BC CANCER BREAST SCREENING

Provincial Health Services Authority

BC Cancer Breast Screening 2019 Program Results

September 2020

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Appendix

1 – MESSAGE

Message from the Medical Director

In 2019, the BC Cancer Breast Screening program provided screening mammograms to 266,405 individuals. The program goal has always been to reduce death and other ill effects of breast cancer through early detection. This intention is paired with an obligation to minimize the downsides of screening for our participants. A key tool in achieving these goals is a quality network integrated throughout the program. This network includes routine quality measures, and also multiple committees to foster quality projects as needed.

While the program is happy to report that this number of individuals screened represents an increase, we continue to work toward further participation across the province. The current large number of screenees nevertheless facilitates a powerful tool in quality: the calculation of numerous metrics. The program is fortunate to host a strong team to acquire the raw data, conduct analysis, compile statistics and present comprehensive measures in a meaningful manner. This includes members in the program registry, business development, biostatistics and promotions.

Two of the central metrics are the Cancer Detection Rate (CDR; screen – detected cancers per 1000 screenees) and the Abnormal Call Rate (ACR; abnormal screens per 100 screenees). The overall CDR for 2019 was 5.8, while the overall ACR was 8.9. These indicate the desired combination of increased cancer detection with decreased abnormal screens compared to 2018. The latter of these changes has been a goal of national interest. The program has recently participated in a project of the Canadian Partnership Against Cancer to identify best practices to further improve the ACR.

The program has long utilized additional metrics to provide annual individualized feedback to the radiologist screeners. This year the program introduced a revised format of this feedback to further support practice development. We are grateful to the responsible working group, consisting of chief screeners and program staff.

In addition to the principle collection of our program statistics and metrics, the Annual Report also highlights our other means of promoting the understanding of breast screening. This occurs through various media, and a recent addition is a discussion guide for primary care providers to facilitate conversations regarding breast density. The guide was the result of extended collaboration including patient advocate, primary care provider and breast health expert representation, followed by focus group testing.

In closing, the annual program achievements and outlook for future development are again positive for breast health in BC. A final note is regarding the value of prevention. Media utilized by the program also provide an opportunity to combine our screening messages with those of breast cancer prevention. And these prevention strategies in turn promise wellness benefits additional to those of breast health.

– Dr. Colin Mar

September 2020

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 2019 the program began its transition to an electronic reporting solution with a pilot centre implementation at the screening centre located on W. Broadway in Vancouver. The new reporting solution will provide many benefits including:

- 100% reduction in paper based breast reporting for screening centres by way of adoption of electronic structured reporting.
- Breast screening data captured electronically in a central provincial system to support quality initiatives, audit and other statistical analysis for the provincial program.
- The screening report will be linked to the breast images at the time of reporting.
- Screening mammogram results will be reported directly by the radiologist into the application, removing the need for manual results data entry, and eliminating potential data entry errors.
- 100% elimination of future film bag and film bag storage costs in accordance with program retention schedule.
- 100% elimination of redundant quality checks that were historically built in for quality assurance.

The pilot centre implementation was successful and rolling activation for the remaining centres across the province should be complete by November, 2020.

In the Fall, the program held a successful promotions campaign targeting the breast screening eligible population (women ages 40-74) that included development of four personal stories that cover a patient's cancer screening journey from a unique angle, encouraging others to tell their own story. We are so grateful to the community in BC that so generously supports our program activities and initiatives to encourage women to be screened.

The program also completed several important education materials related to breast density, including an animated video, brochures, and a discussion guide for health care providers.

Lastly, new online content and a campaign targeting program staff was developed on the topic of accessibility, and the importance of screening for those with disabilities.

– Janette Sam

BC Cancer Screening
October 24, 2019 · 🌐

Meet Dr. Bonnie Sawatzky and her service dog, Gucci. Bonnie is an associate professor of orthopaedics at UBC, and has dedicated much of her life to biomechanics related research for spinal cord injuries and disorders – a passion that was sparked by her own personal journey with spinal cord disease.

At age 30, Bonnie was in a car accident that left her using a wheelchair for her primary mobility. After years of delaying a mammogram due to other health issues, she finally got ... See More

I had no family history or risk factors. Breast cancer was the last thing on my list.

Dr. Bonita Sawatzky,
Breast Cancer Survivor

September 2020

2 – EXECUTIVE SUMMARY

BC Cancer is proud of the achievements of the Breast Screening Program. The population based breast cancer screening program was the first of its kind in Canada and is in its 31st year of operation. Since the inception of the program in 1988 to the end of 2019, the program has provided over 6,389,958 screening mammograms and detected 28,230 (breast) cancers.

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

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, 2019 Breast Screening Program Screening Recommendations, and online at www.bccancer.bc.ca/screening/breast.

3.1 Breast Density Update

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

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

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

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

4 – ABOUT THE BREAST SCREENING PROGRAM

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

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

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

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

4.1 Centres and Mobile Services

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

4.2 The Screening Process

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

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

4.3 FAST TRACK – Facilitated Referral to Diagnostic Imaging

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

4.4 Fast Track Overview

- At the time of screening, women are informed that if further tests are required, they will be called directly by a diagnostic facility to book their appointment.
- If further testing is required i.e. additional mammographic views or breast ultrasound, the woman is booked at the Fast Track diagnostic clinic closest to the screening site, usually at the same location.
- Images and results from the Breast Screening Program 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.

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

4.6 Quality Assurance

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

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

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

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

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

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

4.6 Quality Assurance (continued)

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

4.7 Regular Promotion and Education Activities

Ongoing promotion activities include:

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

FIGURE 1: SCREENING PROCESS OVERVIEW
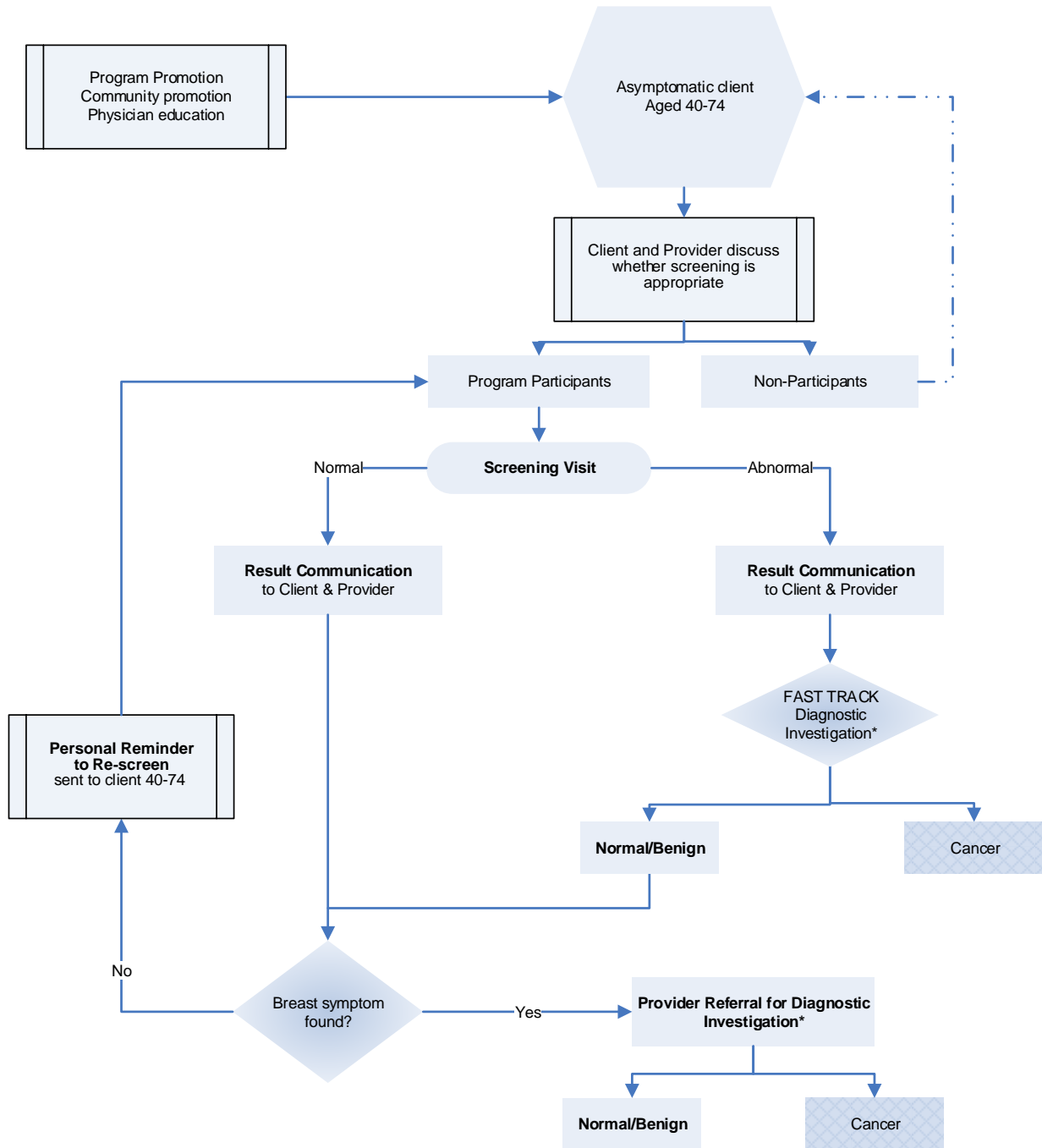
* Breast Screening obtains diagnostic investigation information from sources such as Medical Services Plan, surgeons, hospitals and BC Cancer Registry on women who consent to follow up.

5.0 — 2019 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.

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[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 266,405 examinations in 2019. During this period, 27,986 (10.5%) of those examinations were provided to first time attendees.

Figure 2 shows that the total number of exams provided by Breast Screening Program in 2019 increased compared to 2018.

