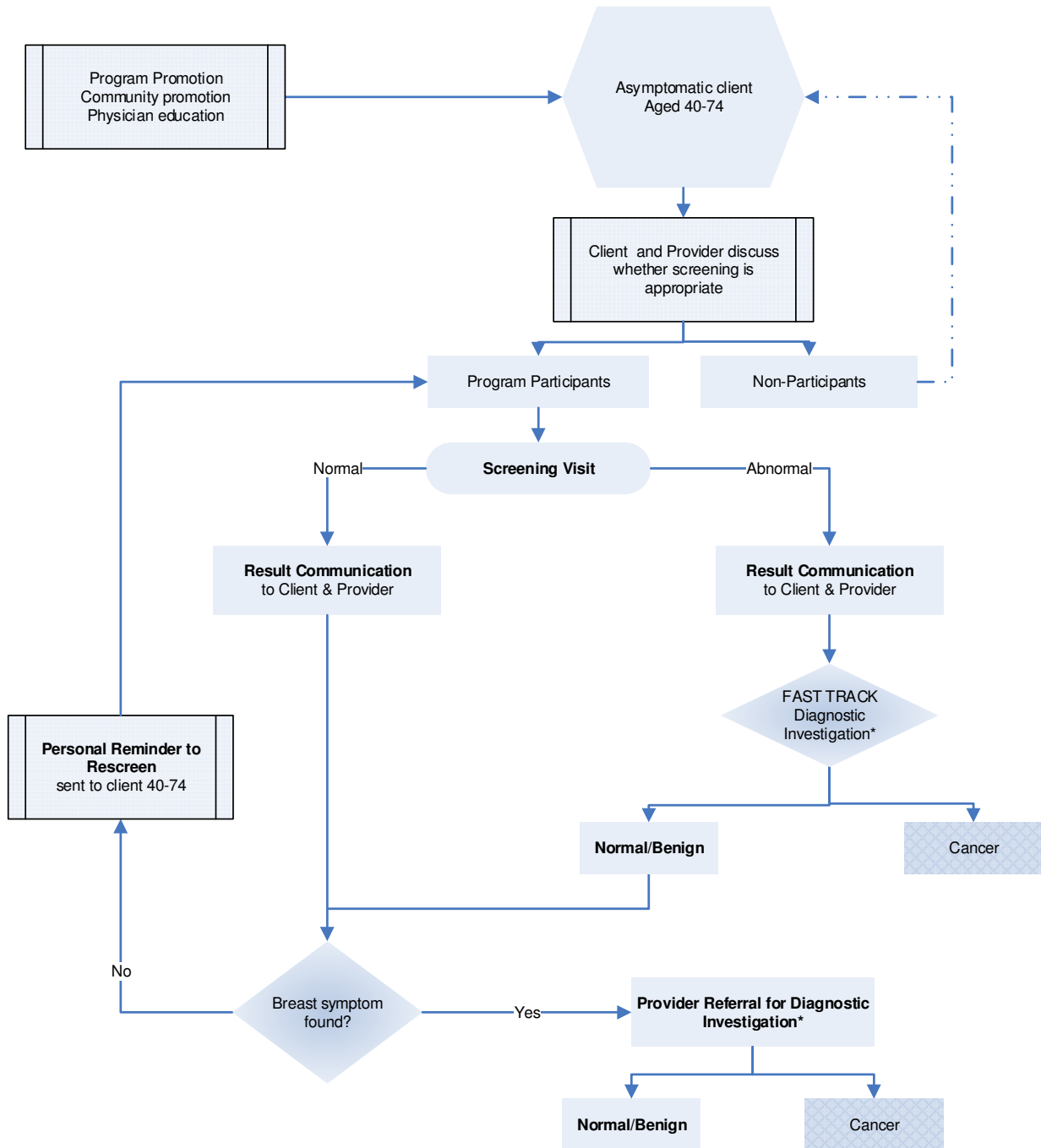
4.9 2018 Summary of Breast Screening Program Client Satisfaction Survey Results:

- The total number of surveys sent – **12,007**
- Total number of surveys returned – **4,893** (41% return rate)

The results are compiled and both program-wide and centre-specific results are shared with the centres twice a year. Any centre-specific comments provided by those surveyed are also forwarded to the centres for review.

Overall results show that the Breast Screening Program is meeting client expectations. Centres are encouraged to review their individual results, which also include trends over a three year period, and to identify opportunities for improvement at each individual site.

FIGURE 1: SCREENING PROCESS OVERVIEW



* Breast Screening obtains diagnostic investigation information from sources such as Medical Services Plan, surgeons, hospitals and BC Cancer Registry on women who consent to follow up.

5.0 — 2018 PROGRAM RESULTS

The program results section provides outcomes for various indicators including coverage, participation, follow-up, quality of screening, detection, and disease extent at diagnosis. The indicators used are adapted from the Canadian Partnership Against Cancer Guidelines for Monitoring Breast Cancer Screening Program Performance².

The program results include outcomes where applicable for women who have indicated they have a family history (higher than average risk women). In section 5.8, the Breast Screening Program performance measures are presented against the national targets set for Canadian breast cancer screening programs.

² http://www.cancerview.ca/idc/groups/public/documents/webcontent/guideline_monitoring_breast.pdf

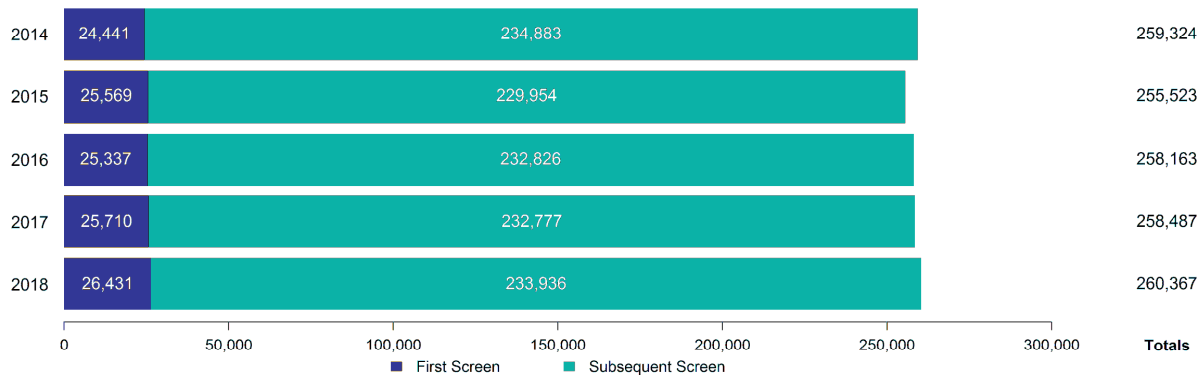
5.1 – RECRUITMENT AND RE-SCREENING

Screening Volume

The Breast Screening Program provided 260,367 examinations in 2018. During this period 26,431 (10.1%) of those examinations were provided to first time attendees.

Figure 2 shows that the total number of exams provided by Breast Screening Program in 2018 increased slightly compared to 2017. The 2014 updated screening policy transition completed in 2016. The revised policy recommended that average risk women 40-49 years old return to screen every two years rather than annually and that women with a higher risk due to family history screen annually. There was a resulting volume transition from 2014 - 2016 as women adjusted their screening frequency. This transition is now complete.

FIGURE 2: ANNUAL SCREENING VOLUME YEARS: 2014-2018



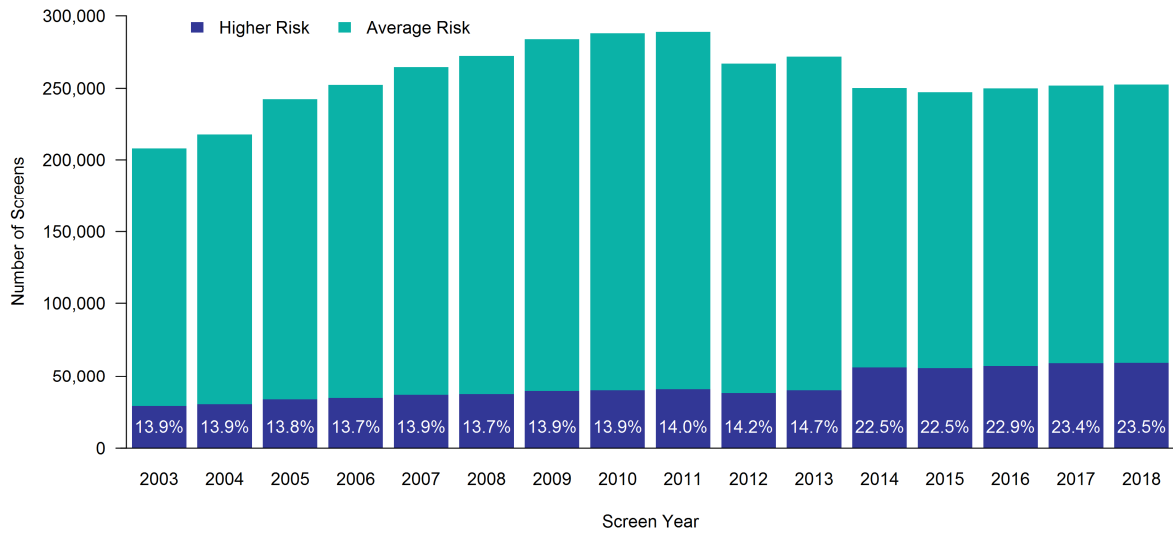
Notes

1. Breast Screening Program data extraction date: July 8, 2019.

Screening Volume (continued)

Figure 3 shows the percentage of women who are at higher risk increased slightly to 23.5% of the total number of women screened in 2018.

FIGURE 3: ANNUAL SCREENING VOLUME BY RISK AND SCREEN YEARS: 2003-2018



Notes

1. Breast Screening Program data extraction date: July 8, 2019.

Volume by Health Service Delivery Area: 2018

The age distribution of all exams and first exams performed in 2018 by Health Services Delivery Areas (HSDA) are displayed in Table 1.

- The majority of exams (67%) are performed for women between ages 50 to 69 in all HSDAs. This is similar to 2017.
- The majority of first time attendees were under 50 years of age; however, there are regional variations ranging from 39% in East Kootenay to an average of ~ 65% of first time attendees being under 50 years of age across most of the Lower Mainland.

TABLE 1: VOLUME BY HEALTH SERVICE DELIVERY AREA YEAR: 2018

HSDA	Total Exams	Age Distribution of All Exams			First Exams		Age Distribution of First Exams		
		<50	50-69	70+	n	% Total	<50	50-69	70+
East Kootenay	3,952	11%	71%	18%	464	12%	39%	57%	5%
Kootenay Boundary	3,746	11%	71%	18%	377	10%	42%	55%	3%
Okanagan	22,633	12%	69%	18%	1,969	9%	43%	52%	5%
Thompson Cariboo Shuswap	13,086	15%	69%	17%	1,166	9%	58%	40%	2%
Interior	43,417	13%	69%	18%	3,976	9%	47%	49%	4%
Fraser East	15,475	19%	66%	15%	1,671	11%	63%	35%	3%
Fraser North	36,058	22%	66%	12%	3,861	11%	66%	31%	3%
Fraser South	42,375	22%	65%	13%	4,917	12%	64%	33%	3%
Fraser	93,908	21%	66%	13%	10,449	11%	65%	33%	3%
Richmond	12,137	20%	68%	13%	1,235	10%	63%	33%	3%
Vancouver	33,359	22%	66%	12%	3,619	11%	65%	33%	2%
North Shore / Coast Garibaldi	16,345	18%	66%	15%	1,586	10%	62%	35%	3%
Vancouver Coastal	61,841	20%	66%	13%	6,440	10%	64%	34%	2%
South Vancouver Island	22,154	14%	68%	18%	1,964	9%	50%	46%	4%
Central Vancouver Island	17,612	11%	69%	21%	1,506	9%	44%	50%	5%
North Vancouver Island	7,739	11%	71%	18%	657	8%	42%	55%	4%
Vancouver Island	47,505	12%	69%	19%	4,127	9%	47%	49%	5%
Northwest	3,223	18%	68%	14%	343	11%	66%	34%	0%
Northern Interior	7,060	16%	70%	14%	625	9%	57%	41%	1%
Northeast	2,093	18%	71%	11%	259	12%	51%	47%	2%
Northern	12,376	17%	70%	13%	1,227	10%	58%	40%	1%
British Columbia	260,367	18%	67%	15%	26,431	10%	59%	38%	3%

Notes

1. Breast Screening Program data extraction date: July 8, 2019.

Volume by Health Service Delivery Area: 2018 (continued)

The age and volume distribution of all screens performed for women who self-identified as having a family history (higher risk) are displayed in table 2.

- The majority of higher risk exams (82%) are performed for women between ages 50 to 74 in all HSDAs.

TABLE 2: AGE AND VOLUME DISTRIBUTION FOR HIGHER RISK WOMEN BY HEALTH SERVICE DELIVERY AREA: 2018

HSDA	Number of Higher Risk Exams	% Higher Risk Exams	Age Distribution of Higher Risk Exams		
			40-49	50-74	75+
East Kootenay	950	24%	10%	84%	5%
Kootenay Boundary	962	26%	10%	86%	4%
Okanagan	6,169	27%	9%	86%	5%
Thompson Cariboo Shuswap	3,503	27%	11%	84%	4%
Interior	11,584	27%	10%	85%	4%
Fraser East	3,717	24%	13%	83%	4%
Fraser North	7,636	21%	17%	79%	4%
Fraser South	8,991	21%	16%	80%	4%
Fraser	20,344	22%	16%	80%	4%
Richmond	2,521	21%	14%	82%	4%
Vancouver	6,899	21%	18%	78%	3%
North Shore / Coast Garibaldi	4,078	25%	15%	82%	3%
Vancouver Coastal	13,498	22%	16%	80%	3%
South Vancouver Island	6,013	27%	12%	85%	4%
Central Vancouver Island	4,759	27%	9%	87%	4%
North Vancouver Island	2,075	27%	9%	87%	3%
Vancouver Island	12,847	27%	10%	86%	4%
Northwest	879	27%	16%	80%	3%
Northern Interior	1,836	26%	13%	84%	3%
Northeast	528	25%	17%	80%	2%
Northern	3,243	26%	15%	82%	3%
British Columbia	61,790	24%	14%	82%	4%

Notes

1. Breast Screening Program data extraction date: July 8, 2019.

Screening Participation

The percentage of BC women who have completed a Breast Screening Program screening mammogram at least once within 30 months as a proportion of the prevalence adjusted population.

