BC CANCER BREAST SCREENING

Provincial Health Services Authority

BC Cancer Breast Screening
2017 Program Results

November 2018

Table of Contents

Appendix

1 – MESSAGE

Message from the Medical Director

The past twelve months have continued to provide exciting developments for our provincial breast screening. These include the completion of the transition to digital imaging. The benefits of increased cancer detection, decreased radiation dose, retirement of film processing and improved logistics for image sharing can now be enjoyed across the province.

After careful consideration, breast density will now be available in screening results letters to both program clients and their primary care providers. This will facilitate further understanding of breast cancer risk and the limitations of mammography. The lead-up to this policy change benefited from an external review of our program data and the recent literature, incorporation of local and distant expertise and contribution from public advocates.

In accordance with the recommendations of this review, patient and provider engagement is underway to optimize the communication of breast density results and related facts. We are also looking forward to the ongoing developments in breast density reporting and screening options. Please stay tuned for other policy work related to additional risk factors. Program policy must also facilitate access to all individuals of appropriate breast cancer risk. To this end, we have recently collaborated with Trans Care BC to update our guidelines for transgender, Two-Spirit and gender-diverse people in British Columbia.

Of course, I am also happy to share the program statistics for 2017. Cancer detection rates remain above national targets at 8.8/1000 for initial screens and 3.9/1000 for subsequent screens. There has been both program and national level attention to the upward trend in abnormal recall rates, and the past year has seen slight improvement in BC at 8.5% overall. The screening forum earlier this year was a great opportunity to discuss these and other topics, and for us to share experiences.

Thank you for your continued commitment to breast health across the province.

– 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 2017 the province completed its digital mammography transition. Women in BC can be assured that their screening exams are being performed on state of art technology by knowledgeable professionals regardless of where they attend for a screening mammogram in the province.

The next phase of the digital transition includes transferring the reporting process from a paper based process to an electronic format. The screening program is undertaking a provincial breast imaging electronic reporting solution implementation that will enable timelier reporting and minimize paper handling errors. The project will be completed by the spring of 2020.

– Janette Sam

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 30th year of operation. Since the inception of the program in 1988 to the end of 2017, the program has provided over 5,863,186 screening mammograms and detected 25,289 (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. While the number of screens performed in this age group increased slightly in 2017 compared with 2016, 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, 2017 Breast Screening Program Screening Services, and online at www.bccancer.bc.ca/screening/breast.

3.1 Breast Density Update

BC Cancer's Breast Screening Program recently conducted an external review of its protocols related to breast density and screening mammography. Given the complexity of the topic BC Cancer commissioned Dr. Andrew Coldman, Emeritus Scientist in Cancer Control Research, to provide the review. The Coldman review involved evaluating 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 BC Cancer's 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 mammography.

B.C. is adopting all three recommendations to empower women with greater information about their breast health. Beginning mid-October 2018, BC Cancer's Breast Screening Program will include BIRADS breast density information with all screening mammogram results sent to both B.C. women and their primary care providers.

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

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 2013[1].

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, 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 2017 Summary of Breast Screening Program Client Satisfaction Survey Results:

- The total number of surveys sent – **11,997**
- Total number of surveys returned – **5,185** (43% return rate)

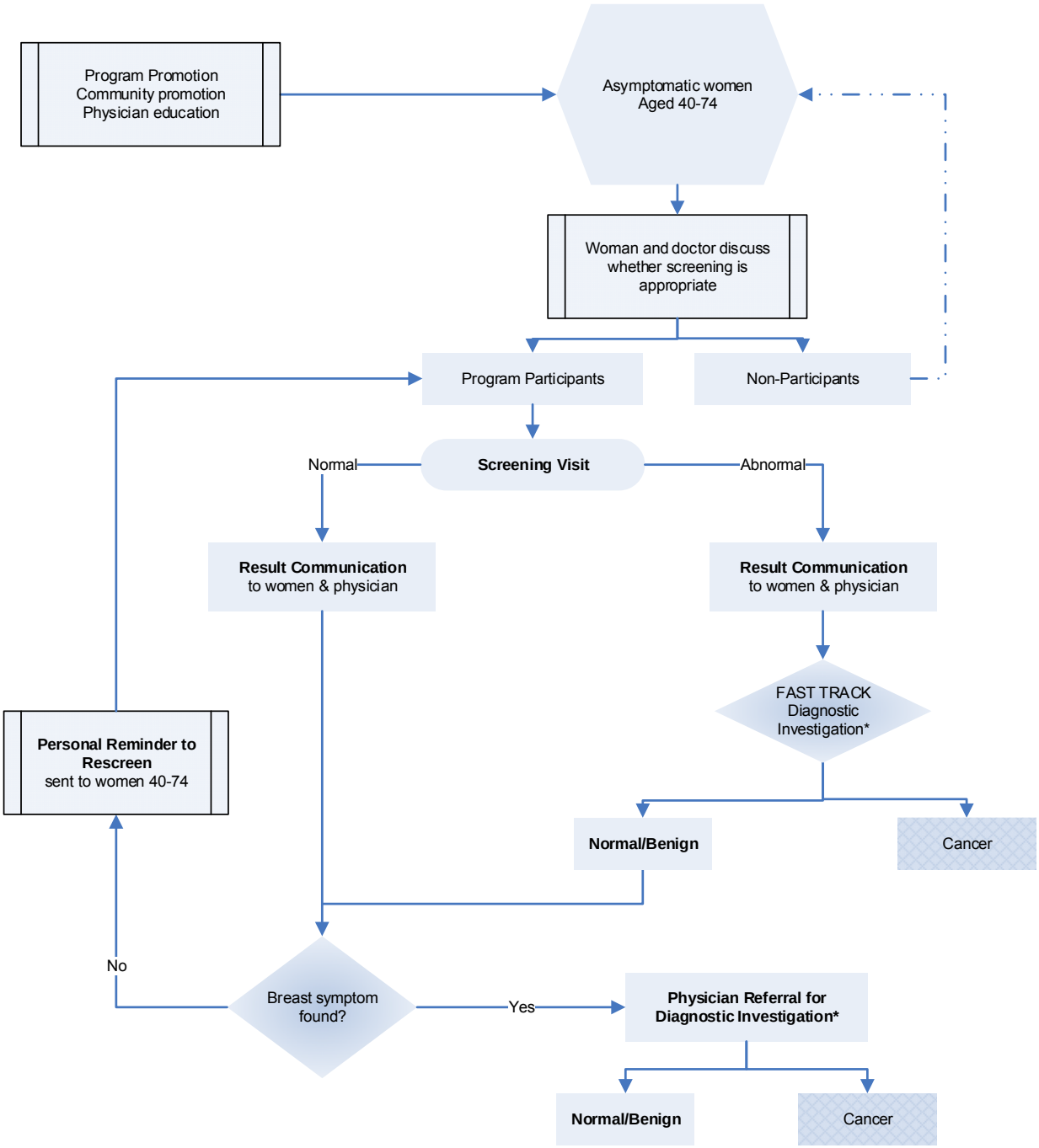
The results are compiled and both program-wide and centre-specific results are shared with the centres twice a year. Any centre-specific comments provided by those surveyed are also forwarded to the centres for review.

Overall results show that the Breast Screening Program is meeting client expectations. However, six major factors were identified that affect retention and whether a woman is more or less likely to return to screening. These are:

1. My appointment was on time
2. The receptionist was friendly and helpful
3. The Technologist explained the procedure to my satisfaction
4. The pressure used during the procedure was tolerable
5. I was informed about the importance of returning for regular screening
6. I was informed about the possibility of having to come back for extra tests

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 — 2017 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 Performance[2].

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

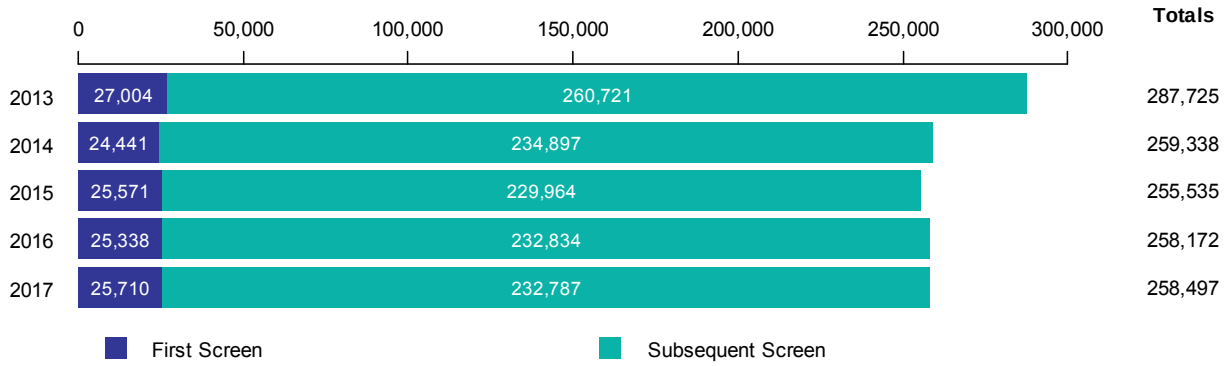
5.1 – RECRUITMENT AND RE-SCREENING

Screening Volume

The Breast Screening Program provided 258,497 examinations in 2017. During this period 25,710 (9.9%) of those examinations were provided to first time attendees.

Figure 2 shows that the total number of exams provided by Breast Screening Program in 2017 increased slightly compared to 2016. 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. The decrease in the number of subsequent screens since 2014 is a result of the change in screening frequency for women 40-49 years old.

FIGURE 2: ANNUAL SCREENING VOLUME YEARS: 2013-2017



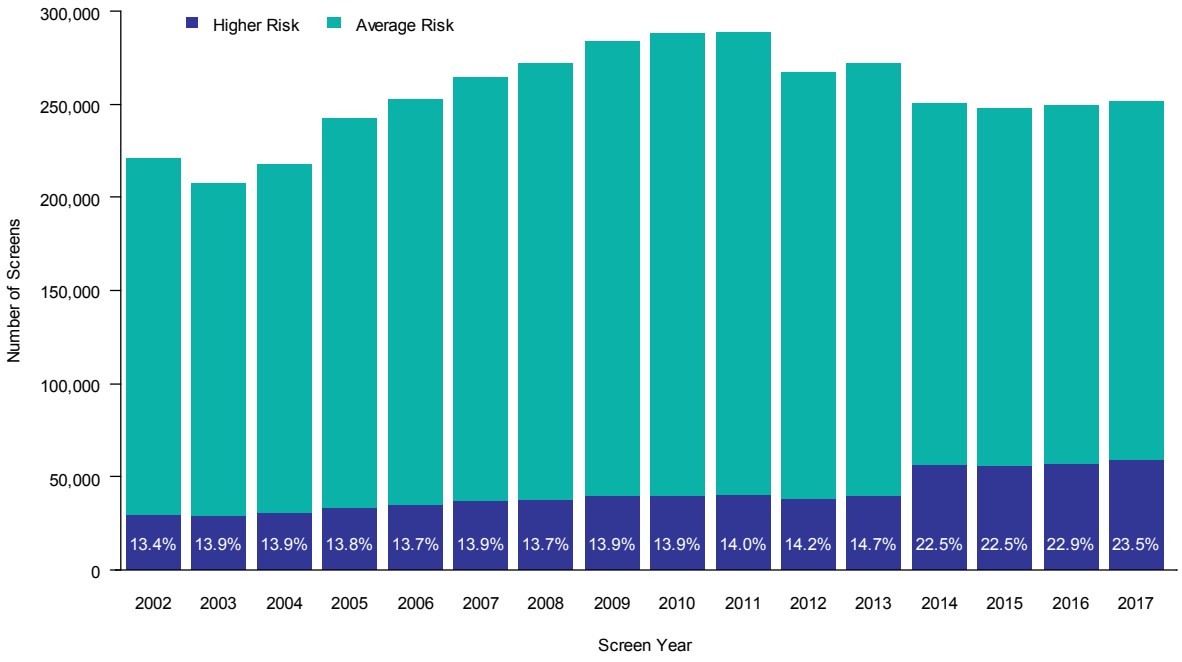
Notes

1. Breast Screening Program data extraction date: August 20, 2018

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 2017.