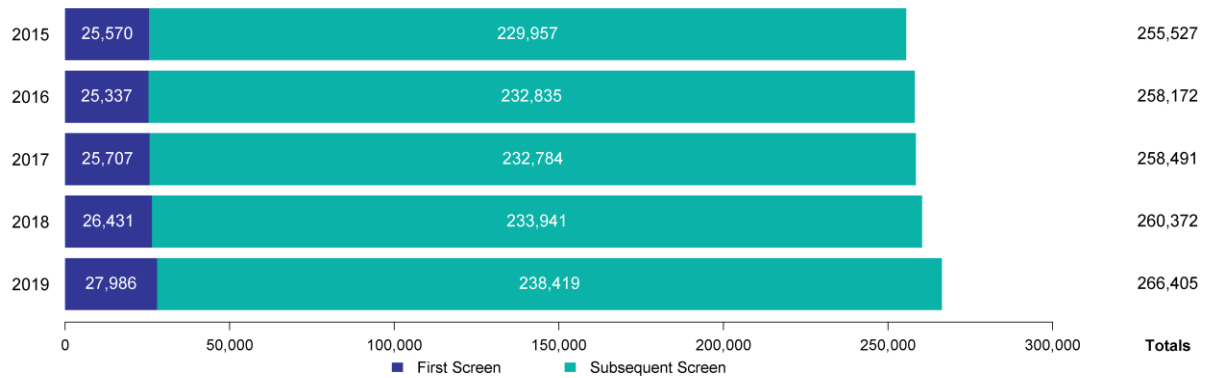**FIGURE 2: ANNUAL SCREENING VOLUME YEARS: 2015-2019**

Figure 3 shows the percentage of women who are at higher risk remained the same at 23.2% of the total number of women screened in 2019.

FIGURE 3: ANNUAL SCREENING VOLUME BY RISK AND SCREEN YEARS: 2004-2019

Notes

1. Breast Screening Program data extraction date: July 20, 2020.

Volume by Health Service Delivery Area: 2019

The age distribution of all exams and first exams performed in 2019 by Health Services Delivery Areas (HSDA) are displayed in Table 1.

- The majority of exams (67%) are performed for women between ages 50 to 69 in all HSDAs. This is similar to 2018.
- The majority of first time attendees were under 50 years of age; however, there are regional variations ranging from 40% in Kootenay Boundary to an average of ~ 64% 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: 2019

HSDA	Total Exams	Age Distribution of All Exams			First Exams		Age Distribution of First Exams		
		<50	50-69	70+	n	% Total	<50	50-69	70+
East Kootenay	4,386	12%	70%	18%	506	12%	43%	51%	7%
Kootenay Boundary	4,130	10%	71%	18%	435	11%	40%	54%	5%
Okanagan	22,657	11%	70%	18%	1,965	9%	42%	54%	3%
Thompson Cariboo Shuswap	13,371	14%	69%	17%	1,140	9%	55%	43%	3%
Interior	44,544	12%	70%	18%	4,046	9%	46%	51%	4%
Fraser East	15,877	18%	66%	16%	1,690	11%	62%	35%	3%
Fraser North	36,147	22%	66%	12%	4,092	11%	67%	31%	3%
Fraser South	42,711	22%	65%	14%	5,087	12%	66%	32%	3%
Fraser	94,735	21%	65%	13%	10,869	11%	65%	32%	3%
Richmond	13,194	19%	68%	13%	1,449	11%	61%	36%	3%
Vancouver	33,791	21%	66%	13%	3,754	11%	65%	33%	2%
North Shore / Coast Garibaldi	17,662	19%	66%	16%	1,918	11%	63%	33%	4%
Vancouver Coastal	64,647	20%	66%	14%	7,121	11%	63%	34%	3%
South Vancouver Island	23,155	14%	68%	19%	2,105	9%	52%	44%	4%
Central Vancouver Island	17,499	10%	69%	21%	1,505	9%	45%	50%	6%
North Vancouver Island	7,933	11%	71%	18%	768	10%	44%	52%	4%
Vancouver Island	48,587	12%	69%	19%	4,378	9%	48%	47%	4%
Northwest	3,467	18%	68%	14%	394	11%	58%	41%	2%
Northern Interior	7,093	16%	70%	14%	673	9%	56%	42%	1%
Northeast	2,085	18%	71%	11%	278	13%	52%	46%	2%
Northern	12,645	17%	70%	14%	1,345	11%	56%	43%	2%
British Columbia	**266,405**	**18%**	**67%**	**15%**	**27,986**	**11%**	**59%**	**38%**	**3%**

Notes

1. Breast Screening Program data extraction date: July 20, 2020.

Volume by Health Service Delivery Area: 2019 (continued)

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

- The majority of higher risk exams (83%) 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: 2019

HSDA	Number of Higher Risk Exams	% Higher Risk Exams	Age Distribution of Higher Risk Exams		
			40-49	50-74	75+
East Kootenay	1046	24%	10%	82%	7%
Kootenay Boundary	1058	26%	8%	86%	5%
Okanagan	5,923	26%	9%	86%	5%
Thompson Cariboo Shuswap	3,612	27%	11%	84%	5%
Interior	11,639	26%	10%	85%	5%
Fraser East	3,731	23%	12%	84%	4%
Fraser North	7,630	21%	16%	79%	4%
Fraser South	9,204	22%	15%	81%	4%
Fraser	20,565	22%	15%	81%	4%
Richmond	2,696	20%	13%	83%	3%
Vancouver	6,892	20%	17%	79%	4%
North Shore / Coast Garibaldi	4,202	24%	14%	82%	4%
Vancouver Coastal	13,790	21%	15%	81%	4%
South Vancouver Island	6,178	27%	12%	84%	4%
Central Vancouver Island	4,874	28%	8%	86%	5%
North Vancouver Island	2,171	27%	9%	87%	3%
Vancouver Island	13,223	27%	10%	85%	4%
Northwest	900	26%	15%	80%	4%
Northern Interior	1,894	27%	13%	83%	3%
Northeast	503	24%	13%	85%	2%
Northern	3,297	26%	14%	83%	3%
British Columbia	**62,780**	**24%**	**13%**	**83%**	**4%**

Notes
1. Breast Screening Program data extraction date: July 20, 2020.

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, 2017 and December 31, 2019, 344,751 women ages 50-69 participated in the Breast Screening Program.
- The Okanagan, Fraser North and Vancouver had the highest HSDA participation rate at 51%.

TABLE 3: REGIONAL 30-MONTH PARTICIPATION RATES BY 10-YEAR AGE GROUPS ENDING DECEMBER 31, 2019 INCLUSIVE

| HSDA | 10-Year Age Groups | | | | |
	40-49	50-59	60-69	70-74	Ages 50-69
East Kootenay	16%	41%	53%	54%	47%
Kootenay Boundary	14%	36%	46%	50%	41%
Okanagan	21%	46%	56%	57%	51%
Thompson Cariboo Shuswap	25%	44%	54%	55%	49%
Interior	21%	44%	54%	55%	49%
Fraser East	26%	45%	53%	52%	49%
Fraser North	28%	48%	54%	53%	51%
Fraser South	27%	47%	53%	51%	50%
Fraser	27%	47%	53%	52%	50%
Richmond	29%	46%	53%	52%	49%
Vancouver	26%	48%	54%	54%	51%
North Shore/Coast Garibaldi	25%	47%	55%	54%	50%
Vancouver Coastal	26%	47%	54%	54%	50%
South Vancouver Island	21%	45%	53%	53%	49%
Central Vancouver Island	20%	42%	54%	58%	49%
North Vancouver Island	18%	44%	56%	59%	50%
Vancouver Island	20%	44%	54%	56%	49%
Northwest	21%	42%	52%	53%	47%
Northern Interior	21%	44%	55%	55%	49%
Northeast	14%	35%	46%	48%	40%
Northern	20%	42%	52%	53%	46%
British Columbia	**25%**	**46%**	**54%**	**54%**	**50%**

Notes

1. Population data source: P.E.O.P.L.E. 2019 population projection (Oct 2019), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
2. Postal code translation file: TMF202007 (Jul 2020), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
3. Breast Screening Program data extraction date: July 20, 2020.

FIGURE 4: BIENNIAL SCREENING PARTICIPATION BY WOMEN AGES 50-69 OVER 30-MONTH PERIOD BETWEEN JULY 1, 2017 AND DECEMBER 31, 2019
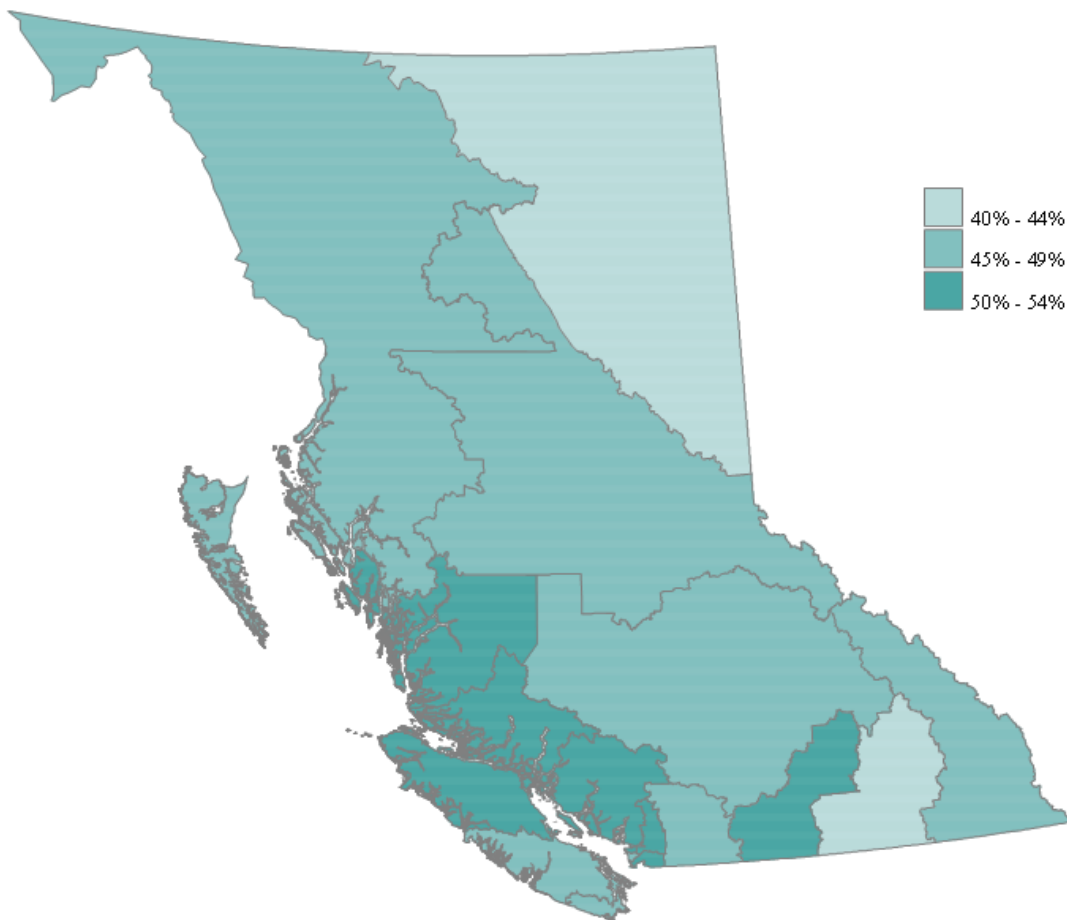
Notes