The biennial screening participation rates are shown by HSDA for each age group in Table 3.

- In the 30-month period between July 1, 2016 and December 31, 2018, 344,685 women ages 50-69 participated in the Breast Screening Program.
- Compared with 2017, the participation increased overall in FHA. Fraser North had the highest HSDA participation rate at 55%.

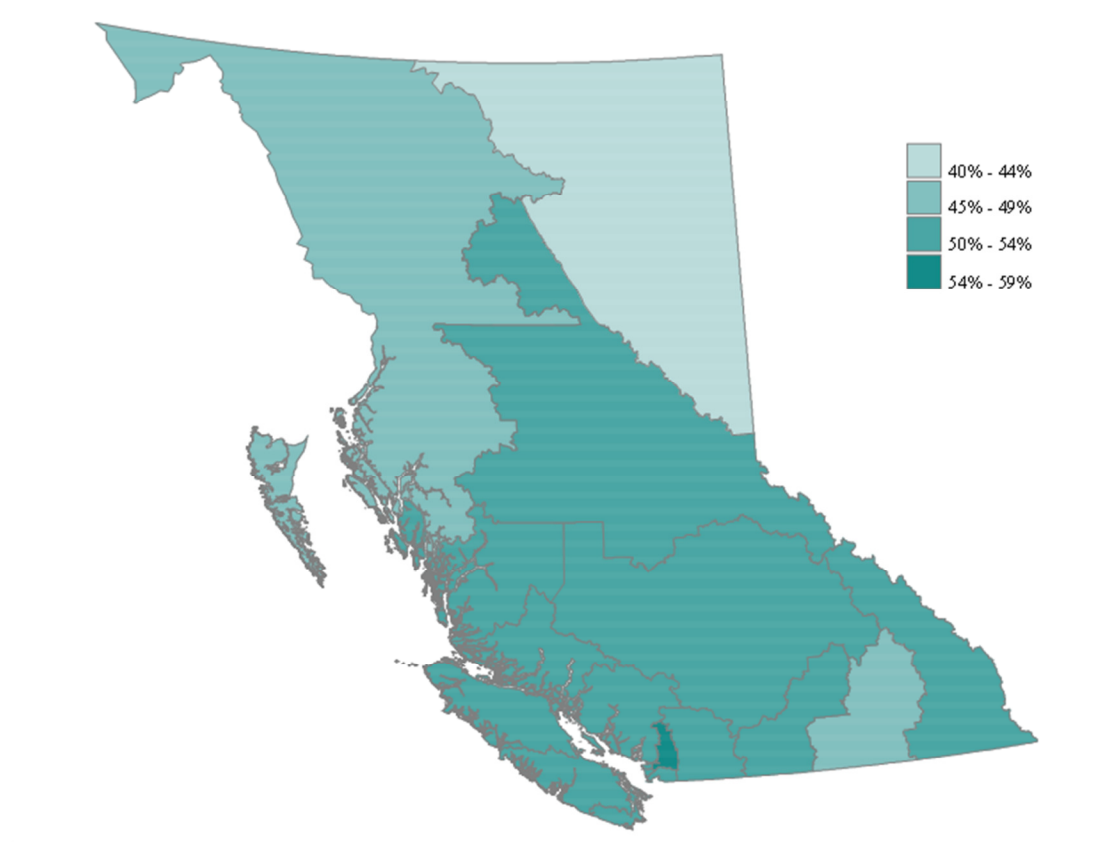
TABLE 3: REGIONAL 30-MONTH PARTICIPATION RATES BY 10-YEAR AGE GROUPS ENDING DECEMBER 31, 2018 INCLUSIVE

HSDA	10-Year Age Groups				Ages 50-69
	40-49	50-59	60-69	70-74	
East Kootenay	17%	45%	56%	55%	51%
Kootenay Boundary	16%	40%	49%	48%	45%
Okanagan	23%	49%	60%	59%	54%
Thompson Cariboo Shuswap	25%	46%	56%	56%	51%
Interior	22%	47%	57%	57%	52%
Fraser East	27%	49%	58%	55%	54%
Fraser North	29%	52%	59%	56%	55%
Fraser South	28%	50%	56%	52%	52%
Fraser	28%	50%	58%	54%	54%
Richmond	28%	46%	56%	51%	50%
Vancouver	28%	49%	56%	52%	52%
North Shore/Coast Garibaldi	27%	50%	59%	58%	54%
Vancouver Coastal	27%	49%	57%	54%	52%
South Vancouver Island	22%	49%	58%	57%	54%
Central Vancouver Island	21%	46%	59%	61%	53%
North Vancouver Island	19%	46%	59%	59%	53%
Vancouver Island	21%	47%	59%	59%	53%
Northwest	25%	45%	53%	51%	49%
Northern Interior	23%	48%	60%	56%	54%
Northeast	16%	39%	49%	46%	43%
Northern	22%	45%	56%	53%	50%
British Columbia	26%	49%	58%	55%	53%

Notes

1. Population data source: P.E.O.P.L.E. 2018 population projection (Sept 2018), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
2. Prevalence adjusted population estimates based on the weighted average of 2016, 2017 and 2018 female population estimates.
3. Postal code translation file: TMF201903 (Mar 2019).
4. Population and postal code data acquired through BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
5. Breast Screening Program data extraction date: July 8, 2019.

FIGURE 4: BIENNIAL SCREENING PARTICIPATION BY WOMEN AGES 50-69 OVER 30-MONTH PERIOD BETWEEN JULY 1, 2016 AND DECEMBER 31, 2018



Notes

1. Population data source: P.E.O.P.L.E. 2018 population projection (Sept 2018), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
2. Prevalence adjusted population estimates based on the weighted average of 2016, 2017 and 2018 female population estimates.
3. Postal code translation file: TMF201804 (Apr 2019).
4. Population and postal code data acquired through BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
5. Breast Screening Program data extraction date: July 8, 2019.

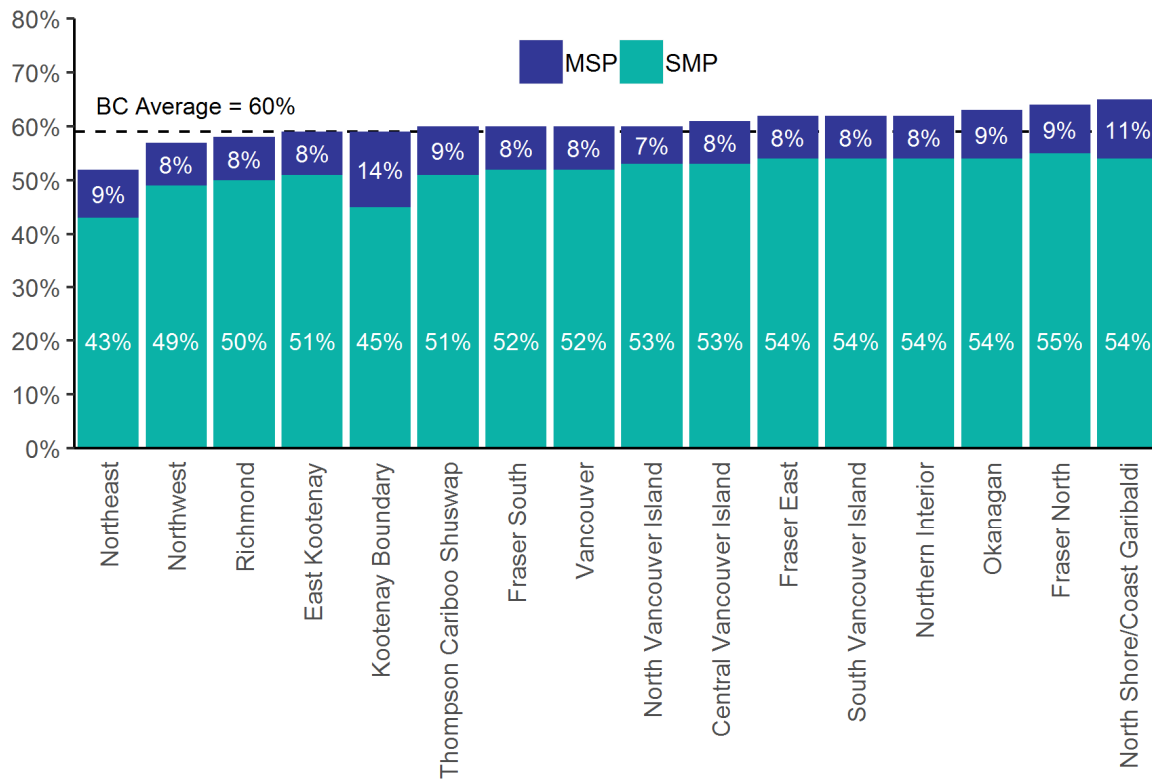
Bilateral mammography may be used for both screening and diagnostic purposes. A proportion of the bilateral mammography services paid through the Medical Services Plan (MSP) are directly related to screening. Data on bilateral mammography utilization were obtained from the MSP.

Figure 5 shows the proportion of women receiving bilateral mammography services through either the Breast Screening Program or MSP over a 30 month period. Some women may have had bilateral mammograms through both the Breast Screening Program and MSP. Thus, the proportions presented here may be slightly higher than the actual figures due to this possible duplication.

Screening Participation (continued)

- During the 30-month reporting period, 60% of BC women ages 50 to 69 received bilateral mammography services through either the screening program or MSP. This rate has increased 1% overall since the 30 month period ending December 2017.
- The percentage of women ages 50 to 69 receiving bilateral mammography ranged from 52% to 65% across the province. The percentage increased in the Northeast to 52% from 47% the year previous.
- Overall, the Breast Screening Program provided 86% of the bilateral mammography services for this age group.

FIGURE 5: BILATERAL MAMMOGRAPHY UTILIZATION BY WOMEN AGES 50-69 IN BC BETWEEN JULY 1, 2016 AND DECEMBER 31, 2018 INCLUSIVE



Notes

1. MSP data includes only MSP Fee-For-Service item 8611 on female patients only; all out of province claims are excluded.
2. MSP data contains payment date to June 30, 2018 for services provided between July 1, 2016 and December 31, 2018.
3. Breast Screening Program data includes single and multiple screens per woman provided between July 1, 2016 and December 31, 2018.
4. Population data source: P.E.O.P.L.E. 2018 (Sept 2018), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
5. Breast Screening Program data extraction date: July 8, 2019.

Screening Participation in Select Ethnic Groups

Participation rates of women ages 50 to 69 by selected ethnic groups are shown in Table 4. The percentage of each ethnic group in the population was computed based on Statistics Canada, Census of Population, 2016, Custom Table. The ethnic population size for each HSDA was estimated based on this ethnic population percentage and the P.E.O.P.L.E. 2018 population projections. The use of single ethnic group response data may cause an under-estimation of the ethnic population size, especially the East/South East Asian population in the Fraser North, Richmond, and Vancouver HSDAs. The Breast Screening Program data on ethnic origin were collected at the time of program registration on approximately 86% of attendee's ages 50 to 69 screened between July 1, 2016 and December 31, 2018. 11% of attendees did not specify their ethnicity and were excluded from this analysis.

The population data source file used for this calculation was updated, from 2011 to 2017, resulting in some changes in participation.

- Participation by Aboriginal women has increased by 1% overall (from 61% in 2017 to 62% in 2018).
- Participation by East/South East Asians decreased by 8% overall (from 62% in 2017 to 54% in 2018).
- Participation by South Asians has decreased by 3% overall (from 58% in 2017 to 55% in 2018).
- Participation by select ethnic groups remain higher than the overall provincial rate of 53%.

Table 4 indicates that there are regional variations in participation. This information helps inform future promotional activities.

TABLE 4: REGIONAL PARTICIPATION RATES OF WOMEN AGES 50-69 BY SELECTED ETHNIC GROUPS BETWEEN JULY 1, 2016 AND DECEMBER 31, 2018 INCLUSIVE

HSDA	Aboriginal		East/South-East Asian		South Asian	
	Population %	Participation Rate	Population %	Participation Rate	Population %	Participation Rate
East Kootenay	1%	>99%	1%	51%	<1%	80%
Kootenay Boundary	1%	>99%	1%	40%	<1%	>99%
Okanagan	1%	82%	2%	49%	1%	64%
Thompson Cariboo Shuswap	4%	61%	2%	58%	1%	38%
Interior	2%	74%	2%	51%	1%	56%
Fraser East	2%	58%	3%	78%	9%	51%
Fraser North	<1%	88%	29%	58%	4%	61%
Fraser South	<1%	80%	14%	61%	16%	48%
Fraser	1%	72%	18%	60%	11%	51%
Richmond	<1%	86%	61%	46%	5%	70%
Vancouver	1%	60%	42%	49%	4%	66%
North Shore/Coast Garibaldi	2%	45%	10%	51%	2%	75%
Vancouver Coastal	1%	51%	37%	49%	4%	69%
South Vancouver Island	1%	72%	5%	48%	1%	65%
Central Vancouver Island	2%	35%	2%	55%	1%	40%
North Vancouver Island	2%	41%	2%	52%	<1%	91%
Vancouver Island	2%	45%	3%	50%	1%	57%
Northwest	15%	57%	3%	28%	1%	65%
Northern Interior	4%	79%	2%	36%	1%	59%
Northeast	4%	81%	2%	15%	<1%	58%
Northern	7%	66%	2%	30%	1%	60%
British Columbia	1%	62%	16%	54%	5%	55%

Notes

1. Population data sources: P.E.O.P.L.E. 2018 population projection (Sept 2018), BC STATS, Ministry of Technology, Innovation and Citizens' Services, Government of British Columbia, and Statistics Canada, and Statistics Canada, Census of Population, 2016, Custom Table.
2. Postal code translation file: TMF201903 (Mar 2019).
3. Women attended the Breast Screening Program at least once between July 1, 2016 and December 31, 2018 inclusive.
4. East/South-East Asians include Chinese, Japanese, Korean, Filipino, Burmese, Cambodian, Laotian, Thai, Vietnamese, Indonesian, Malay, and other Asians.
5. South Asians include Bangladeshi, Bengali, East Indian, Gujarati, Pakistani, Punjabi, Sinhalese, Sri Lankan, Tamil.
6. Breast Screening Program data extraction date: July 8, 2019.