FIGURE 3: ANNUAL SCREENING VOLUME BY RISK AND SCREEN YEARS: 2002-2017



Notes

1. Breast Screening Program data extraction date: August 20, 2018

Volume by Health Service Delivery Area: 2017

The age distribution of all exams and first exams performed in 2017 by Health Services Delivery Areas (HSDA) are displayed in Table 1.

- The majority of exams (68%) are performed for women between ages 50 to 69 in all HSDAs. This is similar to 2016.
- The majority of first time attendees were under 50 years of age; however, there are regional variations ranging from 36% 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: 2017

		Age Distribution of All Exams			First Exams		Age Distribution of First Exams		
HSDA	**Total Exams**	**<50**	**50-69**	**70+**	**n**	**% Total**	**<50**	**50-69**	**70+**
East Kootenay	3,953	12%	72%	16%	404	10%	36%	60%	4%
Kootenay Boundary	3,929	12%	72%	16%	428	11%	44%	51%	5%
Okanagan	23,526	13%	70%	17%	2,098	9%	44%	52%	4%
Thompson Cariboo Shuswap	12,943	15%	69%	16%	1,215	9%	55%	43%	2%
Interior	44,351	13%	70%	17%	4,145	9%	46%	50%	4%
Fraser East	15,669	18%	68%	14%	1,544	10%	61%	37%	3%
Fraser North	34,745	23%	66%	11%	3,803	11%	66%	31%	3%
Fraser South	39,774	22%	65%	12%	4,529	11%	65%	33%	3%
Fraser	90,188	22%	66%	12%	9,876	11%	65%	33%	3%
Richmond	12,244	21%	68%	11%	1,198	10%	65%	33%	2%
Vancouver	32,599	23%	66%	12%	3,425	11%	65%	32%	3%
North Shore / Coast Garibaldi	17,190	19%	67%	14%	1,610	9%	64%	33%	3%
Vancouver Coastal	62,033	21%	67%	12%	6,233	10%	65%	33%	3%
South Vancouver Island	22,766	14%	71%	16%	1,874	8%	50%	47%	4%
Central Vancouver Island	17,693	11%	71%	18%	1,496	8%	42%	52%	5%
North Vancouver Island	7,407	10%	73%	17%	572	8%	42%	54%	3%
Vancouver Island	47,866	12%	71%	17%	3,942	8%	46%	50%	4%
Northwest	3,595	18%	69%	12%	388	11%	63%	35%	1%
Northern Interior	7,176	17%	71%	13%	653	9%	57%	41%	2%
Northeast	1,969	18%	71%	11%	261	13%	48%	47%	5%
Northern	12,740	17%	70%	12%	1,302	10%	57%	40%	2%
British Columbia	**258,497**	**18%**	**68%**	**14%**	**25,710**	**10%**	**58%**	**39%**	**3%**

Notes

1. Breast Screening Program data extraction date: August 20, 2018.

Volume by Health Service Delivery Area: 2017 (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.

- A higher percentage (27%) of the screens performed on Vancouver Island are for higher risk women.
- 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: 2017

			Age Distribution of Higher Risk Exams		
HSDA	**Number of Higher Risk Exams**	**% Higher Risk Exams**	**40-49**	**50-74**	**75+**
East Kootenay	940	24%	10%	86%	4%
Kootenay Boundary	938	24%	11%	85%	4%
Okanagan	6,239	27%	10%	85%	4%
Thompson Cariboo Shuswap	3,378	26%	12%	84%	4%
Interior	11,495	26%	11%	85%	4%
Fraser East	3,701	24%	13%	83%	4%
Fraser North	7,654	22%	18%	78%	3%
Fraser South	8,600	22%	17%	80%	3%
Fraser	19,955	22%	17%	80%	3%
Richmond	2,495	20%	16%	81%	3%
Vancouver	6,684	21%	18%	79%	2%
North Shore / Coast Garibaldi	4,234	25%	15%	82%	3%
Vancouver Coastal	13,413	22%	17%	80%	3%
South Vancouver Island	5,987	26%	11%	85%	3%
Central Vancouver Island	4,811	27%	9%	87%	4%
North Vancouver Island	2,093	28%	11%	86%	3%
Vancouver Island	12,891	27%	10%	86%	3%
Northwest	919	26%	15%	81%	3%
Northern Interior	1,776	25%	13%	84%	2%
Northeast	481	24%	16%	82%	2%
Northern	3,176	25%	14%	83%	3%
British Columbia	**61,223**	**24%**	**14%**	**82%**	**3%**

Notes

1. Breast Screening Program data extraction date: August 20, 2018.

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, 2015 and December 31, 2017, 512,731 women ages 40 and over participated in the Breast Screening Program.
- Compared with 2016, the participation increased overall in FHA, VCHA and NHA. The Okanagan and North Shore had the highest HSDA rates at 55%.

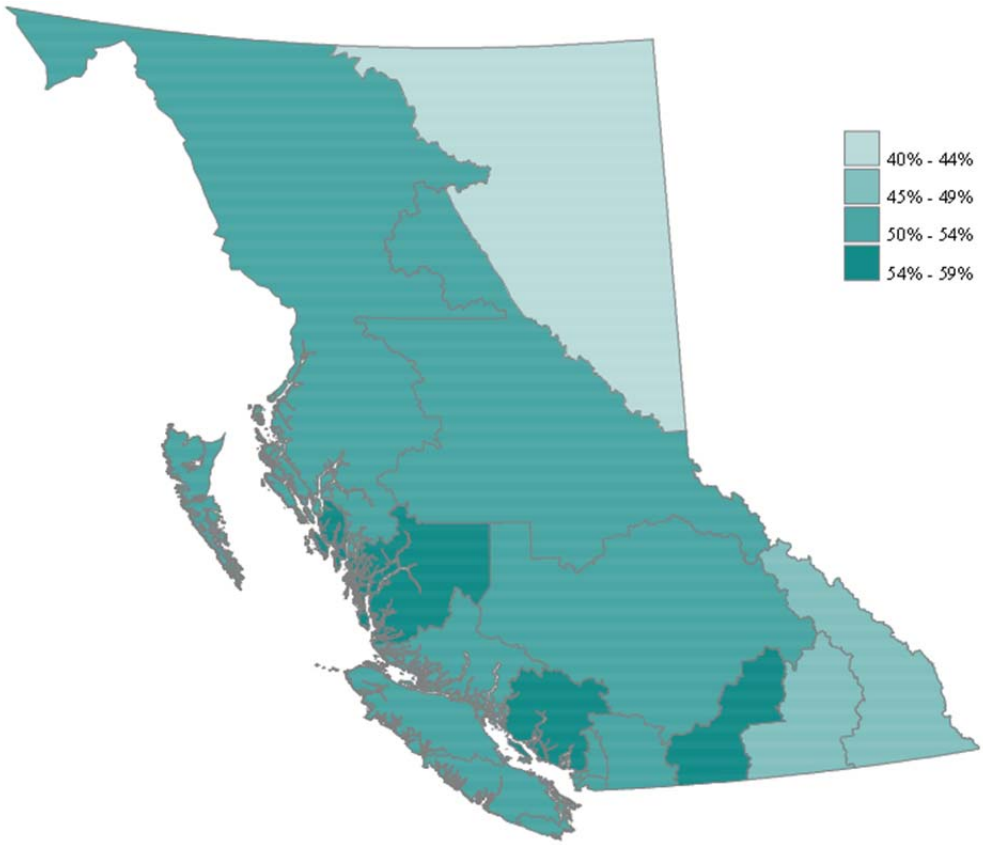
TABLE 3: REGIONAL 30-MONTH PARTICIPATION RATES BY 10-YEAR AGE GROUPS ENDING DECEMBER 31, 2017 INCLUSIVE

	10-Year Age Groups				
HSDA	**40-49**	**50-59**	**60-69**	**70-74**	**Ages 50-69**
East Kootenay	18%	44%	54%	55%	**49%**
Kootenay Boundary	17%	43%	51%	50%	**47%**
Okanagan	25%	50%	60%	59%	**55%**
Thompson Cariboo Shuswap	26%	46%	56%	55%	**51%**
Interior	23%	47%	57%	57%	**52%**
Fraser East	27%	49%	57%	52%	**53%**
Fraser North	30%	51%	58%	54%	**54%**
Fraser South	29%	49%	55%	51%	**52%**
Fraser	29%	50%	57%	52%	**53%**
Richmond	30%	47%	57%	52%	**53%**
Vancouver	29%	48%	55%	52%	**51%**
North Shore/Coast Garibaldi	28%	52%	60%	59%	**55%**
Vancouver Coastal	29%	49%	57%	54%	**53%**
South Vancouver Island	23%	49%	58%	58%	**54%**
Central Vancouver Island	22%	47%	60%	60%	**54%**
North Vancouver Island	20%	46%	59%	60%	**53%**
Vancouver Island	22%	48%	59%	59%	**54%**
Northwest	27%	47%	55%	53%	**50%**
Northern Interior	25%	49%	59%	57%	**54%**
Northeast	15%	37%	45%	44%	**40%**
Northern	23%	46%	55%	54%	**50%**
British Columbia	**27%**	**49%**	**57%**	**55%**	**53%**

Notes

1. Population data source: P.E.O.P.L.E. 2017 population projection (Sept 2017), 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 2015, 2016 and 2017 female population estimates.
3. Postal code translation file: TMF201804 (Apr 2018).
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: August 20, 2018.

FIGURE 4: BIENNIAL SCREENING PARTICIPATION BY WOMEN AGES 50-69 OVER 30-MONTH PERIOD BETWEEN JULY 1, 2015 AND DECEMBER 31, 2017



Notes

1. Population data source: P.E.O.P.L.E. 2017 population projection (Sept 2017), 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 2015, 2016 and 2017 female population estimates.
3. Postal code translation file: TMF201804 (Apr 2018).
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: August 20, 2018.