1. Population data source: P.E.O.P.L.E. 2019 population projection (Oct 2019), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.

2. Postal code translation file: TMF202007 (Jul 2020), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.

3. Breast Screening Program data extraction date: July 20, 2020.

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

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

Screening Participation (continued)

- During the 30-month reporting period, 57% of BC women ages 50 to 69 received bilateral mammography services through either the screening program or MSP.
- The percentage of women ages 50 to 69 receiving bilateral mammography ranged from 47% to 60% across the province.
- 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, 2017 AND DECEMBER 31, 2019 INCLUSIVE
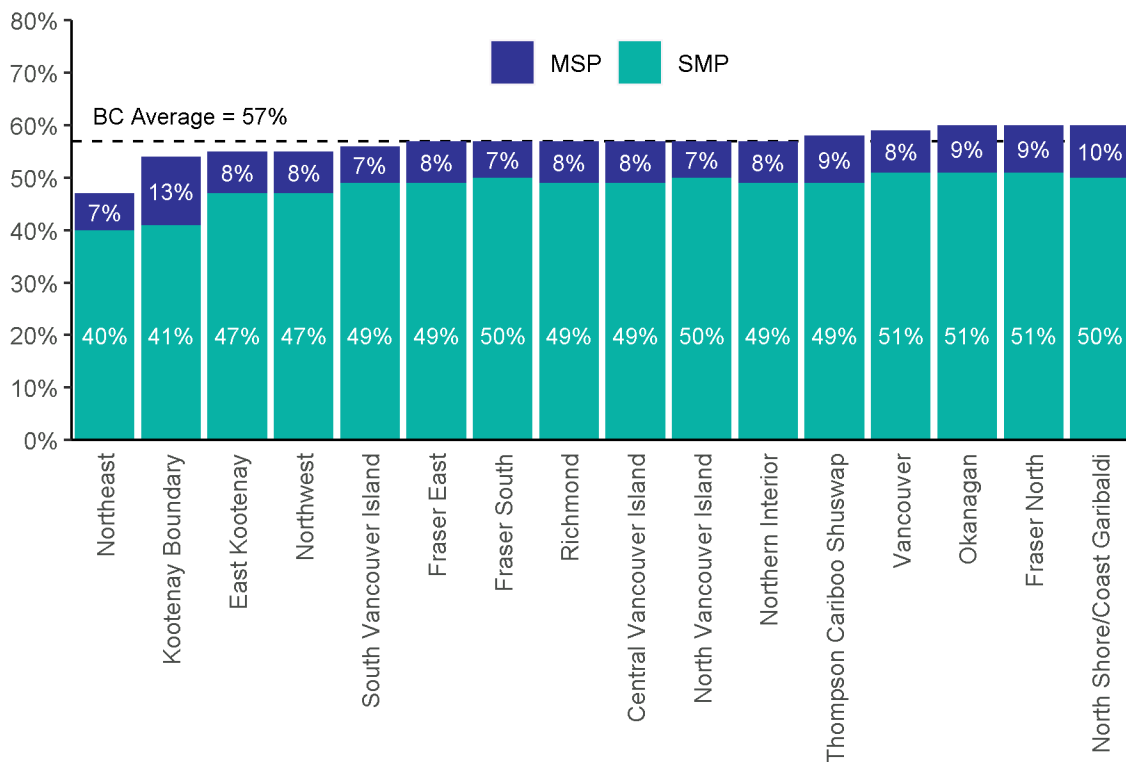
Notes
1. MSP data includes only MSP Fee-For-Service item 8611 on female patients; all out of province claims are excluded.
2. MSP data contains payment date to June 30, 2019 for services provided between July 1, 2017 and December 31, 2019.
3. Breast Screening Program data includes single and multiple screens per woman provided between July 1, 2017 and December 31, 2019.
4. Population data source: P.E.O.P.L.E. 2019 (Oct 2019), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
5. Breast Screening Program data extraction date: July 20, 2020.

Screening Participation in Select Ethnic Groups

Participation rates of women ages 50 to 69 by selected ethnic groups are shown in Table 4. The percentage of each ethnic group in the population was computed based on Statistics Canada, Census of Population, 2016, Custom Table. The ethnic population size for each HSDA was estimated based on this ethnic population percentage and the P.E.O.P.L.E. 2019 population projections. The use of single ethnic group response data may cause an under-estimation of the ethnic population size, especially the East/South East Asian population in the Fraser North, Richmond, and Vancouver HSDAs. The Breast Screening Program data on ethnic origin were collected at the time of program registration on approximately 86% of attendees' ages 50 to 69 screened between July 1, 2017 and December 31, 2019. 11% of attendees did not specify their ethnicity and were excluded from this analysis.

The population data source file used for this calculation was updated, from 2011 to 2016, resulting in some changes in participation.
- Participation by Aboriginal women has decreased by 2% overall (from 62% in 2018 to 60% in 2019).
- Participation by East/South East Asians decreased by 2% overall (from 54% in 2018 to 52% in 2019).
- Participation by South Asians has decreased by 2% overall (from 55% in 2018 to 53% in 2019).
- Participation by select ethnic groups remain higher than the overall provincial rate of 50%.

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, 2017 AND DECEMBER 31, 2019 INCLUSIVE

HSDA	Aboriginal		East/South-East Asian		South Asian	
	Population %	Participation Rate	Population %	Participation Rate	Population %	Participation Rate
East Kootenay	1%	>99%	1%	42%	<1%	90%
Kootenay Boundary	1%	>99%	1%	41%	<1%	>99%
Okanagan	1%	77%	2%	47%	1%	63%
Thompson Cariboo Shuswap	4%	60%	2%	60%	1%	34%
Interior	2%	71%	2%	50%	1%	55%
Fraser East	2%	55%	3%	77%	9%	48%
Fraser North	<1%	85%	29%	54%	4%	58%
Fraser South	<1%	80%	14%	62%	16%	47%
Fraser	1%	70%	18%	58%	11%	48%
Richmond	<1%	79%	61%	45%	5%	70%
Vancouver	1%	62%	42%	48%	4%	67%
North Shore/Coast Garibaldi	2%	38%	10%	50%	2%	68%
Vancouver Coastal	1%	48%	37%	48%	4%	68%
South Vancouver Island	1%	69%	5%	46%	1%	61%
Central Vancouver Island	2%	33%	2%	52%	1%	37%
North Vancouver Island	2%	43%	2%	52%	<1%	106%
Vancouver Island	2%	44%	3%	48%	1%	54%
Northwest	15%	56%	3%	29%	1%	57%
Northern Interior	4%	78%	2%	37%	1%	54%
Northeast	4%	75%	2%	17%	<1%	62%
Northern	7%	64%	2%	30%	1%	55%
British Columbia	**1%**	**60%**	**16%**	**52%**	**5%**	**53%**

Notes
1. Population data sources: P.E.O.P.L.E. 2019 population projection (Oct 2019), BC STATS, Ministry of Technology, Innovation and Citizens' Services, Government of British Columbia, and Statistics Canada, and Statistics Canada, Census of Population, 2016, Custom Table.
2. Postal code translation file: TMF202007 (Jul 2020), BC STATS, Ministry of Technology, Innovation and Citizens' Services, Government of British Columbia.
3. East/South-East Asians include Chinese, Japanese, Korean, Filipino, Burmese, Cambodian, Laotian, Thai, Vietnamese, Indonesian, Malay, and other Asians.
4. South Asians include Bangladeshi, Bengali, East Indian, Gujarati, Pakistani, Punjabi, Sinhalese, Sri Lankan, Tamil.
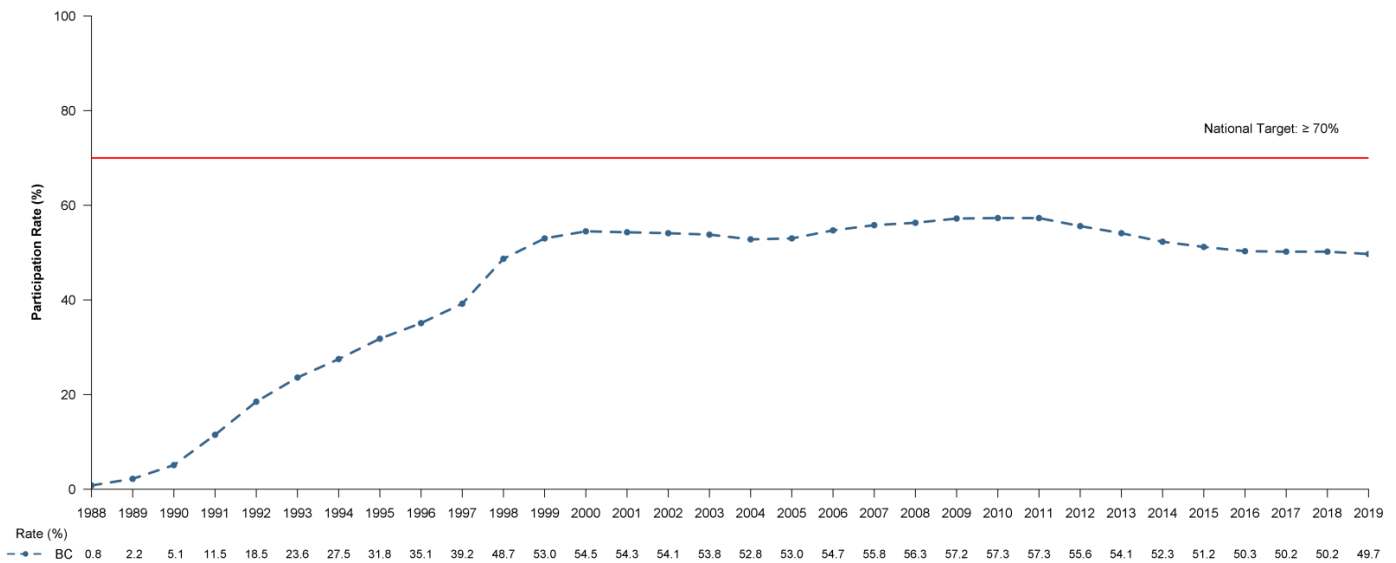5. Breast Screening Program data extraction date: July 20, 2020.