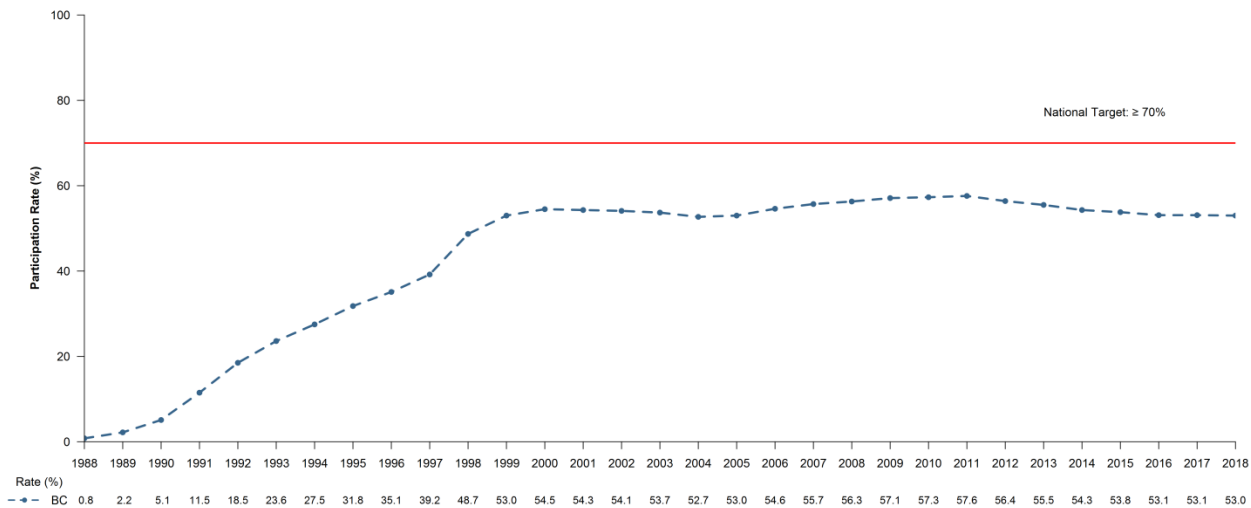
Population Percentage

1. Original data source - Statistics Canada, Census of Population, 2016, Custom Table.
2. East/South-East Asians include Chinese, Filipino, Burmese, Cambodian, Hmong, Khmer, Laotian, Thai, Vietnamese, Indonesian, Japanese, Korean, Malaysian, Singaporean, Mongolian, Taiwanese, Tibetan, Asian n.o.s. and East/Southeast Asian n.i.e.
3. South Asians include Bangladeshi, Bengali, East Indian, Goan, Gujarati, Kashmiri, Nepali, Pakistani, Punjabi, Sinhalese, Sri Lankan, Tamil, and South Asian n.i.e.

Trends in Screening Participation

By 2000, there were 36 fixed and mobile mammography centres enabling all BC women to have reasonable access to screening services. There are now 39 fixed and mobile centres serving BC. The percentage of women participating each year in the target population increased until 2000 and has remained steady since then, ranging between ~53-58%. This participation rate does not include women screened outside of the program.

FIGURE 6: BREAST SCREENING PROGRAM PARTICIPATION RATES (%) FOR WOMEN AGES 50-69 BY CALENDAR YEAR: 1988 – 2018



Notes

1. Breast Screening Program data extraction date: July 8, 2019.

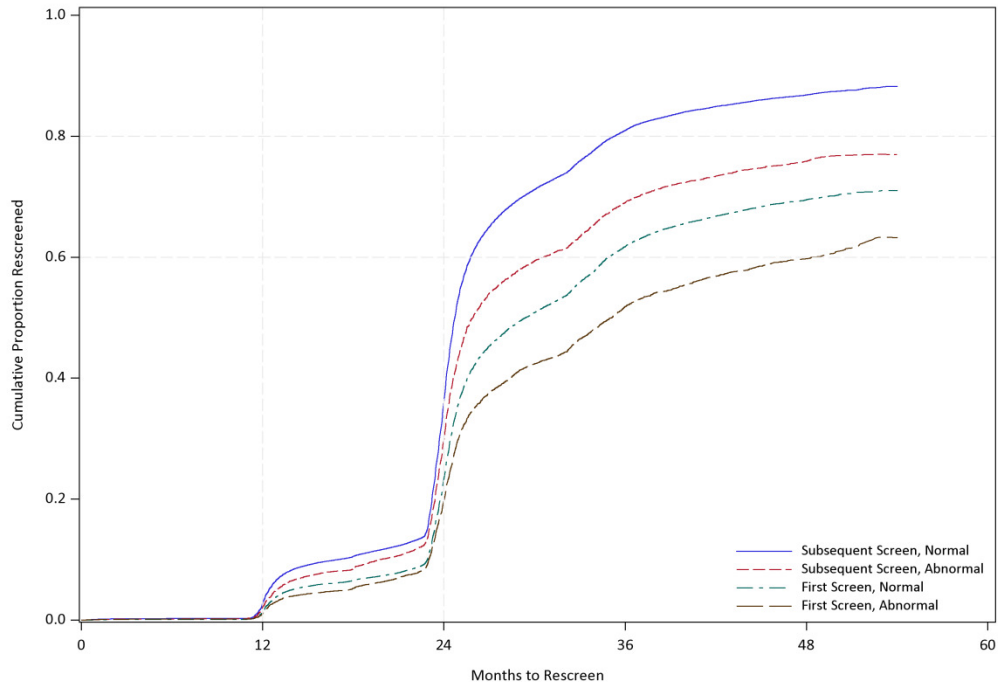
Screening Return Rates

Retention rate is the percentage of screen eligible women age that had a subsequent Breast Screening Program screening mammogram within 30 months of their previous program mammogram.

Regular attendance for screening is important in order to benefit from a reduction in breast cancer mortality. The program sends recall reminders to women when they are due for their next screening interval. A second letter is sent if there is no appointment scheduled within four to six weeks of the first letter. This two-letter reminder system is repeated again the following year if there is no response.

Figure 7-9 and Table 5-7 show return rates for **average risk** women ages 40 to 49, 50 to 69 and 40-74 respectively, who attended for breast screening between 2015 and 2017. By 24 months, when program recall mailing is active, women with normal results are more likely to respond to the recall letters than women who previously had an abnormal result. First time attendees have a lower rate of return than those who have had two or more visits already. By 30 months, 68% of women with a previous normal result and 50% of women with a previous abnormal result had returned to screening (Table 7). The Program has developed support material for the technologists to share with women at their first appointment to encourage them to return when they are recalled for future screening.

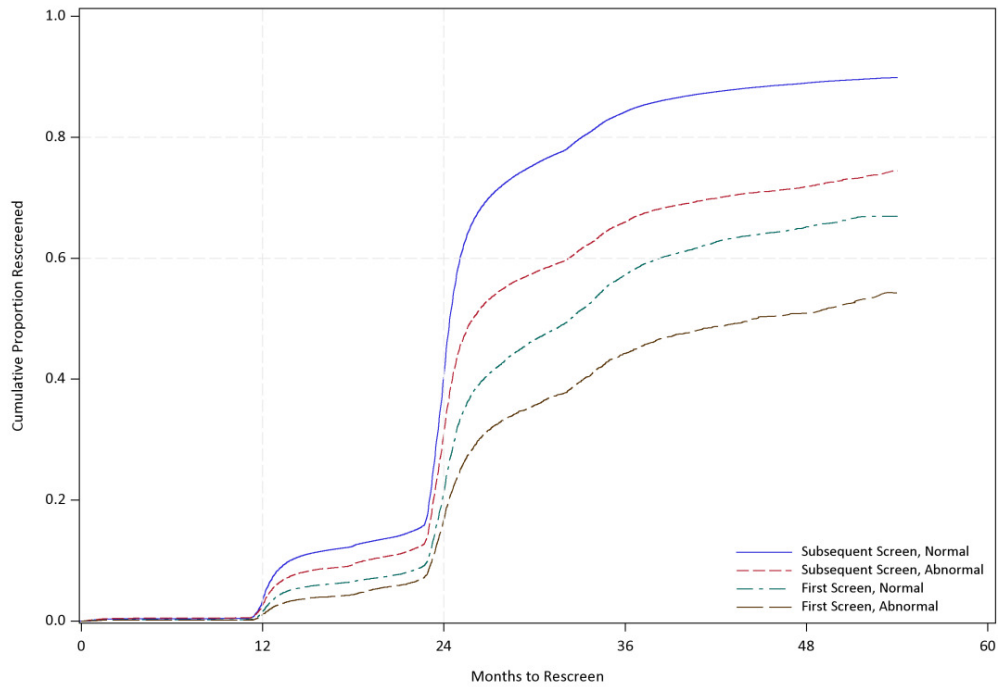
FIGURE 7: SCREENING RETURN RATES FOR AVERAGE RISK WOMEN AGES 40-49: 2015 – 2017



Notes

- 1. Breast Screening Program data extraction date: July 8, 2019.

FIGURE 8: SCREENING RETURN RATES FOR AVERAGE RISK WOMEN AGES 50-69: 2015 – 2017



Notes

- 1. Breast Screening Program data extraction date: July 8, 2019.

TABLE 5: SCREENING RETURN RATES FOR AVERAGE RISK WOMEN AGES 40-49: 2015 – 2017

	First Screen		Subsequent Screen		Overall	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Total Number to be Re-screened	36,074	8,358	64,572	7,309	100,646	15,667
Returned by 12 months	1%	1%	3%	2%	2%	2%
18 months	7%	5%	10%	8%	9%	7%
24 months	23%	20%	36%	30%	32%	24%
30 months	51%	42%	71%	59%	65%	51%
36 months	62%	52%	81%	69%	75%	61%

Notes

1. Breast Screening Program data extraction date: July 8, 2019.

TABLE 6: SCREENING RETURN RATES FOR AVERAGE RISK WOMEN AGES 50-69: 2015 – 2017

	First Screen		Subsequent Screen		Overall	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Total Number to be Re-screened	22,912	5,845	295,505	25,761	318,417	31,606
Returned by 12 months	1%	1%	3%	3%	3%	2%
18 months	7%	4%	12%	9%	12%	8%
24 months	21%	17%	40%	31%	39%	28%
30 months	46%	36%	75%	58%	74%	54%
36 months	57%	44%	84%	66%	83%	62%

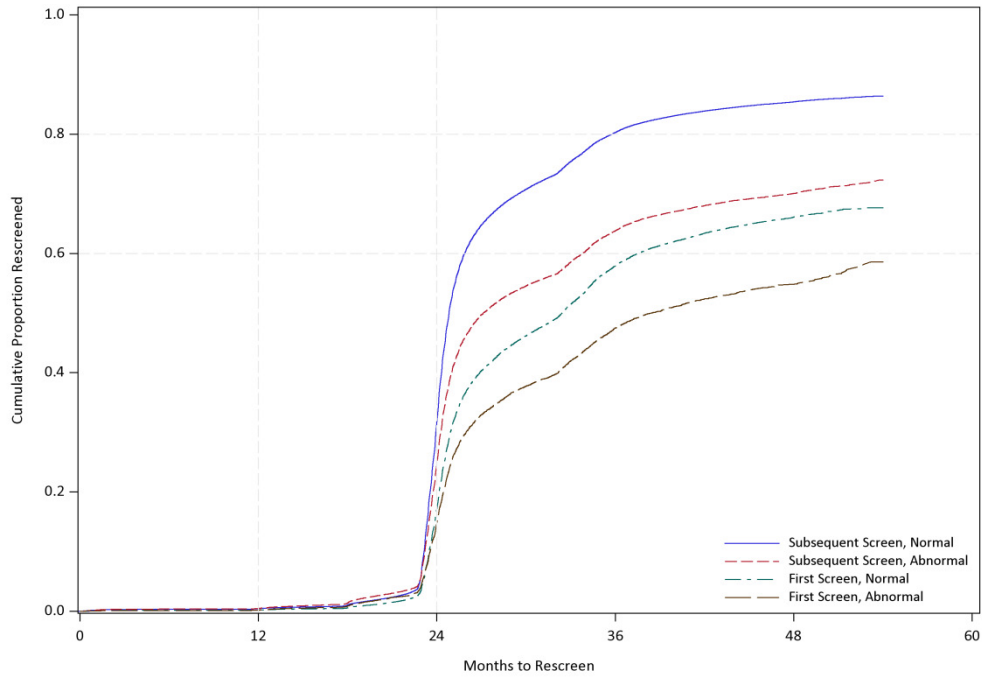
Notes

1. Breast Screening Program data extraction date: July 8, 2019.

Screening Return Rates by Risk Group

Figure 10 shows a graph of return rates for women ages 40 to 74 who self-identified as having a **family history** of breast cancer (higher risk) and attended for breast screening between 2015 and 2017. Women in this cohort are recommended to screen annually rather than every two years. By 18 months, 68% of women with a previous normal result and 48% of women with a previous abnormal result had returned to screening (Table 8). By 30 months, 85% of higher risk women who had a normal screen have returned for screening compared with 68% of average risk women.