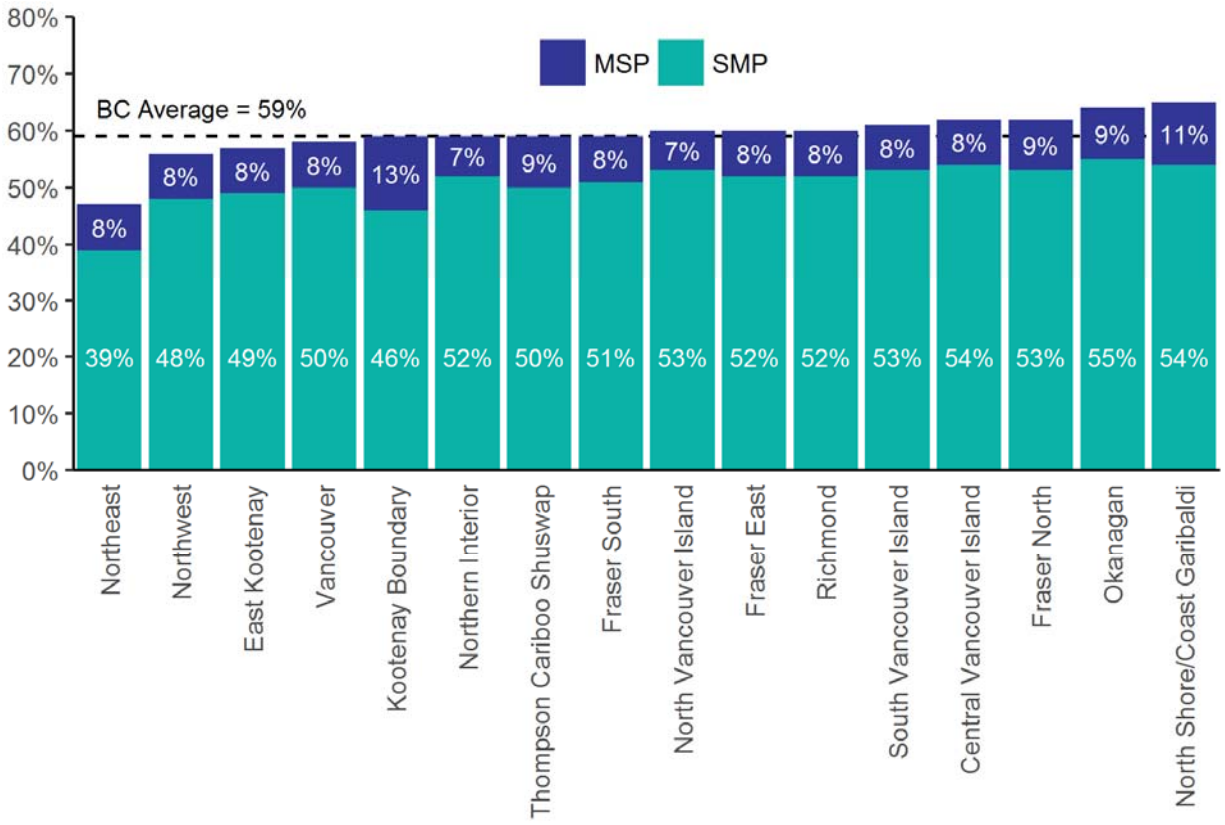
Bilateral mammography may be used for both screening and diagnostic purposes. A proportion of the bilateral mammography services paid through the Medical Services Plan (MSP) are directly related to screening. Data on bilateral mammography utilization were obtained from the MSP.

Figure 5 shows the proportion of women receiving bilateral mammography services through the either Breast Screening Program or MSP over a 30 month period. Some women may have had bilateral mammograms through both Breast Screening Program and MSP. Thus, the proportions presented here may be slightly higher than the actual figures due to this possible duplication. In HSDA with long established Breast Screening Program services, the proportion of women using the MSP funded bilateral mammography has stabilized to 8% –10%.

Screening Participation (continued)

- During the 30-month reporting period, 59% of BC women ages 50 to 69 received bilateral mammography services through either the screening program or MSP. This rate has decreased 2% overall since the 30 month period ending December 2016.
- The percentage of women ages 50 to 69 receiving bilateral mammography ranged from 47% to 65% across the province, with Northeast (47%) and Northwest (56%) having the lowest percentages.
- Overall, the Breast Screening Program provided 85% of the bilateral mammography services for this age group.

FIGURE 5: BILATERAL MAMMOGRAPHY UTILIZATION BY WOMEN AGES 50-69 IN BC BETWEEN JULY 1, 2015 AND DECEMBER 31, 2017 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, 2017 for services provided between July 1, 2015 and December 31, 2017.
3. Breast Screening Program data includes single and multiple screens per woman provided between July 1, 2015 and December 31, 2017.
4. Population data source: P.E.O.P.L.E. 2017 (Sept 2017), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
5. Breast Screening Program data extraction date: August 20, 2018.

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 National Household Survey Custom Profile, 2011 (original data source) data. The ethnic population size for each HSDA was estimated based on this ethnic population percentage and the P.E.O.P.L.E. 2017 population projections. The use of single ethnic response data may represent 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 was collected at the time of program registration on approximately 86% of attendee's ages 50 to 69 screened between July 1, 2015 and December 31, 2017. 11.5% of attendees did not specify their ethnicity and were excluded from this analysis.

- Participation in the Breast Screening Program by select ethnic groups has increased slightly compared with 2016.
- Participation by Aboriginal women has increased by 3% overall (from 58% in 2016 to 61% in 2017).
- Participation by East/South East Asians has increased by 3% (from 59% in 2016 to 62% in 2017).
- Participation by South Asians has increased slightly (from 57% in 2016 to 58% in 2017).
- Participation by select ethnic groups has increased over the last six consecutive years, and is 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, 2015 AND DECEMBER 31, 2017 INCLUSIVE

	Aboriginal		East/South-East Asian		South Asian	
HSDA	Population %	Participation Rate	Population %	Participation Rate	Population %	Participation Rate
East Kootenay	1%	>99%	1%	>99%	1%	38%
Kootenay Boundary	<1%	>99%	1%	63%	<1%	>99%
Okanagan	1%	95%	1%	58%	1%	71%
Thompson Cariboo Shuswap	4%	54%	1%	79%	1%	45%
Interior	2%	71%	1%	68%	1%	63%
Fraser East	2%	58%	2%	95%	9%	53%
Fraser North	<1%	67%	25%	65%	4%	60%
Fraser South	<1%	85%	10%	76%	15%	52%
Fraser	1%	68%	14%	70%	10%	53%
Richmond	<1%	>99%	51%	56%	6%	57%
Vancouver	1%	47%	41%	50%	4%	62%
North Shore/Coast Garibaldi	2%	53%	7%	69%	2%	96%
Vancouver Coastal	1%	51%	33%	54%	4%	65%
South Vancouver Island	1%	66%	4%	57%	1%	79%
Central Vancouver Island	2%	38%	2%	68%	1%	45%
North Vancouver Island	2%	49%	1%	75%	<1%	>99%
Vancouver Island	1%	47%	3%	60%	1%	70%
Northwest	15%	61%	3%	26%	1%	>99%
Northern Interior	4%	83%	2%	37%	1%	65%
Northeast	4%	73%	1%	17%	<1%	63%
Northern	7%	68%	2%	30%	1%	72%
British Columbia	**1%**	**61%**	**13%**	**62%**	**4%**	**58%**

Notes

1. Population data sources: P.E.O.P.L.E. 2017 population projection (Sept 2017), BC STATS, Ministry of Technology, Innovation and Citizens' Services, Government of British Columbia, and Statistics Canada, National Household Survey Custom Profile, 2011 (original data source).
2. Postal code translation file: TMF201804 (Apr 2018).
3. Women attended the Breast Screening Program at least once between July 1, 2015 and December 31, 2017 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: August 20, 2018.

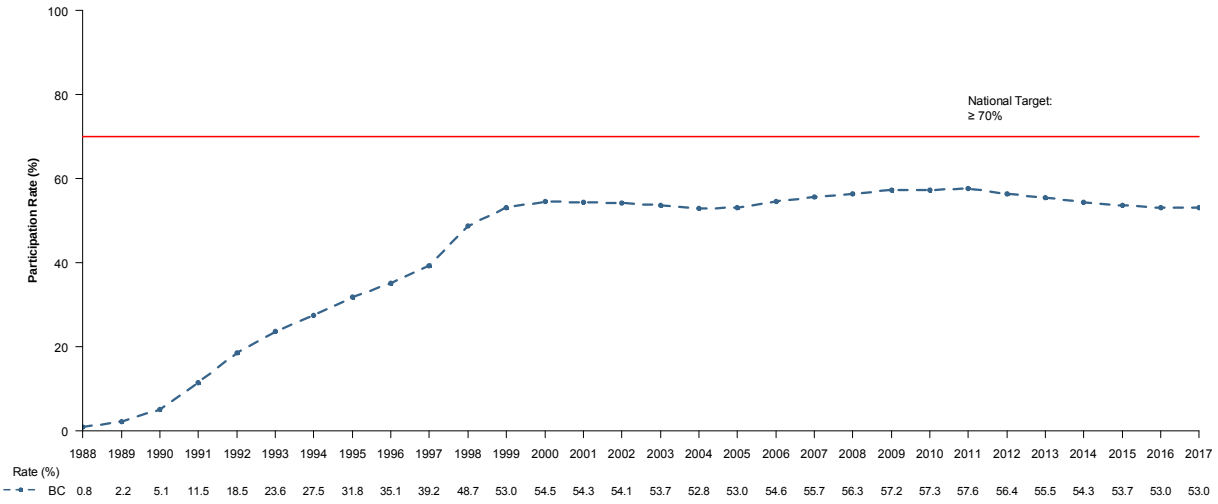
Population Percentage

1. Original data source - Statistics Canada, National Household Survey Custom Profile, 2011.
2. East/South-East Asians include Chinese, Filipino, Burmese, Cambodian, Hmong, Khmer, Laotian, Thai, Vietnamese, Indonesian, Japanese, Korean, Malaysian, Singaporian, 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 53-57%. 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 – 2017



Notes

1. Breast Screening Program data extraction date: August 20, 2018

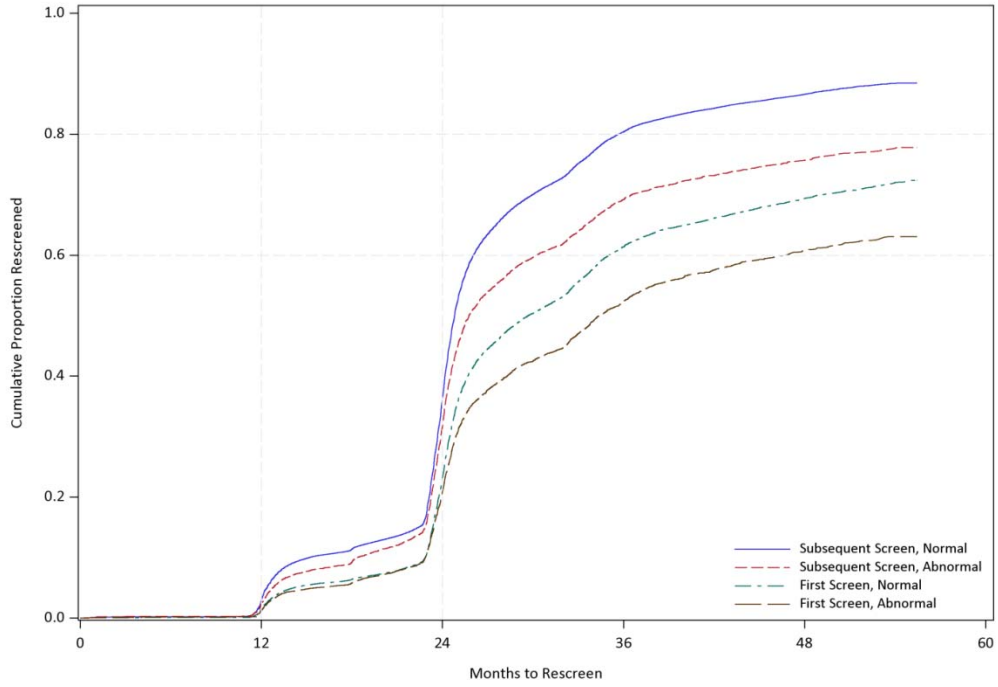
Screening Return Rates

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 2014 and 2016. 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, 67% of women with a previous normal result and 51% 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.