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

Trends in Screening Participation

By 2000, there were 36 fixed and mobile mammography centres enabling all BC women to have reasonable access to screening services. There are now 39 fixed and mobile centres serving BC. The percentage of women participating each year in the target population increased until 2000 and has remained steady since then, ranging between ~50-57%. 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 – 2019

Rate (%)	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
BC	0.8	2.2	5.1	11.5	18.5	23.6	27.5	31.8	35.1	39.2	48.7	53.0	54.5	54.3	54.1	53.8	52.8	53.0	54.7	55.8	56.3	57.2	57.3	57.3	55.6	54.1	52.3	51.2	50.3	50.2	50.2	49.7

Notes
1.   Breast Screening Program data extraction date: July 20, 2020.
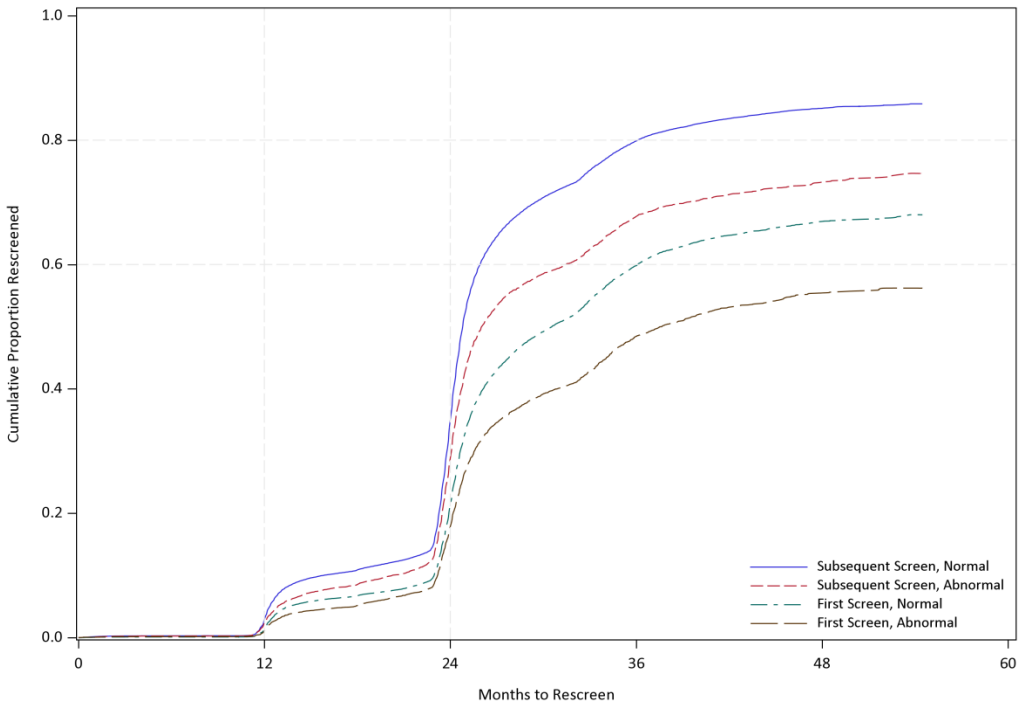
Screening Return Rates

Retention rate is the percentage of screen eligible women 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. A third letter is sent the following year if there is no response.

Figure 7-9 and Table 5-7 show return rates for women ages 40 to 49, 50 to 69 and 40-74 respectively, who attended for breast screening between 2016 and 2018. 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, 66% of average risk women with a previous normal result and 48% 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.
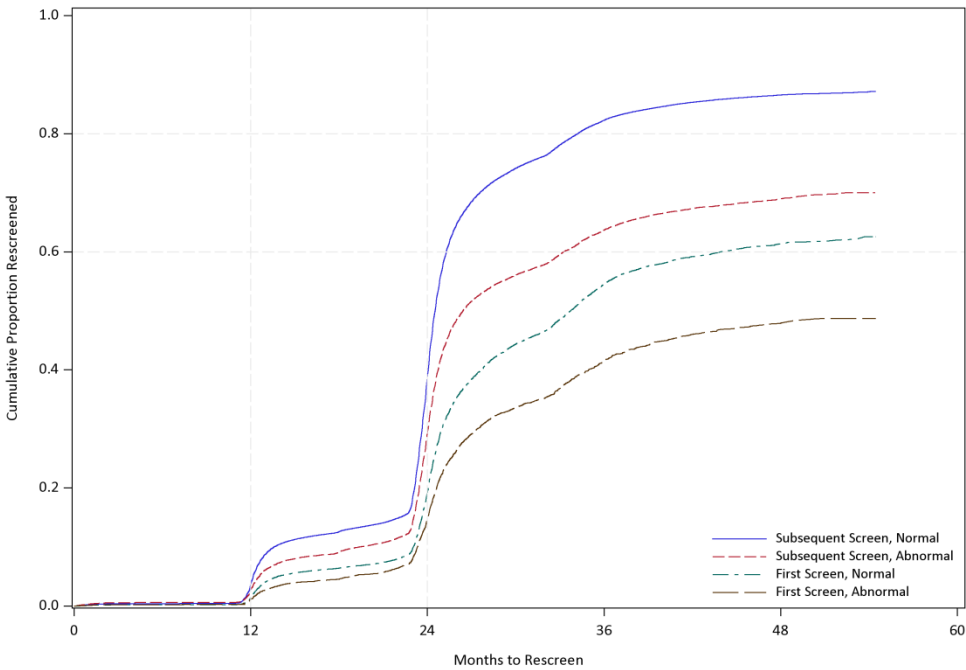
September 2020

FIGURE 7: SCREENING RETURN RATES FOR WOMEN AGES 40-49: 2016 – 2018

Notes

1. Breast Screening Program data extraction date: July 20, 2020.

FIGURE 8: SCREENING RETURN RATES FOR WOMEN AGES 50-69: 2016 – 2018

Notes

1.   Breast Screening Program data extraction date: July 20, 2020.

TABLE 5: SCREENING RETURN RATES FOR WOMEN AGES 40-49: 2016 – 2018

	First Screen		Subsequent Screen		Overall	
	Normal	**Abnormal**	**Normal**	**Abnormal**	**Normal**	**Abnormal**
Total Number to be Re-screened	35,896	8,687	61,753	7,082	**97,649**	**15,769**
Returned by 12 months	1%	1%	3%	2%	**2%**	**2%**
18 months	7%	5%	11%	9%	**9%**	**7%**
24 months	21%	18%	35%	29%	**30%**	**23%**
30 months	49%	39%	71%	59%	**64%**	**49%**
36 months	60%	48%	80%	68%	**73%**	**58%**

Notes
1. Breast Screening Program data extraction date: July 20, 2020.

TABLE 6: SCREENING RETURN RATES FOR WOMEN AGES 50-69: 2016 – 2018

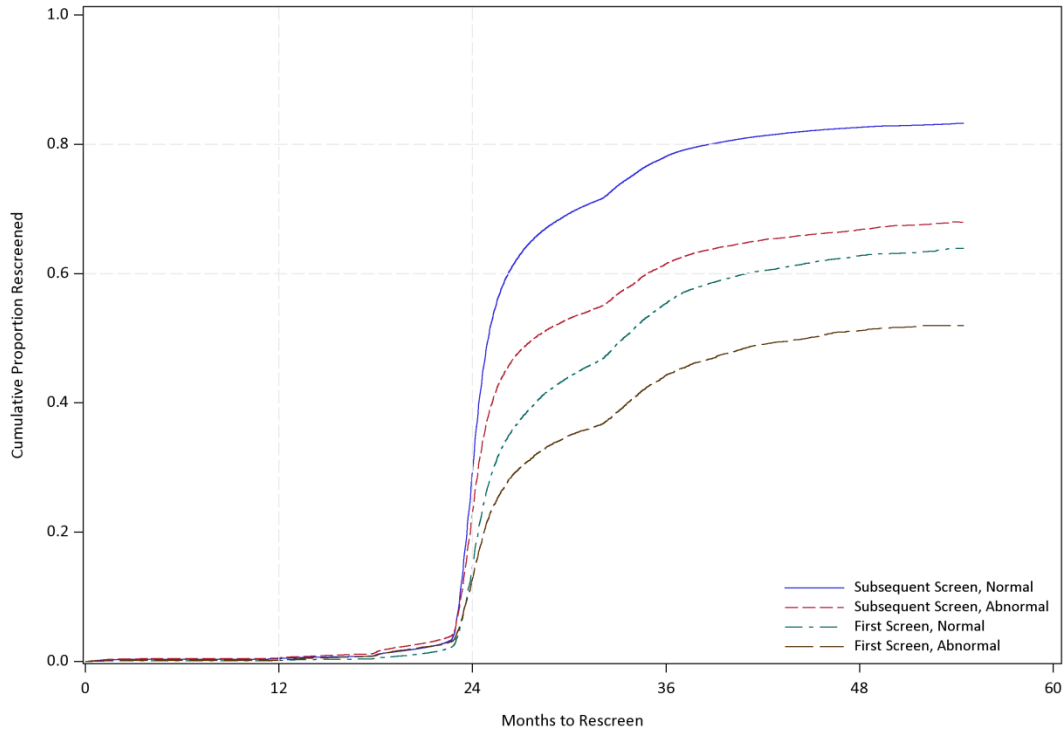|	First Screen		Subsequent Screen		Overall	
	Normal	**Abnormal**	**Normal**	**Abnormal**	**Normal**	**Abnormal**
Total Number to be Re-screened	**23,224**	**6,030**	**297,378**	**25,789**	**320,602**	**31,819**
Returned by 12 months	1%	1%	4%	3%	**3%**	**2%**
18 months	6%	5%	13%	9%	**12%**	**8%**
24 months	19%	15%	38%	29%	**37%**	**26%**
30 months	44%	34%	74%	56%	**72%**	**52%**
36 months	54%	41%	82%	64%	**81%**	**60%**