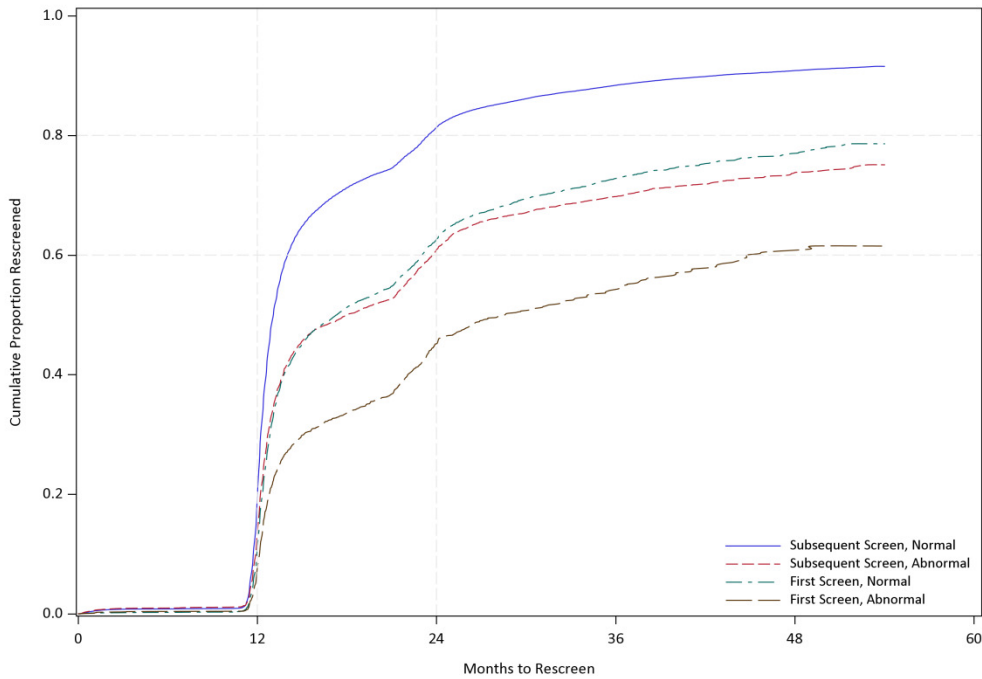
FIGURE 9: RETURN RATES FOR AVERAGE RISK WOMEN AGES 40-74 BY FIRST/SUBSEQUENT SCREEN AND SCREEN RESULT: 2015 – 2017



Notes

1. Breast Screening Program data extraction date: July 8, 2019.

FIGURE 10: RETURN RATES FOR HIGHER RISK WOMEN AGES 40-74 BY FIRST/SUBSEQUENT SCREEN AND SCREEN RESULT: 2015 – 2017



Notes

1. Breast Screening Program data extraction date: July 8, 2019.

TABLE 7: SCREENING RETURN RATES FOR AVERAGE RISK WOMEN AGES 40-74: 2015 – 2017

	First Screen		Subsequent Screen		Overall	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Total Number to be Re-screened	53,545	12,854	351,267	31,787	404,812	44,641
Returned by 12 months	< 1%	< 1%	< 1%	< 1%	< 1%	< 1%
18 months	1%	1%	1%	1%	1%	1%
24 months	17%	15%	31%	24%	30%	22%
30 months	46%	38%	71%	55%	68%	50%
36 months	58%	47%	80%	64%	78%	60%

Notes

1. Breast Screening Program data extraction date: July 8, 2019.

TABLE 8: RETURN RATES FOR HIGHER RISK WOMEN AGES 40-74: 2015 – 2017

	First Screen		Subsequent Screen		Overall	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Total Number to be Re-screened	7,218	1,797	67,130	5,950	74,348	7,747
Returned by 12 months	11%	7%	19%	13%	18%	12%
18 months	51%	34%	71%	50%	69%	46%
24 months	63%	45%	81%	61%	80%	57%
30 months	69%	51%	86%	67%	85%	63%
36 months	73%	54%	88%	70%	87%	66%

Notes

1. Breast Screening Program data extraction date: July 8, 2019.

5.2 – 2018 SCREENING RESULTS

Table 9 summarizes the outcome indicators for screening exams provided in 2018 by 10-year age groups:

- Of the 260,367 screening mammograms performed, 24,035 (9.0%) had an abnormal result.
- There were 1,464 breast cancers reported in 2018 as of July 8, 2019 (5.6 per 1,000 exams).
- The 2018 overall cancer detection rate increased slightly compared with 2017, from 5.4 to 5.6 cancers detected per 1000 women screened.
- The overall cancer detection rate is highest on first screens for women who reported a family history (mother, sister, daughter).
- The proportion of cancers detected per 1000 women screened increases as women age.

Abnormal Call Rate

Abnormal Call Rate is the percentage of women who were referred for further testing because of an abnormal screening mammogram result.

- The overall screen abnormal call rate (first and subsequent screens) remained stable in 2018 compared to 2017 at 9.2%.
- The abnormal call rate is higher on first screens than on subsequent screens.
- The overall abnormal call rate decreases as women age, from 13.6% for ages 40 to 49 to 7.5% for ages 70 to 74.

Cancer Detection Rate

Cancer Detection Rate is the number of women with a screen detected cancer per 1,000 women who had a screening mammogram. Cancer detection rates may be presented as invasive cancer detection rates, in-situ cancer detection rates and overall cancer detection rates.

- The overall cancer detection rate increased slightly in 2018 compared to 2017 (from 5.4 per 1000 screens to 5.6 per 1000).
- The cancer detection rate for higher risk women was greater than that for average risk women for first screens.
- The overall DCIS detection rate remained the same in 2018 compared to 2017 at 1.2 per 1000 women screened.

Positive Predictive Value

Positive Predictive Value (PPV) is the percentage of women with an abnormal mammogram result who were diagnosed with breast cancer (DCIS or invasive) after completion of diagnostic work-up.

- The overall positive predictive value remained the same as 2017 at 6.1%.

TABLE 9: BREAST SCREENING PROGRAM OUTCOME INDICATORS BY 10-YEAR AGE GROUPS: 2018

	Age at Exam					All	
	40-49	50-59	60-69	70-74	75+		
Number of Exams	46,163	85,410	89,669	31,382	7,448	260,367	
on first screens	33.0%	7.9%	3.8%	2.0%	2.6%	10.2%	
on higher risk screens	18.3%	21.6%	26.0%	29.1%	31.1%	23.7%	
Number of Cancers	159	370	567	276	92	1,464	
on first screens	45.3%	16.5%	9.3%	5.1%	5.4%	14.0%	
on higher risk screens	16.4%	21.9%	26.3%	25.7%	30.4%	24.2%	
Abnormal Call Rate	13.6%	9.0%	7.8%	7.5%	9.3%	9.2%	
on first screens	Overall	20.4%	21.9%	20.2%	20.7%	24.5%	20.7%
	Higher Risk	19.3%	21.5%	22.2%	19.6%	23.8%	20.0%
	Average Risk	20.5%	21.9%	19.9%	20.9%	24.7%	20.8%
on subsequent screens	Overall	10.2%	7.9%	7.3%	7.2%	8.9%	7.9%
	Higher Risk	9.7%	7.6%	6.9%	7.1%	8.2%	7.5%
	Average Risk	10.3%	8.1%	7.4%	7.3%	9.2%	8.1%
Overall Cancer Detection Rate (per 1,000)		3.4	4.3	6.3	8.8	12.4	5.6
on first screens	Overall	4.7	9.1	15.6	22.3	26.0	7.8
	Higher Risk	5.2	6.7	20.8	61.9	23.8	9.6
	Average Risk	4.7	9.4	14.7	15.1	26.7	7.5
on subsequent screens	Overall	2.8	3.9	6.0	8.5	12.0	5.4
	Higher Risk	2.5	4.3	6.1	7.2	11.9	5.5
	Average Risk	2.9	3.8	5.9	9.1	12.0	5.3
DCIS Detection Rate (per 1,000)		0.9	1.1	1.2	1.7	1.9	1.2
on first screens	Overall	1.2	1.9	1.8	8.0	10.4	1.7
	Higher Risk	1.7	1.3	---	20.6	---	1.9
	Average Risk	1.1	2.0	2.1	5.7	13.3	1.6
on subsequent screens	Overall	0.8	1.0	1.2	1.6	1.7	1.1
	Higher Risk	0.7	1.6	1.2	1.2	2.2	1.3
	Average Risk	0.8	0.8	1.2	1.7	1.4	1.1
Positive Predictive Value		2.6%	4.8%	8.2%	11.8%	13.4%	6.1%
on first screens	Overall	2.3%	4.2%	7.8%	10.9%	10.6%	3.8%
	Higher Risk	2.7%	3.1%	9.5%	31.6%	10.0%	4.9%
	Average Risk	2.3%	4.4%	7.5%	7.3%	10.8%	3.6%
on subsequent screens	Overall	2.8%	5.0%	8.2%	11.9%	13.6%	6.8%
	Higher Risk	2.6%	5.7%	8.8%	10.2%	14.7%	7.4%
	Average Risk	2.8%	4.8%	8.0%	12.6%	13.1%	6.6%
Core Biopsy Yield Ratio		18.3%	29.7%	44.1%	52.5%	60.1%	35.8%
on first screens		15.3%	21.6%	35.0%	43.3%	44.4%	21.3%
on subsequent screens		22.0%	32.0%	45.3%	53.1%	61.2%	40.3%
Open Biopsy Yield Ratio		8.3%	25.2%	29.9%	43.4%	30.0%	25.2%
on first screens		4.5%	21.9%	19.0%	25.0%	100.0%	14.6%
on higher risk screens		11.5%	26.2%	31.9%	44.9%	22.2%	28.5%

Notes

1. See glossary in the Appendix for definitions of terms.
2. Overall Cancer Rate includes ductal carcinoma in situ (DCIS).
3. An additional 142 abnormal screens had incomplete or lost to follow-up. Information from these screens is excluded from all entries in the table other than exam counts and abnormal call rates.
4. The final number of cancers is still to be determined.
5. 295 exams were performed for women <40 years old. No cancers were detected for this age group.
6. The "All" column includes women less than 40 years of age.
7. Breast Screening Program data extraction date: July 8, 2019.

Diagnostic procedure information is available to date on 23,893 (99%) of the screening mammograms with abnormal findings. Table 10 shows the proportion of women receiving specific diagnostic procedures as part of the work-up on their screen-detected abnormalities.

Overall, 16% and 2% of women with abnormal screening mammograms had core biopsy and open biopsy, respectively.

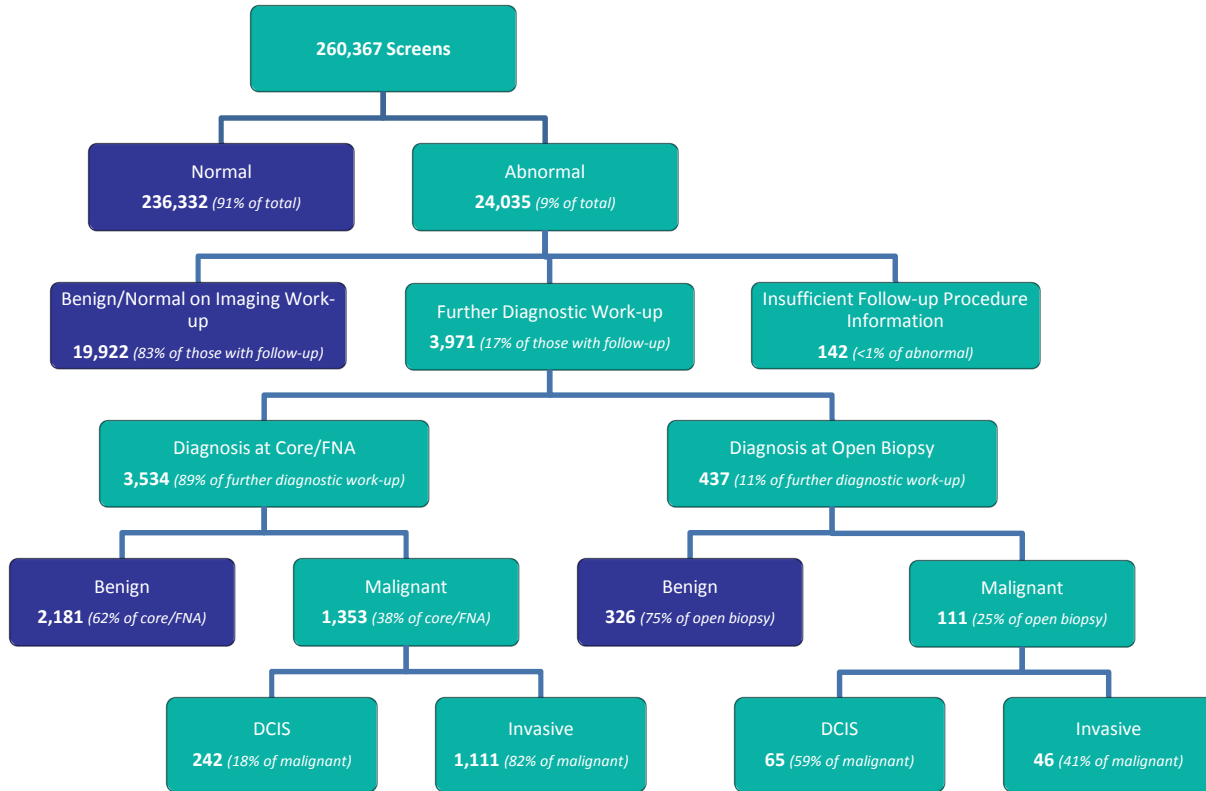
TABLE 10: DIAGNOSTIC PROCEDURES RECEIVED BY BREAST SCREENING PROGRAM PARTICIPANTS WITH "ABNORMAL" SCREENING MAMMOGRAMS: 2018

Procedure	Age at Exam						All
	<40	40-49	50-59	60-69	70-79	80+	
Diagnostic Mammogram	93%	93%	95%	94%	95%	95%	94%
Ultrasound	76%	73%	70%	68%	68%	69%	70%
Fine Needle Aspiration		1%	1%	1%	1%	2%	1%
Core Biopsy	12%	13%	15%	17%	21%	21%	16%
Surgical Biopsy	2%	1%	2%	2%	2%	1%	2%
with Localization	2%	1%	1%	1%	1%	1%	1%
Number of cases with diagnostic assessment information available	41	6,227	7,664	6,937	2,875	149	23,893

Notes

1. Breast Screening Program data extraction date: July 8, 2019.

FIGURE 11: SCREENING OUTCOME SUMMARY: 2018



5.3 2018 CANCER DETECTION

Histologic features of breast cancers detected by the Breast Screening Program in 2018 are summarized by 10-year age groups in Table 11. Histologic features of breast cancer cases were obtained from the pathology reviews, if available. Otherwise, they were obtained from the original diagnostic reports. Invasive tumour size was determined from the best available source: (1) pathological, (2) radiological, or (3) clinical.

- Overall, 22% of cancers detected were in situ.
- Of the invasive cancers detected, 62% were ≤ 15 mm, 78% did not have invasion of the regional lymph nodes, and 19% were grade 3 (i.e. poorly differentiated) tumours.

These overall outcome indicators met the international targets³ recommended for screening programs.