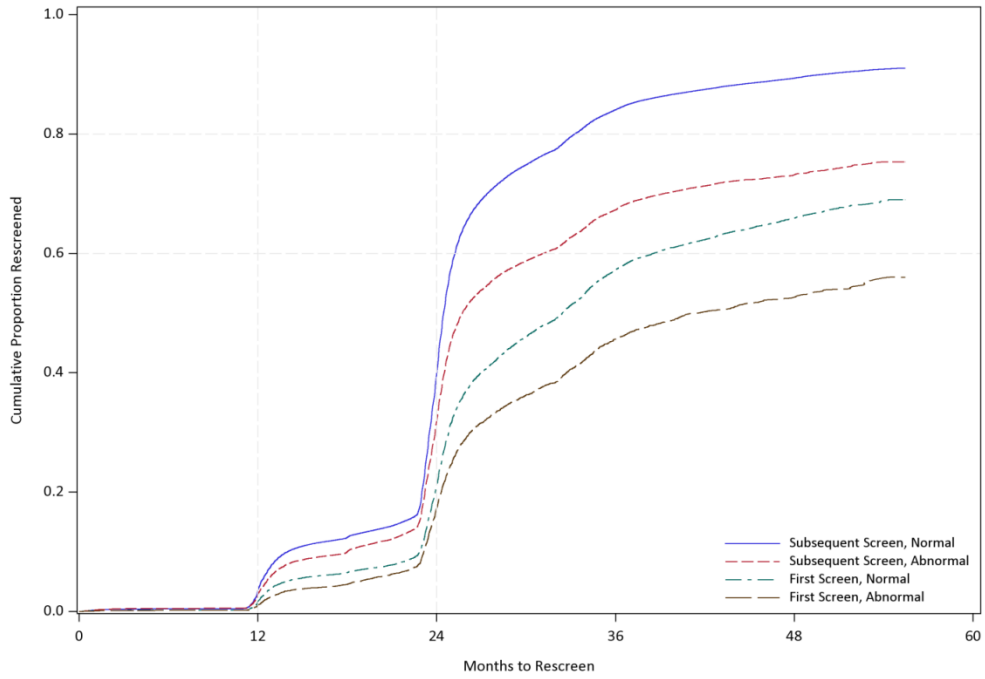
FIGURE 7: RETURN RATES FOR AVERAGE RISK WOMEN AGES 40-49 BY FIRST/SUBSEQUENT SCREEN AND SCREEN RESULT: 2014 – 2016



Notes

1. Breast Screening Program data extraction date: August 20, 2018

FIGURE 8: RETURN RATES FOR AVERAGE RISK WOMEN AGES 50-69 BY FIRST/SUBSEQUENT SCREEN AND SCREEN RESULT: 2014 – 2016



Notes

1. Breast Screening Program data extraction date: August 20, 2018

TABLE 5: RETURN RATES FOR AVERAGE RISK WOMEN AGES 40-49: 2014 – 2016

	First Screen		Subsequent Screen		Overall	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Total Number to be Re-screened	36,267	8,101	69,789	7,284	**106,056**	**15,385**
Returned by 12 months	1%	1%	3%	2%	**2%**	**2%**
18 months	6%	6%	11%	9%	**10%**	**7%**
24 months	23%	21%	36%	31%	**32%**	**26%**
30 months	50%	42%	70%	60%	**64%**	**51%**
36 months	61%	52%	80%	69%	**74%**	**61%**

Notes
1. Breast Screening Program data extraction date: August 20, 2018

TABLE 6: RETURN RATES FOR AVERAGE RISK WOMEN AGES 50-69: 2014 – 2016

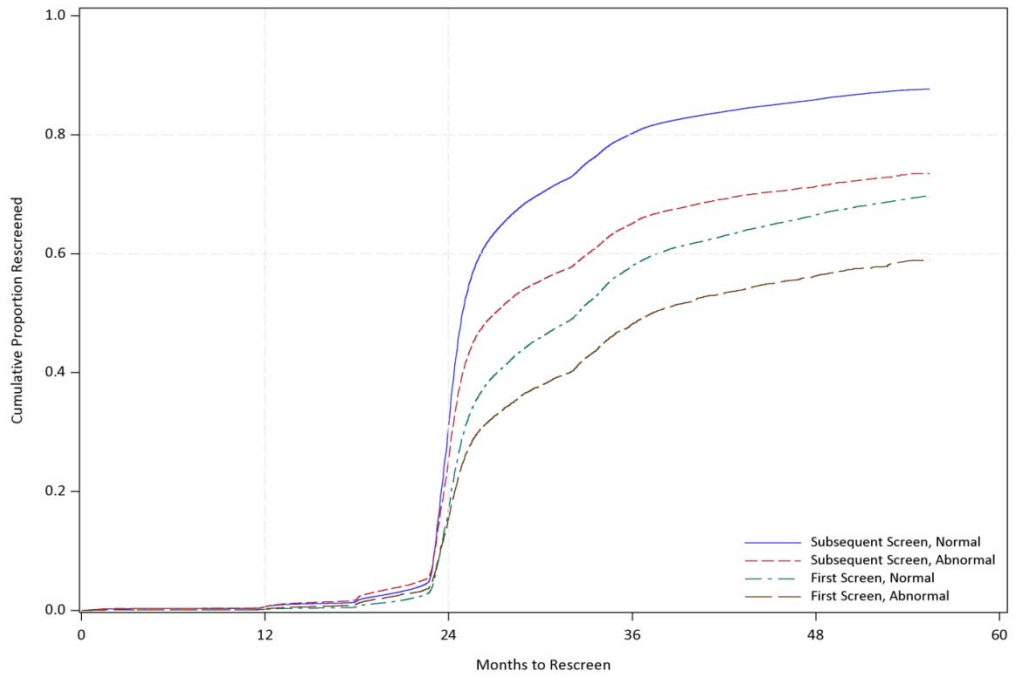
	First Screen		Subsequent Screen		Overall	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Total Number to be Re-screened	**22,196**	**5,582**	**293,545**	**25,216**	**315,741**	**30,798**
Returned by 12 months	2%	1%	4%	3%	**3%**	**3%**
18 months	6%	5%	12%	10%	**12%**	**9%**
24 months	21%	17%	40%	32%	**38%**	**29%**
30 months	46%	36%	75%	59%	**73%**	**55%**
36 months	57%	46%	84%	67%	**82%**	**64%**

Notes
1. Breast Screening Program data extraction date: August 20, 2018

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 2014 and 2016. Women in this cohort are recommended to screen annually rather than every two years. As a result of this 2014 policy change in screening frequency, there was a shift in higher risk women returning earlier to screen. 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).

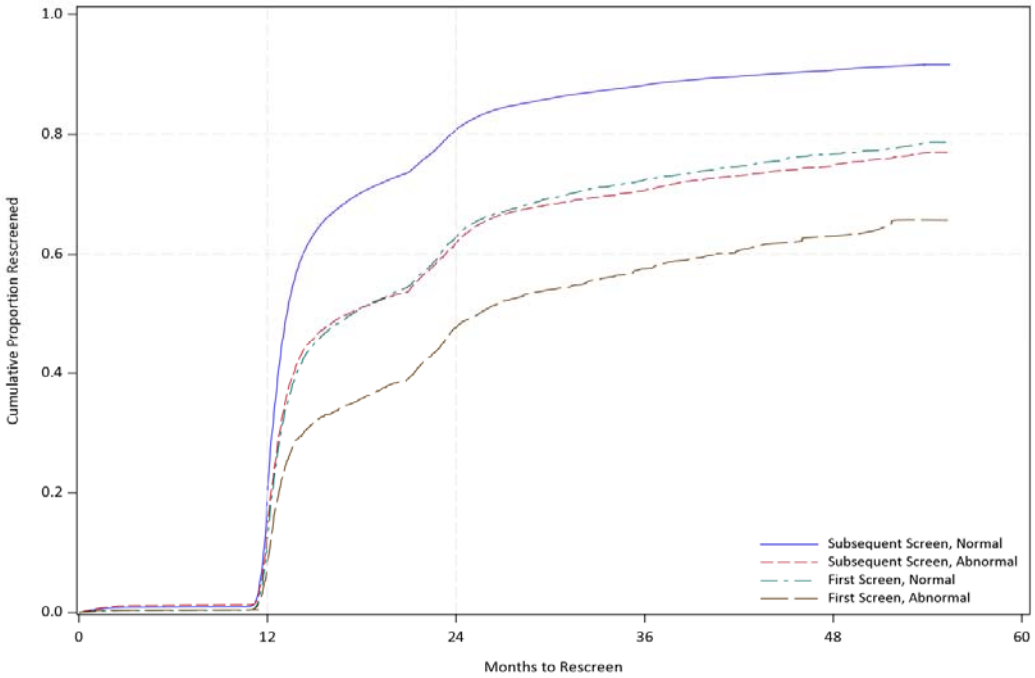
FIGURE 9: RETURN RATES FOR AVERAGE RISK WOMEN AGES 40-74 BY FIRST/SUBSEQUENT SCREEN AND SCREEN RESULT: 2014 – 2016