Notes
1. Breast Screening Program data extraction date: July 20, 2020.

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 2016 and 2018. Women in this cohort are recommended to screen annually rather than every two years. By 18 months, 70% of women with a previous normal result and 46% of women with a previous abnormal result had returned to screening (Table 8). By 30 months, 85% of higher risk women who had a normal screen have returned for screening compared with 63% of average risk women.
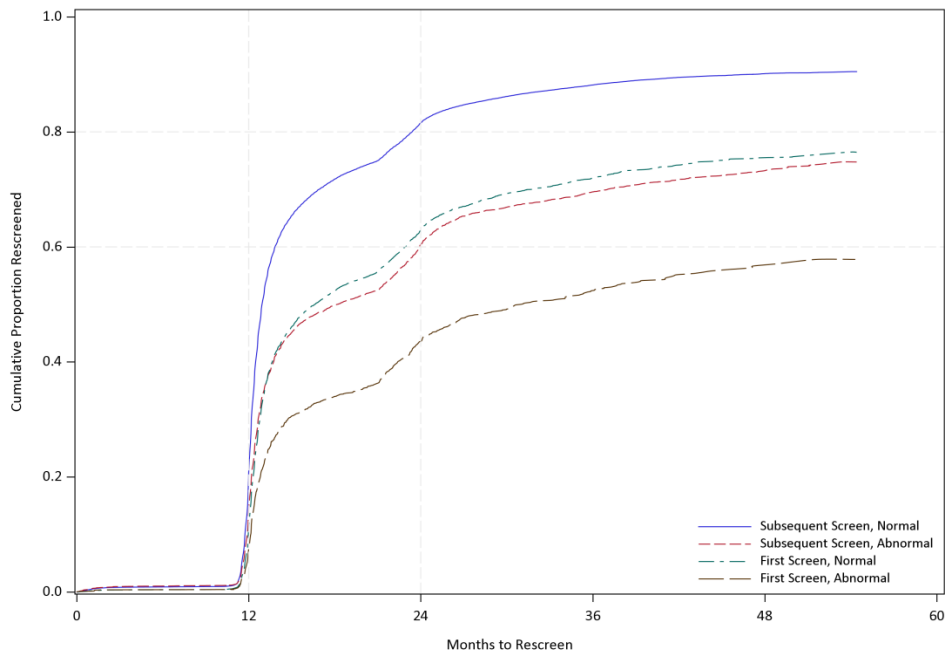
FIGURE 9: RETURN RATES FOR AVERAGE RISK WOMEN AGES 40-74 BY FIRST/SUBSEQUENT SCREEN AND SCREEN RESULT: 2016 – 2018

Notes
1.   Breast Screening Program data extraction date: July 20, 2020.

FIGURE 10: RETURN RATES FOR HIGHER RISK WOMEN AGES 40-74 BY FIRST/SUBSEQUENT SCREEN AND SCREEN RESULT: 2016 – 2018

Notes
1.   Breast Screening Program data extraction date: July 20, 2020.

September 2020

TABLE 7: SCREENING RETURN RATES FOR AVERAGE RISK WOMEN AGES 40-74: 2016 – 2018

	First Screen		Subsequent Screen		Overall	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Total Number to be Re-screened	53,718	13,392	353,185	31,902	406,903	45,294
Returned by 12 months	0%	0%	0%	1%	0%	0%
18 months	0%	1%	1%	1%	1%	1%
24 months	15%	13%	29%	23%	27%	20%
30 months	44%	35%	69%	53%	66%	48%
36 months	55%	44%	78%	61%	76%	57%

Notes
1. Breast Screening Program data extraction date: July 20, 2020.

TABLE 8: RETURN RATES FOR HIGHER RISK WOMEN AGES 40-74: 2016 – 2018

	First Screen		Subsequent Screen		Overall	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Total Number to be Re-screened	7,260	1,833	68,858	5,968	76,118	7,801
Returned by 12 months	11%	7%	20%	14%	19%	13%
18 months	52%	34%	72%	50%	70%	46%
24 months	63%	44%	82%	60%	80%	56%
30 months	69%	49%	86%	67%	85%	63%
36 months	72%	52%	88%	70%	87%	66%

Notes
1. Breast Screening Program data extraction date: July 20, 2020.

5.2 – 2019 SCREENING RESULTS

Table 9 summarizes the outcome indicators for screening exams provided in 2019 by 10-year age groups:

- Of the 266,405 screening mammograms performed, 23,710 (8.9%) had an abnormal result.
- There were 1,537 breast cancers reported in 2019 as of July 20, 2020 (5.8 per 1,000 exams).
- The 2019 overall cancer detection rate increased slightly compared with 2018, from 5.6 to 5.8 cancers detected per 1000 women screened.
- The overall cancer detection rate is highest on first screens for women who reported a family history (mother, sister, daughter).
- The proportion of cancers detected per 1000 women screened increases as women age.

Abnormal Call Rate

Abnormal Call Rate is the percentage of women who were referred for further testing because of an abnormal screening mammogram result.
- The overall screen abnormal call rate (first and subsequent screens) decreased slightly in 2019 (8.9%) compared to 2018 at 9.2%.
- The abnormal call rate is higher on first screens than on subsequent screens.
- The overall abnormal call rate decreases as women age, from 13.3% for ages 40 to 49 to 7.1% for ages 70 to 74.

Cancer Detection Rate

Cancer Detection Rate is the number of women with a screen detected cancer per 1,000 women who had a screening mammogram. Cancer detection rates may be presented as invasive cancer detection rates, in-situ cancer detection rates and overall cancer detection rates.
- The overall cancer detection rate increased slightly in 2019 compared to 2018 (from 5.6 per 1000 screens to 5.8 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 decreased slightly in 2019 compared to 2018 at 1.1 per 1000 women screened.

Positive Predictive Value

Positive Predictive Value (PPV) is the percentage of women with an abnormal mammogram result who were diagnosed with breast cancer (DCIS or invasive) after completion of diagnostic work-up.
- The overall positive predictive value increased from 2018 to 2019 at 6.6%.

TABLE 9: BREAST SCREENING PROGRAM OUTCOME INDICATORS BY 10-YEAR AGE GROUPS: 2019

		Age at Exam					
		40-49	50-59	60-69	70-74	75+	All
Number of Exams		46,503	85,993	92,632	33,477	7,462	**266,405**
on first screens		34.8%	8.3%	3.7%	2.0%	2.8%	**10.5%**
on higher risk screens		17.7%	21.4%	25.7%	28.7%	34.4%	**23.6%**
Number of Cancers		165	435	571	283	83	**1,537**
on first screens		46.1%	15.4%	7.9%	3.2%	7.2%	**13.2%**
on higher risk screens		17.6%	20.9%	25.7%	27.2%	41.0%	**24.6%**
Abnormal Call Rate		13.3%	8.7%	7.4%	7.1%	8.2%	**8.9%**
on first screens	Overall	19.7%	20.6%	21.1%	22.2%	22.3%	**20.2%**
	Higher Risk	21.0%	21.8%	18.5%	22.1%	20.5%	**20.5%**
	Average Risk	19.6%	20.4%	21.5%	22.2%	22.8%	**20.1%**
on subsequent screens	Overall	9.8%	7.6%	6.9%	6.8%	7.8%	**7.5%**
	Higher Risk	9.8%	7.1%	6.1%	6.2%	8.0%	**6.9%**
	Average Risk	9.9%	7.8%	7.2%	7.1%	7.7%	**7.7%**
Overall Cancer Detection Rate (per 1,000)		3.6	5.1	6.2	8.5	11.1	**5.8**
on first screens	Overall	4.7	9.4	13.0	13.4	28.7	**7.3**
	Higher Risk	5.8	16.3	16.4	21.3	45.5	**10.6**
	Average Risk	4.6	8.7	12.5	12.1	24.2	**6.9**
on subsequent screens	Overall	2.9	4.7	5.9	8.4	10.6	**5.6**
	Higher Risk	3.0	4.5	6.0	7.9	12.7	**5.8**
	Average Risk	2.9	4.7	5.9	8.6	9.5	**5.5**
DCIS Detection Rate (per 1,000)		1.1	1.1	1.0	1.1	1.3	**1.1**
on first screens	Overall	1.9	1.4	1.4		9.6	**1.7**
	Higher Risk	3.2	5.9	2.3			**3.4**
	Average Risk	1.7	0.9	1.3		12.1	**1.5**
on subsequent screens	Overall	0.6	1.1	1.0	1.1	1.1	**1.0**
	Higher Risk	0.8	1.1	1.0	1.3	2.0	**1.1**
	Average Risk	0.6	1.1	1.0	1.1	0.6	**1.0**
Positive Predictive Value		2.7%	5.9%	8.4%	11.9%	13.7%	**6.6%**
on first screens	Overall	2.4%	4.6%	6.3%	6.3%	13.3%	**3.6%**
	Higher Risk	2.8%	7.6%	9.0%	10.0%	22.2%	**5.2%**
	Average Risk	2.4%	4.3%	5.9%	5.6%	11.1%	**3.5%**
on subsequent screens	Overall	3.0%	6.2%	8.6%	12.3%	13.7%	**7.5%**
	Higher Risk	3.1%	6.3%	9.8%	12.8%	15.8%	**8.4%**
	Average Risk	3.0%	6.1%	8.2%	12.1%	12.5%	**7.2%**
Core Biopsy Yield Ratio		19.6%	37.9%	49.0%	57.6%	59.9%	**40.7%**
on first screens		15.2%	24.2%	32.4%	21.1%	50.0%	**20.9%**
on subsequent screens		26.1%	42.5%	51.4%	60.8%	60.8%	**47.7%**
Open Biopsy Yield Ratio		16.3%	30.5%	35.8%	45.7%	16.7%	**29.5%**
on first screens		14.0%	8.3%	9.1%	16.7%		**12.0%**
on higher risk screens		18.8%	35.5%	38.8%	51.7%	16.7%	**35.1%**