³ Tabár L, Fagerberg G, Duffy SW, Day NE, Gad A, Grøntoft O. Update of the Swedish two-country program of mammographic screening for breast cancer. *Radiol Clin North Am.* 1992 Jan;30(1):187-210

TABLE 11: HISTOLOGIC FEATURES OF BREAST CANCERS DETECTED BY BREAST SCREENING PROGRAM: 2018

Histological Features	Age at Exam								Age 40-79	
	40-49		50-59		60-69		70-79			
Number of Cancers	159		367		557		339		1,422	
in situ	42	26%	90	25%	107	19%	66	19%	305	21%
invasive	117	74%	277	75%	450	81%	273	81%	1,117	79%
Invasive Cancers Tumour Size										
≤ 5 mm	5	4%	28	10%	35	8%	20	7%	88	8%
6-10 mm	20	17%	48	18%	133	30%	90	33%	291	26%
11-15 mm	30	26%	79	29%	126	28%	68	25%	303	27%
16-20 mm	17	15%	32	12%	67	15%	31	11%	147	13%
> 20 mm	44	38%	86	32%	87	19%	62	23%	279	25%
unknown size	(1)		(4)		(2)		(2)		(9)	
Invasive Cancers with tumour ≤ 15 mm	55	47%	155	57%	294	66%	178	66%	682	62%
Node Involvement in Invasive Cancers										
no	68	65%	187	73%	352	82%	207	82%	814	78%
yes	37	35%	68	27%	78	18%	44	18%	227	22%
no nodes sampled / unknown	(12)		(22)		(20)		(22)		(76)	
Histologic Grade of Invasive Cancers										
1 - well differentiated	25	22%	74	28%	169	38%	100	38%	368	34%
2 - moderately differentiated	59	53%	134	51%	195	44%	119	45%	507	47%
3 - poorly differentiated	28	25%	54	21%	77	17%	47	18%	206	19%
unknown grade	(5)		(15)		(9)		(7)		(36)	
Grade 3 tumour ≤ 15 mm	10	36%	18	33%	40	52%	18	38%	86	42%

Notes

1. Targets: >50% invasive tumours ≤15mm, >70% with negative nodes, >30% grade 3 tumours ≤15mm.
2. Breast Screening Program data extraction date: August 19, 2019.

5.4 OUTCOME INDICATORS BY CALENDAR YEAR: 2014 – 2018

Table 12 shows the outcome indicators for screening exams provided over five years.

- Cancer detection and abnormal call rates have been stable for the last four years.
- Sensitivity is stable at ~90%.
- Specificity is stable at ~92%.

Regular record linkage with the British Columbia Cancer Registry enables the Breast Screening Program to determine the number of non-screen detected (interval) cancers occurring in Breast Screening Program participants. Sensitivity (i.e. probability of finding women with breast cancer) and specificity (i.e. probability of a negative mammogram in women without breast cancer) by calendar year are shown in Table 12. The Breast Screening Program conducts formal reviews, both blinded and retrospective, of ~ 50% of interval cancers in Breast Screening Program participants as a quality assurance process.

Comparison of prevalence rate at first screen with the historical incidence rate prior to the onset of screening practice provides another measure of program performance. The expected age-specific incidence rates in the absence of screening were derived from the 1982 breast cancer incidence data reported for British Columbia. Since screening may be obtained outside of the Breast Screening Program, the definition of prevalent screens have been restricted to those women with no previous outside mammogram within 24 months of their first screening encounter.

TABLE 12: BREAST SCREENING PROGRAM OUTCOME INDICATORS BY CALENDAR YEAR BETWEEN 2014 AND 2018 INCLUSIVE

Outcome Indicators	Calendar Year					5-Year Cumulative
	2014	2015	2016	2017	2018	
Number of Exams	259,324	255,523	258,163	258,487	260,367	1,291,864
on first screens	9.4%	10.0%	9.8%	9.9%	10.2%	9.9%
Number of Cancers	1,421	1,426	1,470	1,416	1,464	7,197
on first screens	12.5%	12.1%	12.5%	14.5%	14.0%	13.1%
Abnormal Call Rate	8.4%	9.1%	9.0%	9.0%	9.2%	8.9%
on first screens	18.3%	19.1%	19.5%	19.7%	20.7%	19.5%
on subsequent screens	7.4%	7.9%	7.8%	7.8%	7.9%	7.8%
Overall Cancer Detection Rate (per 1,000)	5.5	5.6	5.7	5.5	5.6	5.6
on first screens	7.3	6.7	7.3	8.0	7.8	7.4
on subsequent screens	5.3	5.5	5.5	5.2	5.4	5.4
DCIS Detection Rate (per 1,000)	1.1	1.2	1.1	1.2	1.2	1.2
on first screens	1.6	1.5	1.5	1.9	1.7	1.6
on subsequent screens	1.1	1.2	1.1	1.1	1.1	1.1
Positive Predictive Value	6.5%	6.2%	6.4%	6.1%	6.1%	6.3%
on first screens	4.0%	3.6%	3.8%	4.1%	3.8%	3.8%
on subsequent screens	7.2%	6.9%	7.1%	6.7%	6.8%	6.9%
Core Biopsy Yield Ratio	35.1%	34.1%	34.9%	34.2%	35.8%	34.8%
on first screens	19.9%	18.3%	18.2%	19.2%	21.3%	19.4%
on subsequent screens	39.1%	38.7%	39.8%	39.2%	40.3%	39.4%
Open Biopsy Yield Ratio	25.5%	21.9%	25.6%	27.2%	25.2%	25.0%
on first screens	21.6%	14.8%	19.1%	19.7%	14.6%	18.1%
on subsequent screens	26.4%	23.7%	27.3%	29.7%	28.5%	26.9%
Interval Cancer Rate (per 1,000)						
0-12 months	0.6	0.7	0.6	---	---	---
after first screens	0.5	0.7	0.8	---	---	---
after subsequent screens	0.6	0.7	0.6	---	---	---
13-24 months	0.7	0.7	---	---	---	---
Sensitivity (1 - false negative rate)	90.1%	88.9%	90.5%	---	---	---
Specificity (1 - false positive rate)	92.1%	91.5%	91.6%	91.6%	---	---
Prevalence to Expected Incidence Ratio for Age 50-79 (target: >3.0)	5.8	5.6	5.2	4.8	5.8	5.4

Notes

1. See glossary in the Appendix for definitions of terms.
2. Overall Cancer Detection Rate includes ductal carcinoma in situ (DCIS).
3. The final number of cancers in 2018 is still to be determined.
4. Number of cancers and related rates do not include data for women whose follow-up is incomplete.
5. SMP data extraction date: October 16, 2019.

5.5 – OUTCOME INDICATORS BY 10-YEAR AGE GROUPS: 2014 – 2018 CUMULATIVE

Table 13 shows the outcome indicators for exams provided in a five-year period by 10-year age groups.

- From 2014 to 2018, the Breast Screening Program provided 1,291,864 breast screening examinations, and detected 7,197 breast cancers.
- Approximately 89% of the cancers detected during this five year period were in women 50 years of age or older. The screen-to-cancer ratio ranges from 111:1 for women in their 70's to 313:1 for women in their 40's.
- Although the risk of breast cancer increases with age, the abnormal call rates were higher in the younger age groups.
- The abnormal-to-cancer ratio ranges from 8:1 for women in their 70's to 39:1 for women in their 40's.
- The cancer detection rate and positive predictive value increases for women as they get older.

TABLE 13: BREAST SCREENING PROGRAM OUTCOME INDICATORS BY 10-YEAR AGE GROUPS BETWEEN 2014 AND 2018 INCLUSIVE

Outcome Indicators	Age at Exam					All
	40-49	50-59	60-69	70-79	80+	
Number of Exams	246,294	437,908	429,771	169,596	7,150	1,291,864
on first screens	30.2%	7.4%	3.7%	2.1%	2.6%	9.9%
Number of Cancers	786	1,968	2,802	1,526	114	7,197
on first screens	42.5%	14.5%	8.5%	4.9%	7.0%	13.1%
Abnormal Call Rate	12.4%	8.8%	7.7%	7.3%	8.9%	8.9%
on first screens	18.9%	20.9%	19.4%	20.0%	24.5%	19.5%
on subsequent screens	9.6%	7.8%	7.2%	7.0%	8.4%	7.8%
Overall Cancer Detection Rate (per 1,000)	3.2	4.5	6.5	9.0	16.0	5.6
on first screens	4.5	8.9	15.0	21.4	43.2	7.4
on subsequent screens	2.6	4.1	6.2	8.7	15.2	5.4
DCIS Detection Rate (per 1,000)	0.9	1.1	1.3	1.5	2.4	1.2
on first screens	1.3	1.8	2.5	2.3	16.2	1.6
on subsequent screens	0.7	1.0	1.2	1.5	2.0	1.1
Positive Predictive Value	2.6%	5.1%	8.6%	12.4%	18.2%	6.3%
on first screens	2.4%	4.3%	7.8%	10.8%	18.6%	3.8%
on subsequent screens	2.7%	5.3%	8.6%	12.5%	18.1%	6.9%
Core Biopsy Yield Ratio	16.4%	29.4%	44.5%	54.1%	65.0%	34.8%
on first screens	13.1%	20.2%	32.3%	44.3%	46.2%	19.4%
on subsequent screens	20.1%	31.7%	46.1%	54.7%	66.7%	39.4%
Open Biopsy Yield Ratio	14.3%	22.4%	32.1%	37.3%	36.4%	25.0%
on first screens	14.0%	20.1%	25.5%	31.3%	100.0%	18.1%
on subsequent screens	14.6%	22.9%	32.9%	37.5%	30.0%	26.9%
Interval Cancer Rate (per 1,000)						
0-12 months	0.6	0.6	0.6	0.7	1.5	0.6
after first screens	0.6	0.5	1.1	< 0.1	< 0.1	0.6
after subsequent screens	0.6	0.6	0.6	0.7	1.5	0.6
13-24 months	0.2	0.8	0.7	1.1	3.3	0.7
Sensitivity (1 - false negative rate)	83.5%	88.0%	91.3%	92.9%	92.1%	89.8%
Specificity (1 - false positive rate)	88.4%	91.8%	93.0%	93.7%	92.7%	91.7%

Notes

1. See glossary in the Appendix for definitions of terms.
2. Overall cancer detection rate includes ductal carcinoma in situ (DCIS).
3. Number of cancers and related rates do not include data for women whose follow-up is incomplete.
4. The final number of cancers in 2018 is still to be determined.
5. The total for all ages includes women less than 40 years of age.
6. Interval cancer rate does not include years 2017-2018 (for 0-12 months) or 2016-2018 (for 13-24 months).
7. Sensitivity and specificity do not include years 2017-2018.
8. SMP data extraction date: October 16, 2019.

5.6 – OUTCOME INDICATORS BY HSDA: 2014 – 2018 CUMULATIVE

Outcome indicators for 2014 to 2018 are summarized by HSDA in Table 14.

- South Vancouver Island region has the lowest abnormal call rate (5%), Northeast has the highest (12%).
- Northeast has the lowest cancer detection rate (3.7 per 1,000), while East Kootenay has the highest (6.2 per 1,000).
- Northeast has the lowest positive predictive value (3%) and South Vancouver Island has the highest (9%).
- All of the HSDAs meet the national targets⁴ recommended for screening programs for invasive tumour detection size (target > 50%); eleven out of the sixteen HSDAs meet the national target recommended for percentage of cases with negative nodes (target > 70%).

⁴ Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Screening Program Performance third Edition. Health Canada 2013

TABLE 14: BREAST SCREENING PROGRAM OUTCOME INDICATORS BY HEALTH SERVICE DELIVERY AREA (HSDA) BETWEEN 2014 AND 2018 INCLUSIVE

HSDA	% Called Abnormal	Cancer Detection Rate (per 1,000)	PPV	In-Situ : Invasive (number)	% Invasive ≤ 15 mm	% Invasive with -ve nodes
East Kootenay	9%	6.2	7%	25 : 100	61%	79%
Kootenay Boundary	8%	5.1	6%	15 : 86	71%	72%
Okanagan	7%	6.0	8%	138 : 553	63%	74%
Thompson Cariboo Shuswap	10%	6.0	6%	80 : 311	58%	73%
Interior	8%	5.9	7%	258 : 1050	62%	74%
Fraser East	10%	5.6	6%	80 : 351	57%	67%
Fraser North	10%	5.5	6%	229 : 731	60%	70%
Fraser South	10%	5.7	6%	267 : 897	58%	69%
Fraser	10%	5.6	6%	576 : 1979	58%	69%
Richmond	11%	5.7	5%	82 : 257	54%	72%
Vancouver	10%	5.8	6%	240 : 700	61%	67%
North Shore / Coast Garibaldi	9%	4.9	5%	83 : 329	64%	71%
Vancouver Coastal	10%	5.5	6%	405 : 1286	61%	69%
South Vancouver Island	5%	5.0	9%	71 : 485	53%	70%
Central Vancouver Island	7%	6.1	8%	116 : 429	57%	76%
North Vancouver Island	7%	5.4	8%	33 : 172	56%	72%
Vancouver Island	6%	5.4	9%	220 : 1086	55%	72%
Northwest	9%	5.7	6%	12 : 81	60%	65%
Northern Interior	9%	4.9	5%	31 : 142	65%	72%
Northeast	12%	3.7	3%	3 : 35	60%	63%
Northern	10%	4.9	5%	46 : 258	63%	69%
British Columbia	9%	5.6	6%	1509 : 5688	59%	71%

Notes

1. See glossary in the Appendix for definitions of terms.
2. Targets: >50% invasive tumours ≤15mm, >70% with negative nodes.
3. Breast Screening Program data extraction date: July 8, 2019.

5.7 – CANCER CHARACTERISTICS BY AGE: CUMULATIVE UP TO AND INCLUDING 2018

From the start of the program in July 1988 to December 2018, 28,204 women were found to have breast cancer through screening-initiated work-up. Histologic features of breast cancers detected by the Breast Screening Program, cumulative up to and including 2018, are summarized by 10-year age groups in Table 15. Internationally recommended targets have been achieved.

Overall, invasive cancers found in women ages 40 to 49 tend to be larger and more likely to have node involvement than cancers found in older women.