Notes

1. Breast Screening Program data extraction date: August 20, 2018

FIGURE 10: RETURN RATES FOR HIGHER RISK WOMEN AGES 40-74 BY FIRST/SUBSEQUENT SCREEN AND SCREEN RESULT: 2014 – 2016



Notes

1. Breast Screening Program data extraction date: August 20, 2018

TABLE 7: RETURN RATES FOR AVERAGE RISK WOMEN AGES 40-74: 2014 – 2016

	First Screen		Subsequent Screen		Overall	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Total Number to be Re-screened	**53,113**	**12,379**	**352,726**	**30,946**	**405,839**	**43,325**
Returned by 12 months	<1%	<1%	1%	1%	**1%**	**1%**
18 months	1%	1%	2%	2%	**1%**	**2%**
24 months	17%	15%	31%	25%	**29%**	**22%**
30 months	46%	38%	70%	55%	**67%**	**51%**
36 months	58%	48%	80%	65%	**78%**	**61%**

Notes

1. Breast Screening Program data extraction date: August 20, 2018

TABLE 8: RETURN RATES FOR HIGHER RISK WOMEN AGES 40-74: 2014 – 2016

	First Screen		Subsequent Screen		Overall	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Total Number to be Re-screened	**6,998**	**1,701**	**65,857**	**5,914**	**72,855**	**7,615**
Returned by 12 months	12%	8%	19%	14%	**19%**	**13%**
18 months	51%	36%	70%	51%	**68%**	**48%**
24 months	63%	48%	81%	62%	**79%**	**59%**
30 months	69%	54%	86%	68%	**84%**	**65%**
36 months	72%	58%	88%	71%	**87%**	**68%**

Notes

1. Breast Screening Program data extraction date: August 20, 2018

5.2 – 2017 SCREENING RESULTS

Table 9 summarizes the outcome indicators for screening exams provided in 2017 by 10-year age groups:

- Of the 258,497 screening mammograms performed, 23,156 (9.0%) had an abnormal result.
- There were 1,404 breast cancers reported in 2017 as of August 20, 2018 (5.4 per 1,000 exams).
- The 2017 overall cancer detection rate decreased slightly compared with 2016, from 5.6 to 5.4 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 cell 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 2017 compared to 2016 at 9.0%.
- The abnormal call rate is lower on subsequent screens than on first screens.
- The overall abnormal call rate decreases as women age, from 12.8% for ages 40 to 49 to 7.0% 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 decreased slightly in 2017 compared to 2016 (from 5.6 per 1000 screens to 5.4 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 increased in 2017 compared to 2016 (from 1.1 to 1.2 per 1000)

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 decreased compared with 2016 from 6.3% to 6.1% overall.

TABLE 9: BREAST SCREENING PROGRAM OUTCOME INDICATORS BY 10-YEAR AGE GROUPS: 2017

		Age at Exam					
		40-49	50-59	60-69	70-74	75+	All
Number of Exams		47,017	86,963	88,615	29,248	6,428	258,497
on first screens		31.5%	7.6%	3.8%	2.0%	3.4%	9.9%
on higher risk screens		18.4%	21.8%	26.0%	28.9%	31.1%	23.7%
Number of Cancers		176	404	538	221	65	1,404
on first screens		46.0%	14.6%	8.7%	4.5%	10.8%	14.5%
on higher risk screens		15.3%	23.5%	23.2%	29.9%	35.4%	23.9%
Abnormal Call Rate		12.8%	8.9%	7.6%	7.0%	7.6%	9.0%
on first screens	Overall	19.1%	21.2%	19.1%	21.1%	22.6%	19.7%
	Higher Risk	20.0%	21.8%	18.9%	25.7%	26.2%	20.5%
	Average Risk	19.0%	21.1%	19.1%	20.1%	21.7%	19.6%
on subsequent screens	Overall	10.0%	7.9%	7.2%	6.7%	7.1%	7.8%
	Higher Risk	9.6%	7.7%	6.6%	6.6%	7.2%	7.3%
	Average Risk	10.0%	8.0%	7.4%	6.8%	7.0%	7.9%
Overall Cancer Detection Rate (per 1,000)		3.7	4.6	6.1	7.6	10.1	5.4
on first screens	Overall	5.5	9.0	14.2	17.5	32.7	8.0
	Higher Risk	5.3	15.9	26.9	29.7	71.4	12.7
	Average Risk	5.5	8.0	12.0	14.8	23.3	7.3
on subsequent screens	Overall	3.0	4.3	5.8	7.4	9.3	5.2
	Higher Risk	2.6	4.5	5.0	7.5	10.2	5.1
	Average Risk	3.1	4.2	6.0	7.3	8.9	5.2
DCIS Detection Rate (per 1,000)		1.2	1.0	1.3	1.1	1.6	1.2
on first screens	Overall	1.9	2.0	1.8	1.7	---	1.9
	Higher Risk	2.9	3.7	4.1	---	---	3.1
	Average Risk	1.8	1.7	1.4	2.1	---	1.7
on subsequent screens	Overall	0.9	0.9	1.3	1.1	1.6	1.1
	Higher Risk	0.7	1.3	1.1	1.0	2.6	1.1
	Average Risk	1.0	0.8	1.3	1.2	1.2	1.1
Positive Predictive Value		2.9%	5.2%	8.0%	10.8%	13.5%	6.1%
on first screens	Overall	2.9%	4.3%	7.5%	8.3%	15.2%	4.1%
	Higher Risk	2.7%	7.3%	14.4%	11.5%	27.3%	6.2%
	Average Risk	2.9%	3.8%	6.3%	7.4%	11.4%	3.7%
on subsequent screens	Overall	3.0%	5.4%	8.0%	10.9%	13.3%	6.7%
	Higher Risk	2.7%	5.9%	7.6%	11.5%	14.3%	7.0%
	Average Risk	3.0%	5.3%	8.2%	10.7%	12.8%	6.6%
Core Biopsy Yield Ratio		17.2%	30.3%	43.0%	52.8%	54.4%	34.1%
on first screens		13.9%	17.8%	34.1%	45.5%	50.0%	19.2%
on subsequent screens		21.3%	34.2%	44.2%	53.3%	54.9%	39.1%

Open Biopsy Yield Ratio	20.3%	18.8%	39.2%	29.6%	53.3%	**26.7%**
on first screens	20.8%	18.6%	14.3%	---	50.0%	**19.4%**
on higher risk screens	19.7%	18.9%	41.7%	31.4%	53.8%	**29.1%**

Notes

1. See glossary in the Appendix for definitions of terms.
2. Overall Cancer Rate includes ductal carcinoma in situ (DCIS).
3. An additional 129 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. 226 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: August 20, 2018.

Diagnostic procedure information is available to date on 23,027 (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.

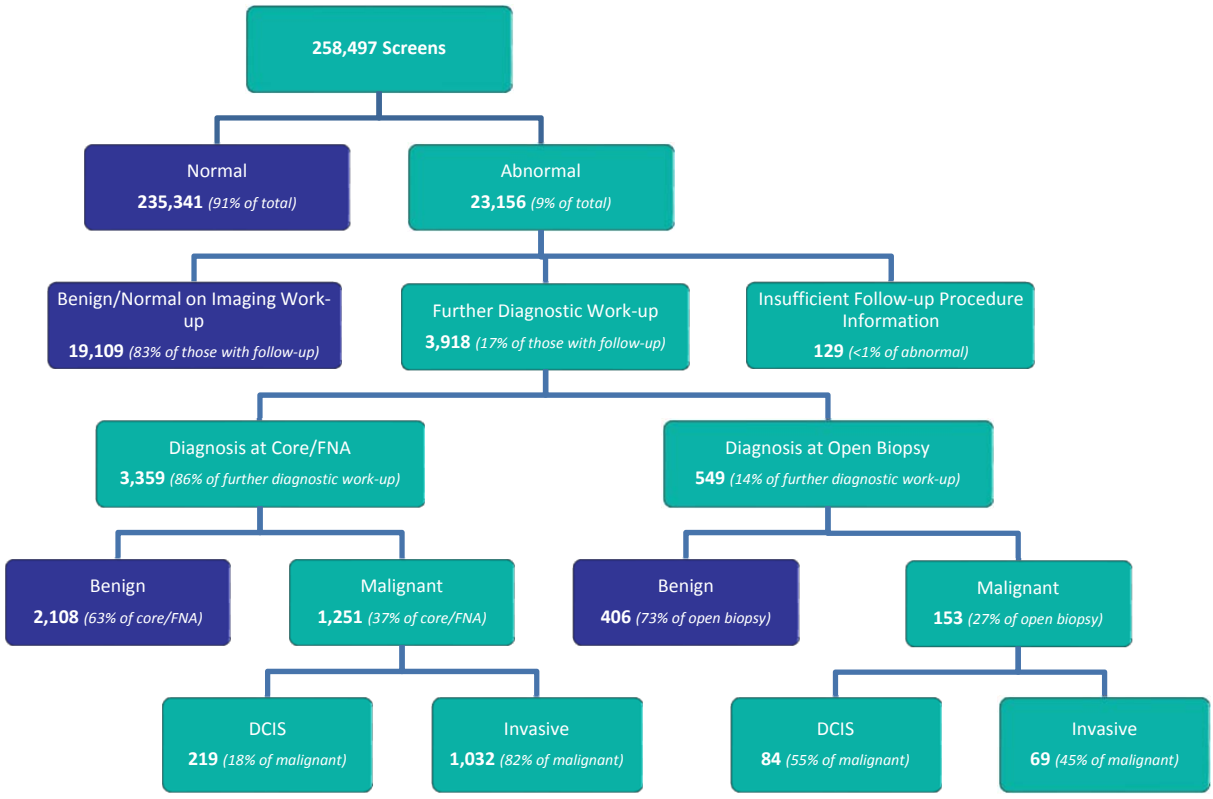
TABLE 10: DIAGNOSTIC PROCEDURES RECEIVED BY BREAST SCREENING PROGRAM PARTICIPANTS WITH "ABNORMAL" SCREENING MAMMOGRAMS: 2017

	Age at Exam						
Procedure	**<40**	**40-49**	**50-59**	**60-69**	**70-79**	**80+**	**All**
Diagnostic Mammogram	85%	93%	94%	95%	94%	93%	94%
Ultrasound	76%	72%	70%	69%	66%	71%	**70%**
Fine Needle Aspiration	0%	1%	1%	1%	1%	0%	**1%**
Core Biopsy	6%	14%	15%	16%	19%	25%	**16%**
Surgical Biopsy	0%	2%	2%	2%	3%	2%	**2%**
with Localization	0%	2%	2%	2%	2%	2%	**2%**
Number of cases with diagnostic assessment information available	34	5,999	7,736	6,728	2,415	115	**23,027**

Notes

1. Breast Screening Program data extraction date: August 20, 2018.

FIGURE 11: SCREENING OUTCOME SUMMARY: 2017



5.3 2017 CANCER DETECTION

Histologic features of breast cancers detected by the Breast Screening Program in 2017 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, 57% were ≤15 mm, 77% did not have invasion of the regional lymph nodes, and 21% were grade 3 (i.e. poorly differentiated) tumours.

These overall outcome indicators met the international targets[3] recommended for screening programs.