Notes

1. See glossary in the Appendix for definitions of terms.
2. Overall Cancer Rate includes ductal carcinoma in situ (DCIS).
3. An additional 191 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. 338 exams were performed for women <40 years old. No cancers were detected for this age group.
6. The "All" column includes women less than 40 years of age.
7. Breast Screening Program data extraction date: July 20, 2020.

Diagnostic procedure information is available to date on 23,426 (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, 15% and 1% 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: 2019

Procedure	<40	40-49	50-59	60-69	70-79	80+	All
Diagnostic Mammogram	97%	93%	94%	94%	95%	94%	**94%**
Ultrasound	64%	74%	72%	70%	68%	69%	**71%**
Fine Needle Aspiration		1%	1%	1%	1%	1%	**1%**
Core Biopsy	14%	13%	14%	16%	20%	25%	**15%**
Surgical Biopsy	2%	1%	2%	1%	1%	3%	**1%**
with Localization	2%	1%	1%	1%	1%	2%	**1%**
Number of cases with diagnostic assessment information available	59	6,120	7,426	6,837	2,840	144	**23,426**

Age at Exam is the column group header spanning <40 through 80+.

Notes

1. Breast Screening Program data extraction date: July 20, 2020.

FIGURE 11: SCREENING OUTCOME SUMMARY: 2019
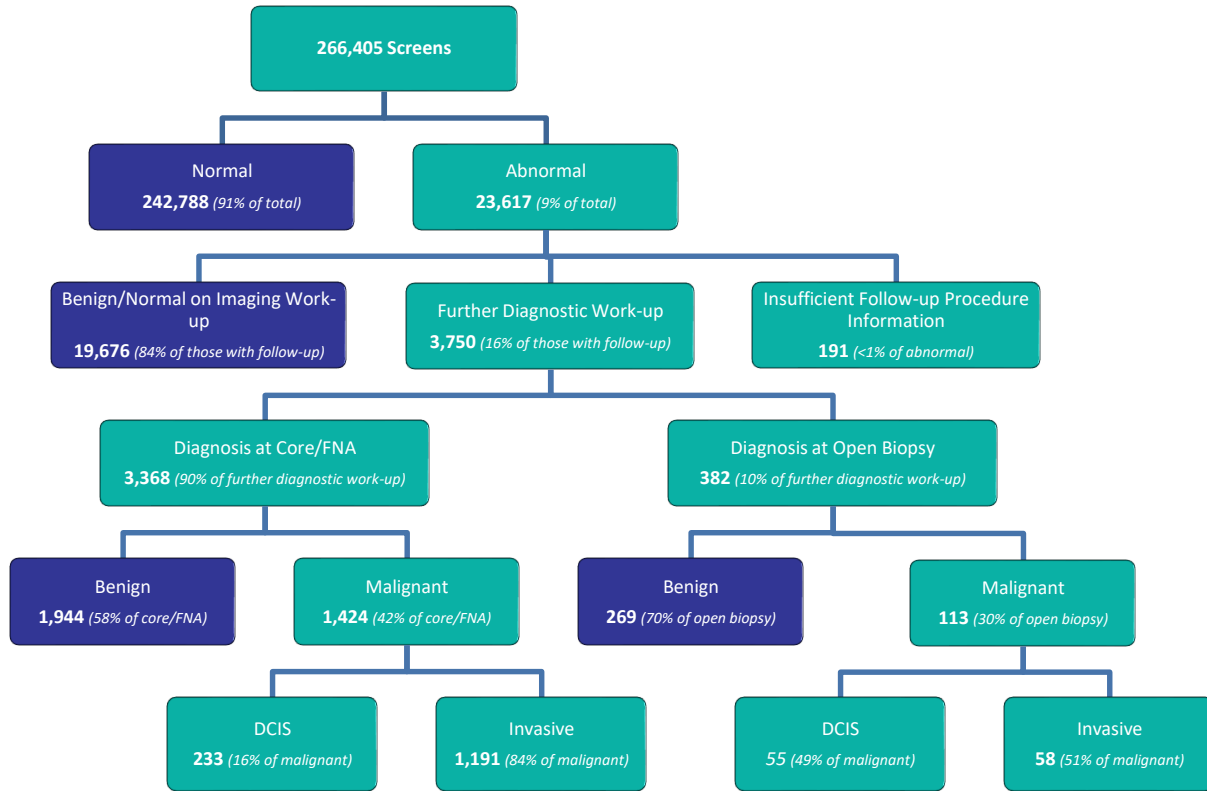
5.3   2019 CANCER DETECTION

Histologic features of breast cancers detected by the Breast Screening Program in 2019 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, 19% of cancers detected were in situ.
- Of the invasive cancers detected, 58% were ≤15 mm, 78% did not have invasion of the regional lymph nodes, and 20% were grade 3 (i.e. poorly differentiated) tumours.

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

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[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: 2019

Histological Features	Age at Exam									
	40-49		50-59		60-69		70-79		Age 40-79	
Number of Cancers	165		432		565		337		**1,499**	
in situ	49	30%	96	22%	96	17%	43	13%	**284**	**19%**
invasive	116	70%	336	78%	469	83%	294	87%	**1,215**	**81%**
Invasive Cancers Tumour Size										
≤ 5 mm	6	5%	29	9%	41	9%	23	8%	**99**	**8%**
6-10 mm	24	22%	53	16%	122	26%	79	27%	**278**	**23%**
11-15 mm	31	28%	92	28%	122	26%	79	27%	**324**	**27%**
16-20 mm	20	18%	65	20%	80	17%	44	15%	**209**	**17%**
> 20 mm	29	26%	93	28%	102	22%	69	23%	**293**	**24%**
unknown size	(6)		(4)		(2)		(0)		**(9)**	
Invasive Cancers with tumour ≤15 mm	61	55%	174	52%	285	61%	181	62%	**701**	**58%**
Node Involvement in Invasive Cancers										
no	71	70%	234	76%	352	79%	233	82%	**890**	**78%**
yes	31	30%	74	24%	92	21%	50	18%	**247**	**22%**
no nodes sampled / unknown	(14)		(28)		(25)		(11)		**(78)**	
Histologic Grade of Invasive Cancers										
1 - well differentiated	23	21%	80	25%	128	28%	106	36%	**337**	**29%**
2 - moderately differentiated	50	46%	156	49%	245	54%	149	51%	**600**	**51%**
3 - poorly differentiated	35	32%	84	26%	82	18%	38	13%	**239**	**20%**
unknown grade	(8)		(16)		(14)		(1)		**(39)**	
Grade 3 tumour ≤ 15 mm	13	37%	32	38%	35	43%	20	53%	**100**	**42%**

Notes

1. Targets: >50% invasive tumours ≤15mm, >70% with negative nodes, >30% grade 3 tumours ≤15mm.
2. Breast Screening Program data extraction date: July 20, 2020.

5.4 OUTCOME INDICATORS BY CALENDAR YEAR: 2015 – 2019

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

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

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

Comparison of prevalence rate at first screen with the historical incidence rate prior to the onset of screening practice provides another measure of program performance. The expected age-specific incidence rates in the absence of screening were derived from the 1982 breast cancer incidence data reported for British Columbia. Since screening may be obtained outside of the Breast Screening Program, the definition of prevalent screens has 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 2015 AND 2019 INCLUSIVE