TABLE 15: HISTOLOGIC FEATURES OF BREAST CANCERS DETECTED BY BREAST SCREENING PROGRAM CUMULATIVE UP TO AND INCLUDING 2018

Histological Features	Age at Exam										Age 40+	
	40-49		50-59		60-69		70-79		80+			
Number of Cancers	4,244		7,893		9,434		6,183		440		28,204	
in situ	1,314	31%	1,930	24%	1,908	20%	1,084	18%	52	12%	6,291	22%
invasive	2,930	69%	5,963	76%	7,526	80%	5,099	82%	388	88%	21,913	78%
Invasive Cancers Tumour Size												
≤ 5 mm	288	10%	550	9%	680	9%	376	7%	35	9%	1,930	9%
6-10 mm	542	19%	1,345	23%	2,014	27%	1,520	30%	95	25%	5,517	26%
11-15 mm	762	27%	1,661	28%	2,169	29%	1,492	30%	108	28%	6,193	29%
16-20 mm	444	16%	965	16%	1,132	15%	751	15%	65	17%	3,359	16%
> 20 mm	823	29%	1,351	23%	1,452	19%	901	18%	80	21%	4,609	21%
unknown size	(71)		(91)		(79)		(59)		(5)		(305)	
Invasive Cancers with tumour size ≤ 15 mm	1,592	56%	3,556	61%	4,863	65%	3,388	67%	238	62%	13,640	63%
Node Involvement in Invasive Cancers												
no	1,822	69%	4,056	73%	5,431	78%	3,671	81%	233	81%	15,219	76%
yes	824	31%	1,482	27%	1,552	22%	878	19%	53	19%	4,790	24%
no nodes sampled / unknown	(284)		(425)		(543)		(550)		(102)		(1,904)	
Histologic Grade of Invasive Cancers												
1 - well differentiated	694	26%	1,737	31%	2,356	33%	1,711	36%	138	39%	6,637	32%
2 - moderately differentiated	1,213	45%	2,360	42%	3,186	45%	2,149	45%	152	43%	9,063	44%
3 - poorly differentiated	807	30%	1,464	26%	1,535	22%	891	19%	67	19%	4,766	23%
unknown grade	(216)		(402)		(449)		(348)		(31)		(1,447)	
Grade 3 tumour ≤ 15 mm	326	40%	647	44%	761	50%	425	48%	26	39%	2,185	46%

Notes

1. Targets1: >50% invasive tumours ≤15mm, >70% with negative nodes, >30% grade 3 tumours ≤15mm.
2. Breast Screening Program data extraction date: August 19, 2019.

5.8 – COMPARISON WITH CANADIAN STANDARDS

The Canadian Breast Cancer Screening Initiative (CBCSI) was launched in 1992. Under this initiative, Health Canada (now Public Health Agency of Canada) facilitated a federal/provincial/territorial network that enabled collaboration in the implementation and evaluation of breast cancer screening programs in Canada. In 2012 the CBCSI component transferred to the Canadian Partnership Against Cancer (CPAC).

The Canadian Breast Cancer Screening Database (CBCSD) was first established in 1993. All provincial and territorial programs in Canada contribute data to the CBCSD. The first evaluation report on Organized Breast Cancer Screening Programs in Canada was published in 1999, and prompted the creation of the Evaluation Indicators Working Group to begin the task of defining performance measures for Canadian breast cancer screening programs. Biennial evaluation reports are now produced regularly from the CBCSD by CPAC.

In this section, the Breast Screening Program performance measures are presented against the targets set for Canadian breast cancer screening programs⁵. This document defined a set of performance measures that were developed on the basis of recognized population screening principles, evidence from randomized controlled trials, demonstration projects, and observational studies.

The Breast Screening Program achieves national targets in invasive cancer detection rates, positive predictive values, invasive tumour sizes, and node negative rates. Improvements are needed to: increase participation and retention rates; and reduce abnormal call rates, diagnostic intervals, and benign to malignant open biopsy ratio.

- The participation rate remained stable compared to 2017 (53.0% plus 8.5% MSP).
- The retention rate has remained stable since 2016.
- There was a slight decline in the percentage of participants with an abnormal screen meeting the target for diagnostic interval where a biopsy was not required (77.4% compared with 81.9% in 2017).

Comparison of Breast Screening Program Performance with Canadian Breast Screening Standards for Ages 50 to 69 is summarized in Table 16.

5 Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Screening Program Performance third Edition. Health Canada 2013

TABLE 16: COMPARISON OF BREAST SCREENING PROGRAM PERFORMANCE WITH CANADIAN BREAST SCREENING STANDARDS FOR WOMEN AGES 50-69 YEARS

Performance Measure	National Target	Breast Screening Program
Participation Rate (1)	≥ 70% of the eligible population	53.0% (plus 8.5% MSP)
Retention Rate (2)		
Initial Re-screen	≥ 75% initial re-screen within 30 months	44.3%
Subsequent Re-screen	≥ 90% subsequent re-screen within 30 months	74.1%
Abnormal Call Rate (3)		
First Screens	< 10% first screens	21.3%
Subsequent Screens	< 5% re-screens	7.6%
Invasive Cancer Detection Rate (3)		
First Screens	> 5.0 per 1,000 first screens	9.4 per 1,000
Subsequent Screens	> 3.0 per 1,000 re-screens	3.9 per 1,000
DCIS Detection Rate (3)		
First Screens	Surveillance and monitoring only	1.9 per 1,000
Subsequent Screens	Surveillance and monitoring only	1.1 per 1,000
Diagnostic Interval (3)		
no tissue biopsy performed	≥ 90% within 5 weeks if no tissue biopsy performed	86.0%
tissue biopsy performed	≥ 90% within 7 weeks if tissue biopsy performed	64.3%
Positive Predictive Value (3)		
First Screens	≥ 5% first screens	5.4%
Subsequent Screens	≥ 6% re-screens	6.6%
Benign Core Biopsy Rate (3)		
First Screens	Surveillance and monitoring only	28.4 per 1,000
Subsequent Screens	Surveillance and monitoring only	7.1 per 1,000
Benign to Malignant Core Biopsy Ratio (3)		
First Screens	Surveillance and monitoring only	2.8 : 1
Subsequent Screens	Surveillance and monitoring only	1.5 : 1
Benign Open Biopsy Rate (3)		
First Screens	Surveillance and monitoring only	4.2 per 1,000
Subsequent Screens	Surveillance and monitoring only	1.0 per 1,000
Benign to Malignant Open Biopsy Ratio (3)		
First Screens	≤ 1 : 1	3.8 : 1
Subsequent Screens	≤ 1 : 1	2.4 : 1
Invasive Cancers Tumour Size ≤ 10 mm (3)	> 25%	33.6%
Invasive Cancers Tumour Size ≤ 15 mm (3)	> 50%	62.1%
Node Negative Rate in Cases of Invasive Cancer (3)	> 70%	78.9%

Notes

1. Screen years: (1) = July 1, 2016 - December 31, 2018, (2) = 2015 - 2017, (3) = 2018.
2. Population data source: P.E.O.P.L.E. 2018 population projection (Sept 2018), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
3. Breast Screening Program data extraction date: July 8, 2019.

5.9 – COST ANALYSIS

The BC Cancer Breast Screening Program is funded by the provincial Ministry of Health through the Provincial Health Services Authority (PHSA). The Breast Screening Program contracts with regional health authorities and private community imaging clinics to provide screening mammography services, including mobile services, throughout the province.

Overall program administration and coordination is provided by the Breast Screening Program Central Office, including: promotion, a provincial toll-free call centre, mobile service coordination and staff travel, result mail-out to women and physicians, invitation and recall reminder system, follow-up tracking, quality management, program evaluation, and research support.

Costing analysis by fiscal year is summarized in Table 17.

Financial reports for PHSA and BCCA are available at the PHSA website:

www.phsa.ca/AboutPHSA/PHSA_Budget_Financials/default.htm

TABLE 17: COST COMPARISON BY FISCAL YEAR

Indicator	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
Total Cost	\$20,364,256	\$19,976,921	\$21,030,530	\$21,127,930	\$21,452,284
Total Cost per Screen	\$78.32	\$79.35	\$79.38	\$82.46	\$81.76
Central Services	\$18.98	\$17.52	\$16.58	\$18.02	\$16.80
Screen Provision Costs	\$44.56	\$46.98	\$47.88	\$49.46	\$49.90
Professional Reading Fees	\$14.78	\$14.85	\$14.92	\$14.99	\$15.06
Cost per Cancer Detected	\$14,545.90	\$13,853.62	\$14,404.47	\$14,878.82	Not Available

Notes

1. Program Expenses are audited through PHSA Finance annually.
2. Screen Provision Costs includes, but are not limited to, staffing costs, equipment related costs, and mobile operation costs.
3. The professional reading fee was \$15.06 per screen effective April 1, 2018.
4. Number of cancers detected in 2018-19 is not available yet, and thus the cost per cancer detected is not computed.
5. Cost per cancer detected is based upon screens with complete follow-up.
6. The cost per screen is exclusive of salary and benefit increases to public screening centers which, commencing in fiscal 2006, have gone directly to the Health Authority.
7. Breast Screening Program data extraction date: July 8, 2019.

APPENDIX 1 – CANCER SCREENING PROGRAM OVERVIEW

Definition of Screening

Screening is one part of a prevention strategy, with the goal of identifying cancer before symptoms or signs develop. Primary cancer prevention strategy involves changes of behaviour or habits that reduce a risk, for example, stopping smoking, fat reduction in the diet, etc. Screening for cancer is a secondary prevention strategy. Secondary cancer prevention strategy targets disease in process⁶. A secondary prevention can reduce cancer morbidity and mortality by: diagnosing invasive disease at an earlier, more favourable prognostic stage; and, detecting precursor lesions associated with some cancers that once eliminated, prevent progression to invasive disease. Screening is “the application of various tests to apparently healthy individuals to sort out those who probably have risk factors or are in the early stages of specified conditions.”⁷

Limitations of Screening

The decision to screen an at-risk population for pre-clinical signs of cancer is based on well-established criteria related to cancer and the screening tests that we may use to identify individuals who may have occult disease.^{8, 9, 10}

The overall objective of a screening program is to reduce morbidity and mortality from cancer. The goal of screening is to “apply a relatively simple, inexpensive test to a large number of persons in order to classify them as likely or unlikely to have the cancer”. The emphasis on likelihood underscores the limits of what should be expected from screening (i.e., screening tests are not diagnostic tests).

A person with an abnormal screening test does not have a definitive diagnosis until additional, more sophisticated diagnostic tests are completed. The emphasis on likelihood also is important because screening tests are inherently limited in their accuracy, which varies by test, cancer site, and individual characteristics. Although most of screening interpretations are accurate, it is inevitable that some individuals are identified as possibly having cancer when they do not (false-positive screen), and screening tests may fail to identify some individuals who do have the disease (false-negative screen).

The comparative evaluation of accuracy versus misinterpretation cannot be considered in absolute terms, but rather should be evaluated in terms of the relative consequences of one or the other kind of error.

⁶ US Preventive Services Task Force: Guide to Clinical Preventive Services, Ed 2. Baltimore, Williams & Wilkins, 1996

⁷ Morrison A: Screening in Chronic Disease. New York, Oxford Press, 1992

⁸ Cole P, Morrison AS: Basic issues in cancer screening. In Miller AB (ed); Screening in Cancer. Geneva, International Union Against Cancer, 1978, P7

⁹ Miller AB; Fundamentals of Screening. In Screening for Cancer. Orlando, Academic Press, 1985, P3

¹⁰ Wilson JMG, Junger G; Principles and Practice of Screening for Disease. Geneva, World Health Organization, 196
September 2019

Organized Population Screening Program

To reduce morbidity and mortality from cancer in a population by screening, there must be coordinated and effective strategies to ensure acceptance and utilization of the established screening test. Since screening is targeted at asymptomatic women, the fine balance between maximizing benefits and minimizing undesirable effects must be maintained.

An organized approach to screening ensures that the target population has access to the screening service and that it accepts and uses the services offered. This is achieved by including the following six program components:

1. Health Promotion
2. Professional Development/Education
3. Recruitment & Retention
4. Screening Test & Reporting
5. Follow-up

APPENDIX 2 – 2018 BREAST SCREENING PROGRAM SCREENING SERVICES

In 2018 the Program provided screening mammography to women ages 40 and over. The recall frequency shown below was used to calculate the program results for the period of January 1, 2018 – December 31, 2018.

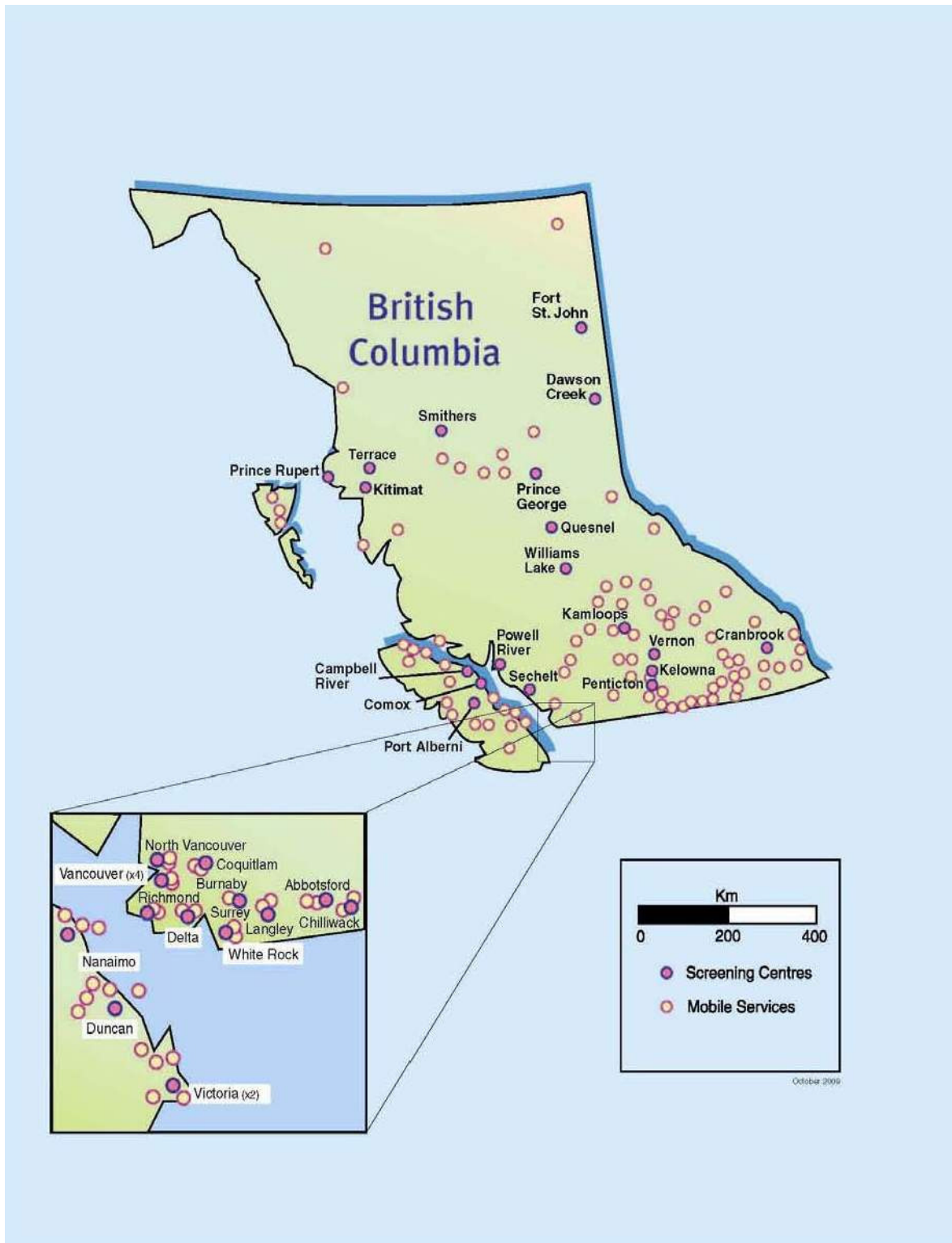
Age	Recall Frequency
<40	Will accept with primary health care provider referral, no recall provided
40-74 Average risk	Reminders for 24-month and 36-month anniversary to age 74.
40-74 Higher Risk	Reminders* for 12-month and 24-month anniversary to age 74
75+	Will accept, no recall provided

Eligibility Criteria:

- Have no breast changes*.
- Have not had a mammogram within 12 months.
- Have not had breast cancer.
- Do not have breast implants.
- Are not pregnant or breast feeding.
- Can provide the name of a primary care provider to receive the results.