[3] Tabàr L, Fagerberg G, Duffy SW, Day NE, Gad A, Gröntoft 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: 2017

	Age at Exam									
Histological Features	**40-49**		**50-59**		**60-69**		**70-79**		**Age 40-79**	
Number of Cancers	175		404		537		266		**1,382**	
in situ	57	33%	89	22%	114	21%	40	15%	**300**	**22%**
invasive	118	67%	315	78%	423	79%	226	85%	**1,082**	**78%**
Invasive Cancers Tumour Size										
≤ 5 mm	15	13%	26	8%	33	8%	13	6%	**87**	**8%**
6-10 mm	15	13%	57	18%	105	25%	54	24%	**231**	**22%**
11-15 mm	29	25%	98	31%	102	24%	63	28%	**292**	**27%**
16-20 mm	18	16%	58	19%	75	18%	35	16%	**186**	**17%**
> 20 mm	39	34%	73	23%	105	25%	60	27%	**277**	**26%**
unknown size	(2)		(3)		(3)		(1)		**(9)**	
Invasive Cancers with tumour ≤ 15 mm	59	51%	181	58%	240	57%	130	58%	**610**	**57%**
Node Involvement in Invasive Cancers										
no	68	66%	227	77%	299	77%	171	81%	**765**	**77%**
yes	35	34%	66	23%	88	23%	39	19%	**228**	**23%**
no nodes sampled / unknown	(15)		(22)		(36)		(16)		**(89)**	
Histologic Grade of Invasive Cancers										
1 - well differentiated	27	26%	101	34%	118	29%	83	38%	**329**	**32%**
2 - moderately differentiated	56	53%	115	39%	208	52%	95	44%	**474**	**46%**
3 - poorly differentiated	22	21%	82	28%	76	19%	39	18%	**219**	**21%**
unknown grade	(13)		(17)		(21)		(9)		**(60)**	
Grade 3 tumour ≤ 15 mm	8	36%	32	39%	24	32%	15	38%	**79**	**36%**

Notes

1. Targets: >50% invasive tumours ≤15mm, >70% with negative nodes, >30% grade 3 tumours ≤15mm.
2. Breast Screening Program data extraction date: August 20, 2018.

5.4 OUTCOME INDICATORS BY CALENDAR YEAR: 2013 – 2017

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

- Abnormal call rates have been stable for the last three years.
- Sensitivity has increased over the last four years and is 94%.
- 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 in the Breast Screening Program participants. Sensitivity (i.e. probability of finding women with breast cancer) and specificity (i.e. probability of a negative mammography in women without breast cancer) by calendar year are shown in Table 10. The Breast Screening Program conducts formal reviews, both blinded and retrospective, of ~ 50% of interval cancers in Breast Screening Program participants.

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, 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 2013 AND 2017 INCLUSIVE

Outcome Indicators	Calendar Year					
	2013	2014	2015	2016	2017	5-Year Cumulative
Number of Exams	287,725	259,338	255,535	258,172	258,497	**1,319,267**
on first screens	9.4%	9.4%	10.0%	9.8%	9.9%	**9.7%**
Number of Cancers	1,401	1,418	1,420	1,459	1,404	**7,102**
on first screens	12.1%	12.5%	12.1%	12.3%	14.5%	**12.7%**
Abnormal Call Rate	7.4%	8.4%	9.1%	9.0%	9.0%	**8.5%**
on first screens	16.6%	18.3%	19.1%	19.5%	19.7%	**18.6%**
on subsequent screens	6.5%	7.4%	7.9%	7.8%	7.8%	**7.5%**
Overall Cancer Detection Rate (per 1,000)	4.9	5.5	5.6	5.7	5.4	**5.4**
on first screens	6.3	7.3	6.7	7.1	8.0	**7.1**
on subsequent screens	4.7	5.3	5.4	5.5	5.2	**5.2**
DCIS Detection Rate (per 1,000)	1.0	1.1	1.2	1.1	1.2	**1.1**
on first screens	1.4	1.6	1.5	1.4	1.9	**1.6**
on subsequent screens	1.0	1.1	1.2	1.1	1.1	**1.1**
Positive Predictive Value	6.6%	6.5%	6.2%	6.3%	6.1%	**6.3%**
on first screens	3.8%	4.0%	3.6%	3.7%	4.1%	**3.8%**
on subsequent screens	7.4%	7.2%	6.9%	7.1%	6.7%	**7.0%**
Core Biopsy Yield Ratio	35.5%	35.1%	34.0%	34.9%	34.1%	**34.7%**
on first screens	18.3%	19.9%	18.3%	18.2%	19.2%	**18.8%**
on subsequent screens	40.6%	39.1%	38.5%	39.8%	39.1%	**39.4%**
Open Biopsy Yield Ratio	24.0%	25.3%	21.7%	24.6%	26.7%	**24.3%**
on first screens	14.9%	21.6%	14.8%	17.3%	19.4%	**17.5%**
on subsequent screens	27.0%	26.2%	23.4%	26.5%	29.1%	**26.3%**
Interval Cancer Rate (per 1,000)						
0-12 months	0.7	0.6	0.6	0.4	---	**0.5**
after first screens	0.9	0.5	0.5	0.4	---	**0.5**
after subsequent screens	0.7	0.6	0.6	0.4	---	**0.5**
13-24 months	0.7	0.6	0.2	---	---	**0.3**
Sensitivity (1 - false negative rate)	87.7%	90.1%	90.7%	93.8%	---	**92.2%**
Specificity (1 - false positive rate)	93.1%	92.1%	91.5%	91.6%	---	**92.0%**
Prevalence to Expected Incidence Ratio for Age 50-79 (target: >3.0)	5.2	5.8	5.6	5.2	4.8	**5.4**

Notes

1. See glossary in the Appendix for definitions of terms.
2. Overall Cancer Rate includes ductal carcinoma in situ (DCIS).
3. The final number of cancers in 2017 is still to be determined.
4. The 5-year cumulative total does not include 2017 for the interval cancer rate, sensitivity or specificity.
5. Number of cancers and related rates do not include data for women whose follow-up is incomplete.
6. Breast Screening Program data extraction date: August 20, 2018.

November 2018

5.5 – OUTCOME INDICATORS BY 10-YEAR AGE GROUPS: 2013 – 2017 CUMULATIVE

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

- From 2013 to 2017, the Breast Screening Program provided 1,319,267 breast screening examinations, and detected 7,102 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 113:1 for women in their 70's to 351:1 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 2013 AND 2017 INCLUSIVE

	Age at Exam					
Outcome Indicators	**40-49**	**50-59**	**60-69**	**70-79**	**80+**	**All**
Number of Exams	284,515	442,039	415,862	169,282	6,501	**1,319,267**
on first screens	26.9%	7.2%	3.7%	2.0%	2.7%	**9.7%**
Number of Cancers	810	1,958	2,727	1,501	105	**7,102**
on first screens	40.0%	14.4%	8.0%	4.7%	6.7%	**12.7%**
Abnormal Call Rate	11.2%	8.5%	7.4%	7.0%	8.6%	**8.5%**
on first screens	17.9%	20.2%	18.9%	19.4%	23.0%	**18.6%**
on subsequent screens	8.7%	7.6%	7.0%	6.7%	8.2%	**7.5%**
Overall Cancer Detection Rate (per 1,000)	2.8	4.4	6.6	8.9	16.2	**5.4**
on first screens	4.2	8.9	14.2	21.1	40.0	**7.1**
on subsequent screens	2.3	4.1	6.3	8.6	15.5	**5.2**
DCIS Detection Rate (per 1,000)	0.8	1.0	1.3	1.5	2.5	**1.1**
on first screens	1.3	1.7	2.8	1.5	5.7	**1.6**
on subsequent screens	0.6	1.0	1.2	1.5	2.4	**1.1**
Positive Predictive Value	2.6%	5.3%	8.9%	12.8%	18.9%	**6.3%**
on first screens	2.4%	4.5%	7.6%	11.0%	18.4%	**3.8%**
on subsequent screens	2.7%	5.4%	9.0%	12.9%	18.9%	**7.0%**
Core Biopsy Yield Ratio	16.1%	29.6%	44.9%	54.8%	65.1%	**34.7%**
on first screens	12.4%	20.6%	31.2%	41.9%	54.5%	**18.8%**
on subsequent screens	19.9%	31.9%	46.7%	55.7%	65.9%	**39.4%**
Open Biopsy Yield Ratio	14.4%	20.8%	32.5%	37.5%	36.4%	**24.3%**
on first screens	14.0%	18.0%	29.1%	29.4%	100.0%	**17.5%**
on subsequent screens	14.7%	21.5%	32.9%	37.9%	33.3%	**26.3%**
Interval Cancer Rate (per 1,000)						
0-12 months	0.5	0.4	0.5	0.4	0.5	**0.5**
after first screens	0.5	0.3	0.8	< 0.1	< 0.1	**0.5**
after subsequent screens	0.5	0.5	0.4	0.4	0.5	**0.5**
13-24 months	< 0.1	0.4	0.4	0.6	1.1	**0.3**
Sensitivity (1 - false negative rate)	85.9%	90.9%	93.5%	95.3%	97.2%	**92.2%**
Specificity (1 - false positive rate)	89.1%	92.0%	93.2%	93.9%	92.9%	**92.0%**

Notes

1. See glossary in the Appendix for definitions of terms.
2. Overall Cancer Rate includes ductal carcinoma in situ (DCIS).
3. The final number of cancers in 2017 is still to be determined.
4. Number of cancers and related rates do not include data for women whose follow-up is incomplete.
5. The "All" column does not include 2017 for the interval cancer rate, sensitivity or specificity.
6. The "All" column includes women less than 40 years of age**.**
7. Breast Screening Program data extraction date: August 20, 2018.

5.6 – OUTCOME INDICATORS BY HSDA: 2013 – 2017 CUMULATIVE

Outcome indicators for 2013 to 2017 are summarized by HSDA in Table 14.

- South Vancouver Island region has the lowest abnormal call rate (5%), Northeast has the highest (11%).
- Northeast has the lowest cancer detection rate (3.1 per 1,000), while Central Vancouver Island and Thompson Cariboo have the highest (6.0 per 1,000).
- Northeast has the lowest positive predictive value (3%) and South and Central Vancouver Island regions have the highest (9%).
- All of the HSDAs meet the international targets[4] recommended for screening programs for invasive tumour detection size (target > 50%); eleven out of the sixteen HSDAs meet the international target recommended for percentage of cases with negative nodes (target > 70%).