Outcome Indicators	Calendar Year					5-Year Cumulative
	2015	2016	2017	2018	2019	
Number of Exams	255,527	258,172	258,491	260,372	266,405	**1,298,967**
on first screens	10.0%	9.8%	9.9%	10.2%	10.5%	**10.1%**
Number of Cancers	1,430	1,475	1,427	1,486	1,537	**7,355**
on first screens	12.1%	12.7%	14.6%	13.9%	13.2%	**13.3%**
Abnormal Call Rate	9.1%	9.0%	9.0%	9.2%	8.9%	**9.0%**
on first screens	19.1%	19.5%	19.7%	20.7%	20.2%	**19.8%**
on subsequent screens	7.9%	7.8%	7.8%	7.9%	7.5%	**7.8%**
Overall Cancer Detection Rate (per 1,000)	5.6	5.7	5.5	5.7	5.8	**5.7**
on first screens	6.8	7.4	8.1	7.9	7.3	**7.5**
on subsequent screens	5.5	5.5	5.2	5.5	5.6	**5.5**
DCIS Detection Rate (per 1,000)	1.2	1.1	1.2	1.2	1.1	**1.2**
on first screens	1.5	1.5	1.9	1.7	1.7	**1.7**
on subsequent screens	1.2	1.1	1.1	1.2	1.0	**1.1**
Positive Predictive Value	6.2%	6.4%	6.2%	6.2%	6.6%	**6.3%**
on first screens	3.6%	3.8%	4.1%	3.8%	3.6%	**3.8%**
on subsequent screens	6.9%	7.1%	6.8%	6.9%	7.5%	**7.0%**
Core Biopsy Yield Ratio	34.1%	35.0%	34.3%	36.0%	40.7%	**36.0%**
on first screens	18.2%	18.5%	19.3%	21.4%	20.9%	**19.7%**
on subsequent screens	38.7%	39.9%	39.3%	40.5%	47.7%	**41.1%**
Open Biopsy Yield Ratio	22.4%	25.7%	27.9%	26.8%	29.5%	**26.0%**
on first screens	15.4%	19.1%	20.3%	15.4%	12.0%	**16.8%**
on subsequent screens	24.1%	27.4%	30.4%	30.2%	35.1%	**28.6%**
Interval Cancer Rate (per 1,000)						
0-12 months	0.7	0.6	0.5	---	---	**---**
after first screens	0.7	0.8	0.5	---	---	**---**
after subsequent screens	0.7	0.6	0.5	---	---	**---**
13-24 months	0.7	0.8	---	---	---	**---**
Sensitivity (1 - false negative rate)	88.9%	90.4%	91.1%	---	---	**---**
Specificity (1 - false positive rate)	91.5%	91.6%	91.6%	---	---	**---**
Prevalence to Expected Incidence Ratio for Age 50-79 (target: >3.0)	5.6	5.4	5.0	5.8	5.4	**5.4**

Notes
1. See glossary in the Appendix for definitions of terms.
2. Overall Cancer Detection Rate includes ductal carcinoma in situ (DCIS).
3. The final number of cancers in 2019 is still to be determined.
4. Number of cancers and related rates do not include data for women whose follow-up is incomplete.
5. SMP data extraction date: July 20, 2020.

5.5 – OUTCOME INDICATORS BY 10-YEAR AGE GROUPS: 2015 – 2019 CUMULATIVE

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

- From 2015 to 2019, the Breast Screening Program provided 1,298,967 breast screening examinations, and detected 7,355 breast cancers.
- Approximately 82% 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 112:1 for women in their 70's to 294:1 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 38:1 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 2015 AND 2019 INCLUSIVE

Outcome Indicators	Age at Exam					All
	40-49	50-59	60-69	70-79	80+	All
Number of Exams	238,608	435,199	440,550	175,726	7,594	**1,298,967**
on first screens	31.8%	7.7%	3.8%	2.1%	2.7%	**10.1%**
Number of Cancers	812	2,010	2,845	1,567	120	**7,355**
on first screens	43.2%	14.9%	8.4%	5.0%	7.5%	**13.3%**
Abnormal Call Rate	12.9%	8.8%	7.7%	7.4%	9.0%	**9.0%**
on first screens	19.3%	20.9%	20.0%	20.9%	25.7%	**19.8%**
on subsequent screens	10.0%	7.8%	7.2%	7.1%	8.6%	**7.8%**
Overall Cancer Detection Rate (per 1,000)	3.4	4.6	6.5	8.9	15.8	**5.7**
on first screens	4.6	9.0	14.3	21.2	45.2	**7.5**
on subsequent screens	2.8	4.3	6.2	8.7	15.0	**5.5**
DCIS Detection Rate (per 1,000)	1.0	1.1	1.3	1.4	2.4	**1.2**
on first screens	1.4	1.7	2.4	2.4	15.1	**1.7**
on subsequent screens	0.7	1.0	1.2	1.4	2.0	**1.1**
Positive Predictive Value	2.6%	5.3%	8.5%	12.1%	17.7%	**6.3%**
on first screens	2.4%	4.4%	7.3%	10.3%	18.4%	**3.8%**
on subsequent screens	2.9%	5.5%	8.6%	12.2%	17.7%	**7.0%**
Core Biopsy Yield Ratio	17.1%	30.9%	45.3%	54.8%	65.5%	**36.0%**
on first screens	13.5%	21.0%	32.1%	41.2%	46.7%	**19.7%**
on subsequent screens	21.5%	33.7%	47.0%	55.8%	67.3%	**41.1%**
Open Biopsy Yield Ratio	16.0%	22.7%	34.0%	37.4%	32.0%	**26.0%**
on first screens	14.7%	16.1%	21.6%	28.6%	100.0%	**16.8%**
on subsequent screens	17.0%	24.3%	35.5%	38.1%	26.1%	**28.6%**
Interval Cancer Rate (per 1,000)						
0-12 months	0.6	0.6	0.6	0.7	1.4	**0.6**
after first screens	0.7	0.6	1.0	< 0.1	< 0.1	**0.7**
after subsequent screens	0.6	0.6	0.6	0.8	1.4	**0.6**
13-24 months	0.2	0.4	0.3	0.5	0.7	**0.4**
Sensitivity (1 - false negative rate)	84.9%	88.7%	91.5%	92.4%	91.9%	**90.1%**
Specificity (1 - false positive rate)	87.7%	91.6%	92.9%	93.5%	92.6%	**91.6%**

Notes
1. See glossary in the Appendix for definitions of terms.
2. Overall cancer detection rate includes ductal carcinoma in situ (DCIS).
3. Number of cancers and related rates do not include data for women whose follow-up is incomplete.
4. The final number of cancers in 2019 is still to be determined.
5. The total for all ages includes women less than 40 years of age.
6. Interval cancer rate does not include years 2018-2019 (for 0-12 months) or 2017-2019 (for 13-24 months).
7. Sensitivity and specificity do not include years 2018-2019.
8. SMP data extraction date: July 20, 2020.

5.6 – OUTCOME INDICATORS BY HSDA: 2015 – 2019 CUMULATIVE

Outcome indicators for 2015 to 2019 are summarized by HSDA in Table 14.

- South Vancouver Island region has the lowest abnormal call rate (5%), Northeast has the highest (12%).
- Northeast has the lowest cancer detection rate (4.1 per 1,000), while East Kootenay has the highest (6.7 per 1,000).
- Northeast has the lowest positive predictive value (4%) and South Vancouver Island has the highest (10%).
- All of the HSDAs meet the national targets[4] recommended for screening programs for invasive tumour detection size (target > 50%); nine out of the sixteen HSDAs meet the national target recommended for percentage of cases with negative nodes (target > 70%).

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

TABLE 14: BREAST SCREENING PROGRAM OUTCOME INDICATORS BY HEALTH SERVICE DELIVERY AREA (HSDA) BETWEEN 2015 AND 2019 INCLUSIVE

HSDA	% Called Abnormal	Cancer Detection Rate (per 1,000)	PPV	In-Situ : Invasive (number)	% Invasive ≤ 15 mm	% Invasive with -ve nodes
East Kootenay	10%	6.7	7%	29 : 108	61%	80%
Kootenay Boundary	9%	5.0	5%	16 : 84	71%	68%
Okanagan	8%	5.9	8%	145 : 543	61%	75%
Thompson Cariboo Shuswap	10%	5.6	5%	71 : 299	55%	70%
Interior	9%	5.8	7%	261 : 1034	60%	73%
Fraser East	10%	5.7	6%	82 : 359	58%	70%
Fraser North	10%	5.7	6%	227 : 767	58%	70%
Fraser South	10%	5.8	6%	280 : 918	58%	69%
Fraser	10%	5.8	6%	589 : 2044	58%	70%
Richmond	10%	5.5	5%	83 : 257	51%	71%
Vancouver	10%	5.6	6%	224 : 693	59%	68%
North Shore / Coast Garibaldi	10%	5.0	5%	79 : 341	62%	71%
Vancouver Coastal	10%	5.4	6%	386 : 1291	59%	70%
South Vancouver Island	5%	5.3	10%	85 : 518	52%	68%
Central Vancouver Island	7%	6.3	9%	110 : 448	58%	76%
North Vancouver Island	7%	5.5	8%	33 : 181	57%	72%
Vancouver Island	6%	5.7	9%	228 : 1147	55%	72%
Northwest	10%	6.4	7%	13 : 92	60%	60%
Northern Interior	10%	5.5	5%	38 : 154	64%	73%
Northeast	12%	4.1	4%	3 : 39	59%	67%
Northern	10%	5.5	5%	54 : 285	62%	68%
British Columbia	**9%**	**5.7**	**6%**	**1524 : 5831**	**58%**	**71%**

Notes
1. See glossary in the Appendix for definitions of terms.
2. Targets: >50% invasive tumours ≤15mm, >70% with negative nodes.
3. Breast Screening Program data extraction date: July 20, 2020.