** If there is a new lump, thickening or discharge, we recommend seeing a doctor immediately, even if the last mammogram was normal.*

APPENDIX 3 – MAP OF SCREENING CENTRES



APPENDIX 4 – SCREENING CENTRES CONTACT INFORMATION

Abbotsford	604-851-4750
Burnaby	604-436-0691
Campbell River	1-800-663-9203
Chilliwack	1-800-663-9203
Comox	250-331-5949
Coquitlam	604-927-2130
Cranbrook	250-417-3585
Dawson Creek	1-800-663-9203
Delta	604-946-1121 x 783511
Duncan	1-800-663-9203
Fort St. John	1-800-663-9203
Kamloops	250-828-4916
Kelowna	250-861-7560
Langley	604-514-6044
Nanaimo	250-716-5904
IK and NLM Mobile	604-877-6232
North Vancouver	604-903-3860
Penticton	250-770-7573
Port Alberni	1-800-663-9203
Powell River	1-800-663-9203
Prince George	250-645-6654
Prince Rupert	1-800-663-9203
Quesnel	1-800-663-9203
Smithers	1-800-663-9203
Sechelt	1-800-663-9203
Richmond	604-244-5505
Surrey - JPOCSC	604-582-4592
Terrace	1-800-663-9203
Vernon	250-549-5451
White Rock	604-535-4512 x 757479
Williams Lake	1-800-663-9203
Vancouver	
BC Women's Health Centre	604-775-0022
Mount St. Joseph Hospital	604-877-8388
5752 Victoria Drive	604-321-6770
#505 - 750 West Broadway	604-879-8700
Victoria	
Victoria General Hospital	250-727-4338
305 - 1990 Fort St.	250-952-4232

Mobile Screening Service Delivery Areas

Mobile Screening Communities:			
Agassiz	Fort St. James	Mission	Salmon Arm
Alert Bay	Fraser Lake	Moricetown	Salt Spring Island
Alexis Creek	Gabriola	Mount Currie	Savona
Anahim Lake	Galiano Island	Nakusp	Sayward
Armstrong	Golden	Nelson	Scotch Creek
Ashcroft	Gold River	New Denver	Sicamous
Balfour	Grand Forks	New Westminster	Skidegate
Barriere	Granisle	North Vancouver	Slocan
Beaver Valley	Greenwood	Old Massett	Sointula
Bella Bella	Hagwilget	Oliver	Sooke
Bella Coola	Hope	Osoyoos	Sorrento
Blind Bay	Houston	Parksville	Southside
Bowen Island	Hudson's Hope	Peachland	Sparwood
Burnaby	Invermere	Pemberton	Squamish
Burns Lake	Iskut	Pender Island	Stewart
Castlegar	Kaslo	Pitt Meadows	Summerland
Chase	Keremeos	Port Alice	Tatla lake
Chemainus	Kimberley	Port Clements	Tofino
Chetwynd	Kitimat	Port Hardy	Trail
Chilliwack	Kitwanga	Port McNeil	Tumbler Ridge
Christina Lake	Ladysmith	Port Moody	Ucluelet
Clearwater	Lake Cowichan	Princeton	Valemount
Clinton	Lillooet	Qualicum Beach	Vancouver
Coquitlam	Logan Lake	Queen Charlotte	Vanderhoof
Crawford Bay	Lumby	Queensborough	Westbank

Creston	Lytton	Radium	Whistler
Dease Lake	Mackenzie	Revelstoke	Williams Lake
Delta	Maple Ridge	Richmond	Windermere
Elkford	Masset	Rock Creek	Winfield
Enderby	McBride	Rosland	100 Mile House
Fernie	Merritt	Saanichton	
Fort Nelson	Midway	Sandspit	
Fort Rupert	Mill Bay	Salmo	

Lower Mainland locations change from time to time. Latest visits include: Alouette Correctional Centre, BCIT Campus, Burnaby City Hall, Creation Technologies, Downtown Eastside Women's Health Centre, Downtown Community Health Centre, Hasting Community Centre, ICBC North Vancouver, Indo-Canadian Senior Centre, Maple Ridge City Hall, Mission Friendship Centre Society, New Vista Society, North Vancouver City Hall, Overwaitea Head Office, Pacific Blue Cross, Prince George Native Friendship Centre, Qwemtsin Health Society, Richmond City Hall, Surrey Primary Care Centre, SFU Campus, TransLink, Urban Native Health Clinic Kamloops, Vancouver Primary Care Centre/Native Health, Work Safe BC (Richmond).

First Nations Communities


Community	Area
Akisknuk First Nation	Windermere
Aq'am First Nation	Cranbrook
Boston Bar Indian Band	Boston Bar
Canim Lake Indian Band	Canim Lake
Esketemc First Nation	Alkali Lake
Fort Nelson First Nation	Fort Nelson
Ginglox Indian Band	Kincolith
Gitanyow First Nation	Kitwanga
Gitlaxdamix First Nation	Gitlaxt'aamiks
Haisla Nation	Kitamaat Village
Katzie First Nation	Pitt Meadows

Kispiox First Nation	Hazleton
Kitselas First Nation	Terrace
Kitsumkalum First Nation	Terrace
Kwantlen First Nation	Langley
Kwikwetlem First Nation	Coquitlam
Laxgalts First Nation	Greenville
Leq'amel First Nation	Deroche
Lil'wat Nation	Mount Currie
Little Shuswap Lake Indian Band	Chase
Lower Nicola Indian Band	Merritt
Lower Similkameen Indian Band	Keremeos
Musqueam Indian Band	Vancouver
Nadleh Whut'en First Nation	Fort Fraser
Nak'azdli First Nation	Fort St. James
Nazko First Nation	Quesnel
Nisga'a Village of Gitwinskihlkw	Gitwinskihlkw
Okanagan Indian Band	Vernon
Osoyoos Indian Band	Osoyoos
Pauquachin First Nation	Saanich
Penelakut First Nation	Penelakut Island
Penticton Indian Band	Penticton
Prophet River First Nation	Fort Nelson
Saik'uz First Nation	Vanderhoof
Seabird Island Band	Agassiz
Shuswap Band	Invermere
Simpcw First Nation	Barriere
Skeetchestn First Nation	Savona

Soda Creek Indian Band	Williams Lake
Splatsin First Nation	Enderby
Stella'ten First Nation	Fraser Lake
Sto:lo First Nation	Chilliwack
Sts'ailes First Nation	Agassiz
Stz'uminus First Nation	Ladysmith
Tlaz'ten First Nation	Fort St. James
T'it'q'et First Nation	Lillooet
Toosey Indian Band	Riske Creek
Tsawwassen First Nation	Tsawwassen
Tsleil-Waututh Nation	North Vancouver
Upper Nicola Indian Band	Merritt
Westbank First Nation	West Kelowna
Xaxli'p First Nation	Lillooet
Yale First Nation	Hope
Yunesit'in First Nation	Hanceville

APPENDIX 5 – EDUCATIONAL MATERIALS ORDER FORM

The materials order form can be found online at <http://www.bccancer.bc.ca/screening/breast>.

		<h2>Order Form</h2> <p>Cancer Screening Promotion and Resource Materials</p>	
ITEM		QUANTITY	
Breast Screening			
Patient Education Materials	Breast Screening Tear-Off Referral Pad (50 sheets)	# of pads:	
	Brochure – “Answering your questions about breast cancer screening”	English:	Punjabi:
		Simplified Chinese:	Traditional Chinese:
	Brochure – “Answering your questions about your breast density score”	English:	
Poster - “Why Mammograms Work”	English:		
Provider Resources	Physician Protocol Fact Sheet	English:	
	Breast Density Provider Guidance Fact Sheet	English:	
Cervix Screening			
Patient Education Materials	Brochure – “Answering your questions about cervical cancer screening”	English:	Punjabi:
		Simplified Chinese:	Traditional Chinese:
		English:	Punjabi:
	Brochure – “Answering your questions about abnormal cervix screening results”	English:	Punjabi:
		Simplified Chinese:	Traditional Chinese:
	Brochure – “Answering your questions about colposcopy”	English:	
	Brochure – “Answering your questions about LEEP”	English:	
Cervix Screening Pad (50 sheets) – “After Your Pap Test”	# of pads:		
Poster - “Cervical Cancer Screening: What You Should Know”	English:	Punjabi:	
	Simplified Chinese:	Traditional Chinese:	
Poster – “In the time it takes to...You can get a Pap test”	# of posters:		
Bookmark – “In the time it takes to...You can get a Pap test”	# of bookmarks:		
Provider Resources	Health Care Provider FAQ Booklet	English:	
	Fact Sheet – Cervical Cancer Screening Policy Change	English:	
Colon Screening			
Patient Education Materials	Brochure – “Answering your questions about colon cancer screening”	English:	Punjabi:
		Simplified Chinese:	Traditional Chinese:
	Brochure – “Answering your questions about an abnormal FIT”	English:	Punjabi:
		Simplified Chinese:	Traditional Chinese:
	Brochure – “Answering your questions about Colonoscopy”	English:	Punjabi:
Brochure – “Preparing for Your Colonoscopy”	English:	Punjabi:	
	Simplified Chinese:	Traditional Chinese:	
Provider Resources	FIT Decision Table Fact Sheet	English:	
	Colon Screening Program Fact Sheet	English:	
	Polyp Info Sheet	English:	
	Colonoscopy Referral Pad (50 sheets)	# of pads:	
CONTACT INFORMATION			
Name:		Organization:	
Phone Number:		Email:	
Delivery Address:			
<p>Cancer screening promotion and resource materials are available free of charge for use in your office/clinic. To order: Email to screening@bccancer.bc.ca or Fax to 604-877-6113.</p>			
November 2018			

APPENDIX 6 – GLOSSARY

Abnormal Call Rate: Proportion of screening mammography examinations determined to require further diagnostic assessment (i.e. called “abnormal”).

$$\text{Abnormal Call Rate} = \frac{\text{Number of exams called abnormal}}{\text{Total number of exams}} \times 100\%$$

Benign Core Biopsy Rate: Proportion of cases with complete follow-up that resulted in a benign core biopsy for diagnostic purposes, where each core biopsy represents a case.

Benign Open Biopsy Rate: Proportion of cases with complete follow-up that resulted in a benign open biopsy for diagnostic purposes, where each open biopsy represents a case.

Benign to Malignant Core Biopsy Ratio:

$$\text{Benign to Malignant Core Biopsy Ratio} = \frac{B_b}{M_b} : 1$$

B_b Number of benign cases detected by core biopsy, where each core biopsy performed represents a case.

M_b Number of malignant cancers cases detected by core biopsy, where each core biopsy represents a case.

Benign to Malignant Open Biopsy Ratio:

$$\text{Benign to Malignant Open Biopsy Ratio} = \frac{B_b}{M_b} : 1$$

B_b Number of benign cases detected by core biopsy, where each open biopsy performed represents a case.

M_b Number of malignant cancers cases detected by core biopsy, where each open biopsy represents a case.

Core Biopsy Yield Ratio: Proportion of cases with core biopsy that resulted in a diagnosis of breast cancer, where each core biopsy performed represents a case.

$$\text{Core Biopsy Yield Ratio} = \frac{M_b}{B_b + M_b} \times 100\%$$

B_b Number of diagnostic core biopsies without breast cancer diagnosis.

M_b Number of diagnostic core biopsies with breast cancer diagnosis.

DCIS (or In Situ Cancer) Detection Rate: Number of ductal carcinoma in situ (DCIS) cases detected per 1,000 screens with complete follow-up.

Diagnostic Interval: Percentage of women with an abnormal screening mammogram result who were diagnosed (benign or cancer) within the recommended time interval from the abnormal screen date.

- ≤ 5 weeks without a tissue biopsy
- ≤ 7 weeks with a tissue biopsy

Invasive Cancer Detection Rate: Number of invasive cancer cases detected per 1,000 screens with complete follow-up.

Interval Cancer Rate: Number of women being diagnosed with post-screen breast cancer at a breast location which was called normal at previous screen within the specified period of time per 1,000 screens.

Node Negative Rate in Cases of Invasive Cancer: Proportion of invasive cancers in which the cancer has not invaded the lymph nodes.

Open Biopsy Yield Ratio: Proportion of cases with open biopsy that resulted in a diagnosis of breast cancer, where each open biopsy performed represents a case.

$$\text{Open Biopsy Yield Ratio} = \frac{M_b}{B_b + M_b} \times 100 \%$$

B_b Number of diagnostic open biopsies without breast cancer diagnosis.

M_b Number of diagnostic open biopsies with breast cancer diagnosis.

Overall Cancer Detection Rate: Number of cancer cases detected per 1,000 screens with complete follow-up.

Participation Rate: The percentage of women who have a screening mammogram within 30 months as a proportion of the prevalence adjusted population.