[4] Tabàr L, Fagerberg G, Duffy, SW, Day NE, Gad A, Gröntoft O. Update of the Swedish Two-country Program of Mammographic Screening for Breast Cancer. Radiol Clin North Am 1992; 30(1): 187-210

TABLE 14: BREAST SCREENING PROGRAM OUTCOME INDICATORS BY HEALTH SERVICE DELIVERY AREA (HSDA) BETWEEN 2013 AND 2017 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%	5.1	6%	19 : 86	64%	81%
Kootenay Boundary	7%	4.4	6%	14 : 76	64%	78%
Okanagan	7%	5.5	8%	131 : 523	61%	73%
Thompson Cariboo Shuswap	9%	6.0	7%	76 : 325	58%	73%
Interior	8%	5.5	7%	240 : 1010	61%	74%
Fraser East	9%	5.2	6%	76 : 328	58%	68%
Fraser North	9%	5.4	6%	245 : 727	61%	69%
Fraser South	10%	5.7	6%	272 : 911	56%	68%
Fraser	10%	5.5	6%	593 : 1966	58%	68%
Richmond	10%	5.4	5%	84 : 254	57%	72%
Vancouver	9%	5.6	6%	237 : 703	60%	66%
North Shore / Coast Garibaldi	8%	4.9	6%	88 : 336	64%	70%
Vancouver Coastal	9%	5.4	6%	409 : 1293	61%	68%
South Vancouver Island	5%	4.7	9%	59 : 473	53%	69%
Central Vancouver Island	7%	6.0	9%	112 : 426	60%	75%
North Vancouver Island	6%	5.3	8%	29 : 176	63%	73%
Vancouver Island	6%	5.3	9%	200 : 1075	57%	72%
Northwest	8%	5.3	7%	11 : 78	64%	64%
Northern Interior	8%	4.6	6%	26 : 141	62%	73%
Northeast	11%	3.1	3%	4 : 29	55%	59%
Northern	9%	4.5	5%	41 : 248	62%	69%
British Columbia	**8%**	**5.4**	**6%**	**1487 : 5615**	**59%**	**70%**

Notes

1. See glossary in the Appendix for definitions of terms.
2. Targets1: >50% invasive tumours ≤15mm, >70% with negative nodes.
3. Breast Screening Program data extraction date: August 20, 2018.

5.7 – CANCER CHARACTERISTICS BY AGE: CUMULATIVE UP TO AND INCLUDING 2017

From the start of the program in July 1988 to December 2017, 26,722 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 2017, 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 2017

	Age at Exam											
Histological Features	**40-49**		**50-59**		**60-69**		**70-79**		**80+**		**Age 40+**	
Number of Cancers	4,078		7,512		8,868		5,839		415		**26,722**	
in situ	1,270	31%	1,833	24%	1,798	20%	1,017	17%	49	12%	**5,970**	**22%**
invasive	2,808	69%	5,679	76%	7,070	80%	4,822	83%	366	88%	**20,752**	**78%**
Invasive Cancers Tumour Size												
≤ 5 mm	283	10%	521	9%	642	9%	356	7%	32	9%	**1,835**	**9%**
6-10 mm	522	19%	1,294	23%	1,881	27%	1,429	30%	89	25%	**5,216**	**25%**
11-15 mm	730	27%	1,581	28%	2,041	29%	1,422	30%	105	29%	**5,880**	**29%**
16-20 mm	426	16%	933	17%	1,064	15%	719	15%	62	17%	**3,206**	**16%**
> 20 mm	778	28%	1,263	23%	1,365	20%	839	18%	73	20%	**4,320**	**21%**
unknown size	(69)		(87)		(77)		(57)		(5)		**(295)**	
Invasive Cancers with tumour size ≤ 15 mm	1,535	56%	3,396	61%	4,564	65%	3,207	67%	226	63%	**12,931**	**63%**
Node Involvement in Invasive Cancers												
no	1,753	69%	3,864	73%	5,075	78%	3,462	81%	218	81%	**14,378**	**76%**
yes	786	31%	1,412	27%	1,473	22%	834	19%	51	19%	**4,557**	**24%**
no nodes sampled / unknown	(269)		(403)		(522)		(526)		(97)		**(1,817)**	
Histologic Grade of Invasive Cancers												
1 - well differentiated	667	26%	1,661	31%	2,186	33%	1,611	36%	131	39%	**6,257**	**32%**
2 - moderately differentiated	1,153	44%	2,224	42%	2,988	45%	2,029	45%	146	43%	**8,543**	**44%**
3 - poorly differentiated	778	30%	1,408	27%	1,457	22%	843	19%	61	18%	**4,549**	**24%**
unknown grade	(210)		(386)		(439)		(339)		(28)		**(1,403)**	
Grade 3 tumour ≤ 15 mm	315	40%	628	45%	719	49%	407	48%	26	43%	**2,095**	**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 20, 2018.

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 programs[5]. 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 to reduce abnormal call rates, diagnostic intervals, and benign to malignant open biopsy ratio.

- The participation rate increased slightly compared to 2016 (53.0% plus 8.6% MSP).
- The retention rate remained stable since 2016.
- The diagnostic interval improved compared with 2016.

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 8.6% MSP)
Retention Rate (2)		
Initial Re-screen	≥ 75% initial re-screen within 30 months	44.1%
Subsequent Re-screen	≥ 90% subsequent re-screen within 30 months	73.6%
Abnormal Call Rate (3)		
First Screens	< 10% first screens	20.5%
Subsequent Screens	< 5% re-screens	7.6%
Invasive Cancer Detection Rate (3)		
First Screens	> 5.0 per 1,000 first screens	8.8 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	81.9%
tissue biopsy performed	≥ 90% within 7 weeks if no tissue biopsy performed	61.4%
Positive Predictive Value (3)		
First Screens	≥ 5% first screens	5.3%
Subsequent Screens	≥ 6% re-screens	6.7%
Benign Core Biopsy Rate (3)		
First Screens	Surveillance and monitoring only	32.8 per 1,000
Subsequent Screens	Surveillance and monitoring only	7.0 per 1,000
Benign to Malignant Core Biopsy Ratio (3)		
First Screens	Surveillance and monitoring only	3.3 : 1
Subsequent Screens	Surveillance and monitoring only	1.5 : 1
Benign Open Biopsy Rate (3)		
First Screens	Surveillance and monitoring only	4.8 per 1,000
Subsequent Screens	Surveillance and monitoring only	1.3 per 1,000
Benign to Malignant Open Biopsy Ratio (3)		
First Screens	≤ 1 : 1	4.7 : 1
Subsequent Screens	≤ 1 : 1	2.4 : 1
Invasive Cancers Tumour Size ≤ 10 mm (3)	> 25%	30.2%
Invasive Cancers Tumour Size ≤ 15 mm (3)	> 50%	57.5%
Node Negative Rate in Cases of Invasive Cancer (3)	> 70%	77.4%

Notes

1. Screen years: (1) = July 1, 2015 - December 31, 2017, (2) = 2014-2016, (3) = 2017
2. Population data source: P.E.O.P.L.E. 2017 population projection (Sept 2017), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
3. Breast Screening Program data extraction date: August 20, 2018.

November 2018

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	**$21,936,860**	**$20,364,256**	**$19,976,921**	**$21,030,530**	**$21,127,930**
Total Cost per Screen	$79.51	$78.32	$79.35	$79.38	$82.46
Central Services	$19.62	$18.98	$17.52	$16.58	$18.02
Screen Provision Costs	$45.11	$44.56	$46.98	$47.88	$49.46
Professional Reading Fees	$14.78	$14.78	$14.85	$14.92	$14.99
Cost per Cancer Detected	**$15,702.83**	**$14,661.09**	**$13,921.18**	**$14,543.93**	**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 $14.99 per screen effective April 1, 2017.
4. Number of cancers detected in 2017-18 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: August 20, 2018.

APPENDIX 1 – CANCER SCREENING PROGRAM OVERVIEW

Definition of Screening

Screening is a prevention strategy. 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 process[6]. 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

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 – 2016 BREAST SCREENING PROGRAM SCREENING SERVICES

In 2016 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, 2016 – December 31, 2016.

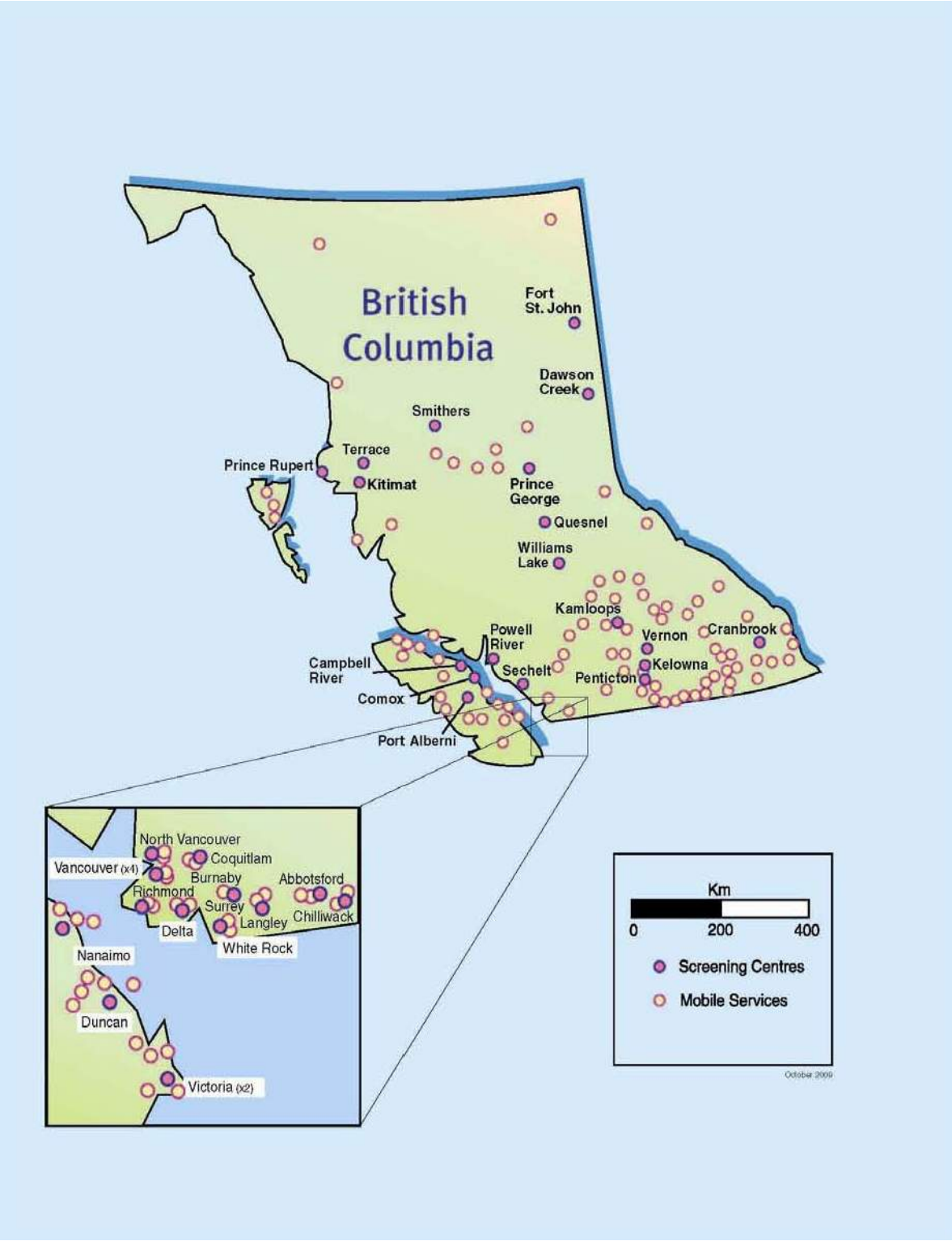
Age	Recall Frequency
<40	Will accept with primary health care provider referral, no recall provided
40-74 Average risk	Reminders for 24-month and 36-month anniversary to age 74.
40-74 Higher Risk	Reminders* for 12-month and 24-month anniversary to age 74
75+	Will accept, no recall provided

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	604-877-6187
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
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	
305-1990 Fort St.	250-952-4232
Victoria General Hospital	250-727-4338

Mobile Screening Service Delivery Areas

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

Creston	Lytton	Radium	Westbank
Dease Lake	Mackenzie	Revelstoke	Whistler
Delta	Maple Ridge	Richmond	Williams Lake
Elkford	Massett	Rock Creek	Windermere
Enderby	McBride	Rossland	Winfield
Fernie	Merritt	Saanichton	100 Mile House
Fort Nelson	Midway	Sandspit	

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
Akisqnuk 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
Gitlakdamix First Nation	Gitlaxt'aamiks
Katzie First Nation	Pitt Meadows
Kispiox First Nation	Hazelton
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
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
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.