Positive Predictive Value (PPV) of Screening Mammography: Proportion of “abnormal” cases found to have breast cancer after diagnostic workup.

$$\text{PPV} = \frac{\text{Number of screen - detected cancers}}{\text{Number of "abnormal" cases with complete follow - up}}$$

Prevalence to Expected Incidence Ratio: Comparison between incidence rates at first (prevalent) screen with historical incidence rate prior to onset of screening practice. Prevalent screens have been restricted to those women with no previous outside mammogram within 24 months of their first program screens. The 1982 incidence rates by five-year age group obtained from the BC Cancer Registry were chosen as the comparison reference.

$$P : I \text{ Ratio} = \frac{\sum_i C a_i}{\sum_i N_i R_i}$$

Where N_i is the number of prevalent screens for age group i , $C a_i$ is the number of cancers detected in prevalent screens for age group i and R_i is the expected incidence rate for age group i . Prevalence to expected incidence ratio for ages 50 to 79 would be calculated by summing over age groups 50 to 54, 55 to 59, 60 to 64, 65 to 69, 70 to 74, and 75 to 79 in the numerator and denominator.

Retention Rate (Return Rate): The estimated percentage of women without history of breast cancer diagnosis returned for rescreen within a certain period of time from their previous screen. This rate is estimated using Fine & Grey competing risk survival analysis method.

Sensitivity: Probability of interpreting screening mammograms of breast cancer cases as “abnormal”. It measures how well screening mammography determines the presence of breast cancer.

$$\text{Sensitivity} = \frac{TP}{TP + FN}$$

TP Number of screen-detected breast cancer cases.

FN Number of breast cancer cases called “normal” and diagnosed within 12 months post screen.

Specificity: Probability of interpreting screening mammograms of cases with no evidence of breast cancer as “normal”. It measures how well screening mammography determines the absence of breast cancer.

$$\text{Specificity} = \frac{TN}{TN + FP}$$

TN Number of cases with “normal” screening mammograms that remained without evidence of breast cancer before the next screening visit, or within 12 months after the last screening visit.

FP Number of cases with no evidence of breast cancer but whose screening mammograms were called “abnormal”.

APPENDIX 7 – ACKNOWLEDGEMENTS

The Breast Screening Program would like to thank its partners who have supported and contributed to the Program over the years. The success of the Program depends on an integrated system of:

- Community health professionals promoting the benefits of screening.
- Dedicated and highly trained staff to perform and interpret the screening mammograms.
- Primary care providers and medical specialists to provide diagnostic follow-up and treatment.
- Community facilities providing space and personnel to support mammography.

We would like to thank the following organizations for their ongoing support (alphabetical):

BC Cancer Foundation

BC Radiological Society

Canadian Cancer Society

Canadian Partnership Against Cancer

College of Physicians and Surgeons of BC

Doctors of BC

Divisions of Family Practice

Society of General Practitioners

University of British Columbia

APPENDIX 8 – COMMITTEES

<i>Alphabetical Listing – By Surname</i>	
<p>Quality Management Committee (QMC)</p> <p>Ms. Nancy Aldoff Dr. Stephen Chia Dr. Malcom Hayes Ms. Lisa Kan Ms. Sheila MacMahon Dr. Colin Mar – Chair Ms. Ritinder Matthew Ms. Mary Nagy Ms. Janette Sam Dr. Linda Warren Ms. Winnie Yen</p>	<p>Quality Management Support Group</p> <p>Ms. Nancy Aldoff Ms. Amanda Hunter Ms. Sheila MacMahon Ms. Moira Pearson Dr. Rasika Rajapakshe Dr. Derek Wells Dr. Joseph Yang</p>
<p>Screeener’s Advisory Committee (SAC)</p> <p>Ms. Nancy Aldoff Dr. Ken Bentley Dr. John Lai Dr. Eleanor Clark Dr. Jennifer Dolden Dr. Donal Downey Dr. Brenda Farnquist Dr. Dennis Janzen Dr. Rob Johnson Ms. Lisa Kan Dr. Tahir Khalid Dr. Nicola Lapinsky Dr. Grant Larsen Dr. Brent Lee</p>	<p>Dr. Colin Mar – Chair Dr. Peter McNicholas Dr. Darryn Maisonneuve Dr. David O’Keeffe Dr. Amie Padilla-Thornton Dr. Catherine Phillips Dr. Rasika Rajapakshe Ms. Janette Sam Dr. Karen Seland Dr. Stuart Silver Dr. Phil Switzer Dr. Beth Tanton Dr. Linda Warren</p>

APPENDIX 9 – RADIOLOGISTS SCREENERS

<i>Alphabetical listing, * Indicates Chief Screener</i>		
<p>Abbotsford & Chilliwack</p> <p>Dr. Amarjit Bajwa</p> <p>Dr. Tahir Khalid*</p> <p>Dr. Marian Kreml</p> <p>Dr. Caroline Pon</p> <p>Burnaby & Richmond</p> <p>Dr. Theodore Blake</p> <p>Dr. Andy Chan</p> <p>Dr. Bill Collins</p> <p>Dr. Brian Ho</p> <p>Dr. Henry Huey</p> <p>Dr. Marty Jenkins</p> <p>Dr. Vanindar (Vee) Lail</p> <p>Dr. Kelly MacLean</p> <p>Dr. Beth Tanton*</p> <p>Dr. Betty Tuong</p> <p>Comox</p> <p>Dr. Kevin Irish</p> <p>Dr. Grant Larson*</p> <p>Dr. Jennifer Waterhouse</p> <p>Coquitlam</p> <p>Dr. Vishal Anand</p> <p>Dr. Debra Chang</p> <p>Dr. Jennifer Dolden*</p> <p>Dr. Brad Halkier</p> <p>Dr. Jian Li</p> <p>Dr. Anita McEachern</p> <p>Dr. Robert van Wiltenburg</p> <p>Cranbrook</p> <p>Dr. Daryn Maisonneuve*</p> <p>Interior / Northern & Lower Mainland Mobile</p> <p>Dr. Marie-Jose Cloutier</p> <p>Dr. Kevin Ibach</p> <p>Dr. Colin Mar*</p> <p>Dr. Charlotte Yong-Hing</p> <p>Kamloops</p> <p>Dr. Donal Downey*</p> <p>Dr. Dellano Fernandez</p>	<p>Kelowna</p> <p>Dr. Brenda Farnquist*</p> <p>Dr. Michael Partrick</p> <p>Dr. Cathy Staples</p> <p>Dr. Tim Wall</p> <p>Langley</p> <p>Dr. Tahir Khalid</p> <p>Dr. John Lai*</p> <p>Dr. Caroline Pon</p> <p>Dr. Jerome Wong</p> <p>Dr. Xing Wong</p> <p>Nanaimo/Islands & Coastal Mobile</p> <p>Dr. David Coupland</p> <p>Dr. Robert Johnson*</p> <p>Dr. Zenobia Kotwall</p> <p>Dr. David O'Keefe* (Mobile Chief Screener)</p> <p>Dr. Paul Trepanier</p> <p>Dr. Peggy Yen</p> <p>North Vancouver & Sechelt</p> <p>Dr. Sven Aippersbach</p> <p>Dr. Simon Bicknell</p> <p>Dr. Bobbi-Jo Coldwell</p> <p>Dr. Patrick Llewellyn*</p> <p>Dr. Catherine Phillips</p> <p>Dr. David Spouge</p> <p>Penticton</p> <p>Dr. Peter McNicholas*</p> <p>Dr. Tracy Chandler</p> <p>Prince George (UHNBC)</p> <p>Dr. Shyr Chui</p> <p>Dr. Karen Seland*</p> <p>Dr. Greg Shand</p> <p>Surrey – JPOC</p> <p>Dr. Sanjiv (Sonny) Bhalla</p> <p>Dr. Guy Eriksen</p> <p>Dr. Fin Hodge</p> <p>Dr. Dennis Janzen*</p> <p>Dr. Dennis Lee</p> <p>Dr. Amir Neyestani</p>	<p>Surrey – JPOC (Continued)</p> <p>Dr. Earl Tregobov</p> <p>Vancouver BC Women's Health Centre</p> <p>Dr. Marie-Josée Cloutier</p> <p>Dr. Paula Gordon</p> <p>Dr. Linda Warren*</p> <p>Vancouver – Mount St. Joseph Hospital</p> <p>Dr. Jessica Farrell</p> <p>Dr. Jennifer Jessup</p> <p>Dr. Amie Padilla-Thornton*</p> <p>Vancouver – Victoria Drive</p> <p>Dr. Connie Siu</p> <p>Dr. Phil Switzer*</p> <p>Vancouver – #505 – 750 West Broadway</p> <p>Dr. Theodore Blake</p> <p>Dr. Paula Gordon</p> <p>Dr. Nicola Lapinsky*</p> <p>Dr. Linda Warren</p> <p>Dr. Charlotte Yong-Hing</p> <p>Vernon</p> <p>Dr. Ken Bentley*</p> <p>Dr. Ian Marsh</p> <p>Dr. Glenn Scheske</p> <p>Dr. Claire Thurgur</p> <p>Victoria General Hospital / Victoria Ft. St.</p> <p>Dr. Richard Eddy</p> <p>Dr. Chris King</p> <p>Dr. Robert Koopmans</p> <p>Dr. Brent Lee*</p> <p>Dr. Stacey Piche</p> <p>Dr. Nicola Proctor</p> <p>Dr. Stuart Silver*</p> <p>Dr. Rick Smith</p> <p>Dr. Paul Sobkin</p> <p>White Rock & Delta</p> <p>Dr. Eleanor Clark</p> <p>Dr. Joanne Coppola*</p> <p>Dr. Jeff Hagel</p>

APPENDIX 10 – PUBLICATIONS AND PRESENTATIONS

Publications

Paula Gordon

Padilla-Thornton A, Farrell J, Gordon P et al. Current Evaluation of Breast Health Concerns and Diagnosis of Breast Cancer. BC Medical Journal 2018; 60:27-32

Rasika Rajapakshe

Rajapakshe, R., Hui, M., Farnquist, B.A., Sam, J., Hartman, M. Risk of breast cancer after a false-positive screening mammogram in relation to mammographic abnormalist: Potential for Prevention. Radiological Society of North America: Scientific Assembly and Annual Meeting 2018.

Colin Mar

Mar C. Supporting breast cancer screening retention with physician reminder letters. Journal of Family Practice Oncology 2018; 30:3.

Woods RR, McGrail KM, Kliewer EV, Kazanjian A, Mar C, J Sam et al. Breast screening participation and retention among immigrants and nonimmigrants in British Columbia: A population-based study. Cancer Medicine 2018; 1-24.

Janette Sam

Woods RR, McGrail KM, Kliewer EV, Kazanjian A, Mar C, J Sam et al. Breast screening participation and retention among immigrants and nonimmigrants in British Columbia: A population-based study. Cancer Medicine 2018; 1-24.

Rajapakshe, R., Hui, M., Farnquist, B.A., Sam, J., Hartman, M. Risk of breast cancer after a false-positive screening mammogram in relation to mammographic abnormalist: Potential for Prevention. Radiological Society of North America: Scientific Assembly and Annual Meeting 2018.

John Spinelli

Woods RR, McGrail KM, Kliewer EV, Kazanjian A, Mar C, Kan L, Sam J, Spinelli JJ. Breast screening participation and retention among immigrants and nonimmigrants in British Columbia: A population-based study. Cancer Med. 2018 Jul 9. doi: 10.1002/cam4.1608. [Epub ahead of print] PMID: 29984906

Presentations, Interviews and Lectures

Nancy Aldoff

Before and After Makeovers – Mammography Positioning. Breast Screening Forum, Radisson Vancouver Airport, Richmond, BC. April 2018

'Just Ask' Province-wide Breast Screening Webinar conducted from Vancouver, BC. September 2018

Paula Gordon

Preventing and Screening for Breast Cancer. Webinar for the Canadian Cancer Survivor Network. October 16, 2018

Preventing and Screening for Breast Cancer. Fraser Health Patient Experience Conference. Surrey, BC. November 8, 2018

Colin Mar

Breast Cancer Screening/Imaging, VGH FCP Rounds, Vancouver; January 16, 2018

Breast Cancer Screening, Family Practice Oncology Network's GPO Training Program; Vancouver; February 26, 2018

Program Update - Policy, Practice and Performance Review. BC Breast Screening Forum, Vancouver, April 7, 2018

Breast Screening, UBC IMG Resident Orientation, Vancouver, Jun 19, 2018

Interview Vancouver Sun; Language, culture may be barriers to breast cancer screening in B.C.; July, 2018

Breast Cancer Screening, Family Practice Oncology Network's GPO Training Program; Vancouver; September 17, 2018

Breast Density Update and High Risk Screening, Rae Fawcett Breast Health Clinic, Kamloops; Sep 24, 2018

Screening participation in immigrants [panel]. CPAC CBCSN meeting. Fredericton; Nov, 2018

Integrating our Work: How to Maximize Benefit and Minimize Harm [panel]. CPAC CBCSN meeting. Fredericton; Nov, 2018

Janette Sam

Program Update - Policy, Practice and Performance Review. Breast Screening Forum, Richmond, BC. April 7, 2018

Interview Global News; Breast Cancer Screening among BC Subpopulations, Vancouver, BC. October 4, 2018

Interview CTV Vancouver Island; Breast density results available for BC women, Vancouver, BC. October 15, 2018

Webinar on education and information needs of patients and providers on breast density, Canadian September 2019

Partnership Against Cancer. November 1st, 2018

Rasika Rajapakshe

Personalized Breast Cancer Screening. Breast Screening Forum, Radisson Vancouver Airport, Richmond, BC. April 2018.

Risk of Breast Cancer After a False-Positive Screening mammogram in Relation to Mammographic Abnormality: Potential for Prevention? RSNA presentation by Dr. Rasika Rajapakshe, Chicago, IL. November 25, 2018.

Establishment of National QA standards for Digital Mammography Systems in Thailand. 18th Asia-Oceania Congress of Medical Physics (AOCMP) & 16th South-East Asia Congress of Medical Physics (SEACOMP) Kuala Lumpur, Malaysia, November 11- 14th 2018.

Artificial Intelligence in Mammography. COMP Mammography Workshop & CSBI Conference, Quebec City May 18 - 19th, 2019

Rocky Mountain Data Science Network-Collaborations in the Health Sciences. 47th Annual Meeting of the Statistical Society of Canada, University of Calgary, May 26-29th, 2019

Amanda Hunter

“Just Ask” Webinar – (New Program Materials Education Webinar). September 27th, 2018. Co-presented with Nancy Aldoff.

APPENDIX 11 – BREAST SCREENING PROGRAM / BC CANCER CONTACT INFORMATION (ALPHABETICAL LISTING BY SURRNAME)

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