BC CANCER
Provincial Health Services Authority

Order Form

Cancer Screening Promotion and Resource Materials

	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:
	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:
		Simplified Chinese:	Traditional Chinese:
	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:	

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.**

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.

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.

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

Where Ni is the number of prevalent screens for age group i, Cai is the number of cancers detected in prevalent screens for age group i and Ri 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: The estimated percentage of women returned for rescreen within 30 months of their previous screen. This rate is estimated using Kaplan-Meier method.

Return (Compliance) Rate: The estimated percentage of women without history of breast cancer diagnosis returned for rescreen within a certain period of time. This rate is estimated using Fine-Gray competing risk 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
College of Physicians and Surgeons
Doctors of BC
Divisions of Family Practice
Society of General Practitioners
University of British Columbia

APPENDIX 8 – COMMITTEES

Alphabetical Listing

Quality Management Committee	Quality Management Support Group
Ms. Nancy Aldoff	Ms. Nancy Aldoff
Dr. Stephen Chia	Ms. Sheila MacMahon
Dr. Malcom Hayes	Ms. Amanda Hunter
Ms. Lisa Kan	Ms. Moira Pearson
Mr. Javis Lui (Interim)	Dr. Rasika Rajapakshe
Ms. Sheila MacMahon	Dr. Derek Wells
Dr. Colin Mar – Chair	Dr. Joseph Yang
Ms. Mary Nagy	
Ms. Janette Sam	
Dr. Linda Warren	
Ms. Winnie Yen	

Screener's Advisory Committee	
Ms. Nancy Aldoff	Dr. Colin Mar – Chair
Dr. Ken Bentley	Dr. Peter McNicholas
Dr. Ron Campbell	Dr. Julie Nichol
Dr. Joanne Coppola	Dr. David O'Keeffe
Dr. Jennifer Dolden	Dr. Amie Padilla-Thorton
Dr. Donal Downey	Dr. Catherine Phillips
Dr. Brenda Farnquist	Dr. Rasika Rajapakshe
Dr. Dennis Janzen	Ms. Janette Sam
Dr. Rob Johnson	Dr. Greg Shand
Ms. Lisa Kan	Dr. Stuart Silver
Dr. Tahir Khalid	Dr. Phil Switzer
Dr. Nicola Lapinsky	Dr. Beth Tanton
Dr. Grant Larsen	Dr. Linda Warren
Dr. Brent Lee	

APPENDIX 9 – RADIOLOGISTS SCREENERS

*Alphabetical listing, *** Indicates Chief Screener***

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

APPENDIX 10 – PUBLICATIONS AND PRESENTATIONS

Publications

Amie Padilla-Thornton

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.

Paula Gordon

Gordon, P. Chen THH, Yen AMF, Fann JCY, Gordon P, Chen SLS, Chiu SYH, Hsu CY, Chang KJ, Lee WC, Yeoh KG, Saito H, Promthet S, Hamashima C, Maidin A, et. al. Clarifying the debate on population-based screening for breast cancer with mammography. A systematic review of randomized controlled trials on mammography with Bayesian meta-analysis and causal model. Medicine (2017) 96:3(e5684).

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, Miao H, Sam J, Farnquist B, Hartman M. Risk of breast cancer after a false-positive screening mammogram in relation to mammographic abnormality: A population-based study in British Columbia [abstract]. In: Proceedings of the 2017 San Antonio Breast Cancer Symposium; 2017 Dec 5-9; San Antonio, TX. Philadelphia (PA): AACR; Cancer Res 2018;78(4 Suppl):Abstract nr PD2-16. http://cancerres.aacrjournals.org/content/78/4_Supplement/PD2-16

Colin Mar

Mar C. Screening Mammography Program of BC: discussing breast density with your patients. Journal of Family Practice Oncology 2017; 29:11,13.

Mar C, Sam J, Wilson C. Breast cancer screening in British Columbia: a guide to discussion with patients. BCMJ 2018; 1:20-26.

Janette Sam

Rajapakshe R, Miao H, Sam J, Farnquist B, Hartman M. Risk of breast cancer after a false-positive screening mammogram in relation to mammographic abnormality: A population-based study in British Columbia [abstract]. In: Proceedings of the 2017 San Antonio Breast Cancer Symposium; 2017 Dec 5-9; San Antonio, TX. Philadelphia (PA): AACR; Cancer Res 2018;78(4 Suppl):Abstract nr PD2-16. http://cancerres.aacrjournals.org/content/78/4_Supplement/PD2-16

Elisa K Chan, Christine Wilson, Scott Tyldesley, Ivo A Olivotto, Anky Lai, Janette Sam, Ritinder Harry, Alan Nichol. Signed family physician reminder letters to women overdue for screening mammography: A randomized clinical trial. J Med Screen 2017 https://doi.org/10.1177%2F0969141317719921

Mar C, Sam J, Wilson C. Breast cancer screening in British Columbia: a guide to discussion with patients. BCMJ 2018; 1:20-26.

Presentations, Interviews and Lectures

Nancy Aldoff

The Importance of Screening Mammography. Heartwood Centre for Women, BC Women's Hospital, Vancouver, BC. April, 2017

Digital Mammography Technology for the Women of the Smithers Community. Bulkley Valley Hospital Digital Mammography Opening & Press Conference, Smithers, BC. January 2018

Paula Gordon

Preventing and Screening for Breast Cancer. Vancouver JCC. Oct 30, 2017

The screening guidelines debate - statistics and politics 101. BCRS Breast CME event, Nov 4, 2017

Breast Cancer Screening Update, UBC School of Population and Public Health, Nov 16, 2017

The Really Fast Breast Course. UBC General Surgery Resident Teaching Half Day. Jan 11, 2018

Colin Mar

Workshop C) Breast Cancer Screening, UBC CPD 52nd Annual Post Graduate Review in Family Medicine Conference; Vancouver; Thursday February 23, 2017

Breast Cancer Screening, Family Practice Oncology Network's GPO Training Program; Vancouver; Monday, February 27, 2017

Where Are We With Breast Cancer Screening?, CME on the Run! Diagnostic & Radiology - Friday June 9, 2017; Vancouver

The gamut of breast imaging beyond high risk surveillance, Hereditary Cancer Program Education Rounds; Vancouver; Friday September 8, 2017

Breast Cancer Screening, Family Practice Oncology Network's GPO Training Program; Vancouver; Monday, September 18, 2017
Report Card Time: Making the most of benchmarks and personal statistics in screening mammography, BCRS Breast Imaging Update, Vancouver; Nov 4, 2017

Janette Sam

CBC, Mobile mammogram clinic travels through BC, January 2017

Smithers Breast health Advisory Group – Introduction to Breast Cancer Screening, July 2017

Breast Imaging Clinic Opening & Press Conference, University of Northern Health Hospital. Prince George, BC. September, 2017

Rocky Mountain Goat News, Cancer Agency Brings mobile screening to Robson Valley, August 2017

Rasika Rajapakshe

Keynote Presentation: "Risk of Breast Cancer after a False-Positive Screening Mammogram in relation to mammographic abnormality: a population-based study in British Columbia", Singapore – Malaysia Breast Cancer Working Group Research Meeting, February 27, 2017, National University of Singapore, Singapore.

Keynote Presentation: "An Interdisciplinary Approach towards Mitigating the Societal Impact of Cancer, 8th Annual University of British Columbia- Okanagan Interdisciplinary Graduate Students' Conference, Kelowna, BC, 5 May 2017

Conducted a UN Expert Mission EX-THA6042-1703250 to Thailand: "IAEA TC Expert Mission on the establishment of National QA standards for Digital Mammography Systems**",** Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand**,** 9-12 October, 2017

Linda Warren

November 2017: Breast Density 2017 Current Concepts, BCRS 2017 Vancouver, BC

March 2018: Gold Medal Award Society of Breast Imaging, Presented at the Society of Breast Imaging Symposium, Las Vegas, Nevada April, 2018

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

Nancy Aldoff
Professional Practice Leader (PPL), Breast Screening Technologists
Phone: 604-877-6000 ext 6357
Email: NAldoff2@bccancer.bc.ca

Kimberly DeVries
Biostatistical Analyst, Cancer Surveillance & Outcomes
Phone: 604-707-6368
E-mail: Kimberly.DeVries@bccancer.bc.ca

Amanda Hunter
Breast Screening Quality Management Coordinator
Phone: 604-877-6000 ext 4621
Email: Amanda.Hunter2@bccancer.bc.ca

Adam Kahnamelli
Business Lead, Screening Solutions
Phone: 604-786-4184
E-mail: Adam.Kahnamelli@bccancer.bc.ca

Lisa Kan
Senior Director, Cancer Screening Programs
Phone: 604-877-6201
E-mail: lkan@bccancer.bc.ca

Javis Lui (Interim)
Promotions Leader, Screening Programs
Phone: 604-877-6000 ext 4836
E-mail: Javis.Lui@bccancer.bc.ca

Dr. Colin Mar
Breast Screening Medical Director
Phone: 604-877-6200
E-mail: SMPMedicalDirector@bccancer.bc.ca

Mary Nagy
Client Services Manager
Phone: 604-877-6167
E-mail: Mary.Nagy@bccancer.bc.ca

Dr. Rasika Rajapakshe
Medical Physicist, Centre for the Southern Interior
Phone: 250-712-3915
E-mail: rrajapak@bccancer.bc.ca

Janette Sam
Screening Operations Director
Phone: 604-877-6000 ext 4845
E-mail: jsam@bccancer.bc.ca

Screening Programs Administration Office
801 – 686 West Broadway, Vancouver, B.C. V5Z 1G1
Phone: 604-877-6200
Fax: 604-660-3645
Website: www.bccancer.bc.ca/screening/breast
E-mail: Screeningadmin@bccancer.bc.ca

November 2018