5.7 – CANCER CHARACTERISTICS BY AGE: CUMULATIVE UP TO AND INCLUDING 2019

From the start of the program in July 1988 to December 2019, 29,769 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 2019, 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 2019

Histological Features	Age at Exam										Age 40+	
	40-49		50-59		60-69		70-79		80+			
Number of Cancers	4,418		8,337		10,014		6,524		466		**29,769**	
in situ	1,367	31%	2,031	24%	2,011	20%	1,128	17%	55	12%	**6,595**	**22%**
invasive	3,051	69%	6,306	76%	8,003	80%	5,396	83%	411	88%	**23,174**	**78%**
Invasive Cancers Tumour Size												
≤ 5 mm	294	10%	583	9%	722	9%	399	7%	35	9%	**2,034**	**9%**
6-10 mm	565	19%	1,398	23%	2,137	27%	1,599	30%	102	25%	**5,802**	**25%**
11-15 mm	794	27%	1,753	28%	2,296	29%	1,572	29%	115	28%	**6,531**	**29%**
16-20 mm	466	16%	1,031	17%	1,212	15%	795	15%	68	17%	**3,574**	**16%**
> 20 mm	855	29%	1,446	23%	1,555	20%	972	18%	86	21%	**4,916**	**22%**
unknown size	(77)		(95)		(81)		(59)		(5)		**(317)**	
Invasive Cancers with tumour size ≤ 15 mm	1,653	56%	3,734	60%	5,155	65%	3,570	67%	252	62%	**14,367**	**63%**
Node Involvement in Invasive Cancers												
no	1,896	69%	4,293	73%	5,791	78%	3,907	81%	243	81%	**16,136**	**76%**
yes	858	31%	1,557	27%	1,644	22%	928	19%	58	19%	**5,046**	**24%**
no nodes sampled / unknown	(297)		(456)		(568)		(561)		(110)		**(1,992)**	
Histologic Grade of Invasive Cancers												
1 - well differentiated	718	25%	1,818	31%	2,484	33%	1,818	36%	144	38%	**6,983**	**32%**
2 - moderately differentiated	1,266	45%	2,518	43%	3,437	46%	2,300	46%	164	43%	**9,688**	**45%**
3 - poorly differentiated	844	30%	1,550	26%	1,618	21%	930	18%	71	19%	**5,015**	**23%**
unknown grade	(223)		(420)		(464)		(348)		(32)		**(1,488)**	
Grade 3 tumour ≤ 15 mm	341	40%	680	44%	797	49%	445	48%	29	41%	**2,292**	**46%**

Notes

1. Targets 1: >50% invasive tumours ≤15mm, >70% with negative nodes, >30% grade 3 tumours ≤15mm.
2. Breast Screening Program data extraction date: July 20, 2020.

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 reduce abnormal call rates, diagnostic intervals, and benign to malignant open biopsy ratio.

- There was slight improvement in the subsequent screen abnormal call rate compared to 2018 (7.2% compared with 7.6% in 2018).
- There was a slight decline in the first screen retention rate (42.1% compared with 44.3% in 2018).

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

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[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	49.7% (plus 8.2% MSP)
Retention Rate (2)		
Initial Re-screen	≥ 75% initial re-screen within 30 months	42.1%
Subsequent Re-screen	≥ 90% subsequent re-screen within 30 months	72.7%
Abnormal Call Rate (3)		
First Screens	< 10% first screens	20.7%
Subsequent Screens	< 5% re-screens	7.2%
Invasive Cancer Detection Rate (3)		
First Screens	> 5.0 per 1,000 first screens	9.2 per 1,000
Subsequent Screens	> 3.0 per 1,000 re-screens	4.3 per 1,000
DCIS Detection Rate (3)		
First Screens	Surveillance and monitoring only	1.4 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	83.0%
Tissue biopsy performed	≥ 90% within 7 weeks if tissue biopsy performed	66.3%
Positive Predictive Value (3)		
First Screens	≥ 5% first screens	5.2%
Subsequent Screens	≥ 6% re-screens	7.4%
Benign Core Biopsy Rate (3)		
First Screens	Surveillance and monitoring only	27.6 per 1,000
Subsequent Screens	Surveillance and monitoring only	5.4 per 1,000
Benign to Malignant Core Biopsy Ratio (3)		
First Screens	Surveillance and monitoring only	2.7: 1
Subsequent Screens	Surveillance and monitoring only	1.1 : 1
Benign Open Biopsy Rate (3)		
First Screens	Surveillance and monitoring only	3.0 per 1,000
Subsequent Screens	Surveillance and monitoring only	0.8 per 1,000
Benign to Malignant Open Biopsy Ratio (3)		
First Screens	≤ 1 : 1	10.7 : 1
Subsequent Screens	≤ 1 : 1	1.7 : 1
Invasive Cancers Tumour Size ≤ 10 mm (3)	> 25%	30.7%
Invasive Cancers Tumour Size ≤ 15 mm (3)	> 50%	57.4%
Node Negative Rate in Cases of Invasive Cancer (3)	> 70%	77.9%

Notes
1. Screen years: (1) = July 1, 2017 - December 31, 2019, (2) = 2016 - 2018, (3) = 2019.
2. Population data source: P.E.O.P.L.E. 2019 population projection (Oct 2019), BC Stats, Ministry of Technology, Innovation and Citizens' Services, Government of the Province of British Columbia.
3. Breast Screening Program data extraction date: July 20, 2020.

September 2020

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	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
Total Cost	**$19,976,921**	**$21,030,530**	**$21,127,930**	**$21,452,284**	**$21,242,674**
Total Cost per Screen	$79.35	$79.38	$82.46	$81.76	$82.40
Central Services	$17.52	$16.58	$18.02	$16.80	$17.18
Screen Provision Costs	$46.98	$47.88	$49.46	$49.90	$50.08
Professional Reading Fees	$14.85	$14.92	$14.99	$15.06	$15.14
Cost per Cancer Detected	**$13,815.30**	**$14,335.74**	**$14,702.80**	**$14,131.94**	**Not Available**

Notes
1. Program Expenses are audited through PHSA Finance annually.
2. Screen Provision Costs include, but are not limited to, staffing costs, equipment related costs, and mobile operation costs.
3. The professional reading fee was $15.14 per screen effective April 1, 2019.
4. Number of cancers detected in 2019-20 is not available yet, and thus the cost per cancer detected is not computed.
5. Cost per cancer detected is based upon screens with complete follow-up.
6. The cost per screen is exclusive of salary and benefit increases to public screening centers which, commencing in fiscal 2006, have gone directly to the Health Authority.
7. Breast Screening Program data extraction date: July 20, 2020.

APPENDIX 1 – CANCER SCREENING PROGRAM OVERVIEW

Definition of Screening

Screening is one part of a prevention strategy, with the goal of identifying cancer before symptoms or signs develop. Primary cancer prevention strategy involves changes of behaviour or habits that reduce a risk, for example, stopping smoking, fat reduction in the diet, etc. Screening for cancer is a secondary prevention strategy. Secondary cancer prevention strategy targets disease in 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.

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[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, 1968

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 – 2019 BREAST SCREENING PROGRAM SCREENING SERVICES

In 2019, 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, 2019 – December 31, 2019.

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

Eligibility Criteria:

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

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

APPENDIX 3 – MAP OF SCREENING CENTRES
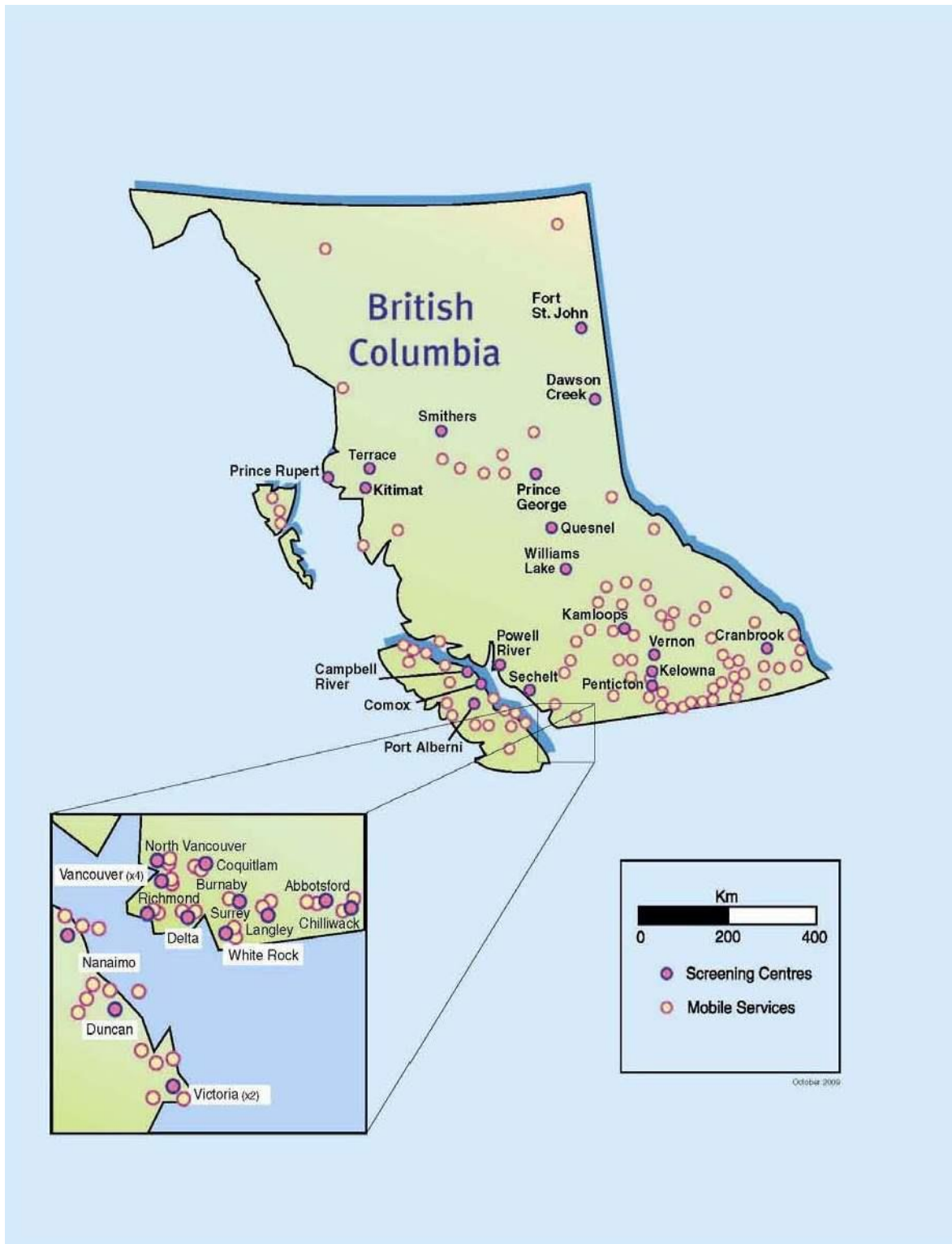
APPENDIX 4 – SCREENING CENTRES CONTACT INFORMATION

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

Mobile Screening Service Delivery Areas

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

Elkford	Massett	Rock Creek	Winfield
Enderby	McBride	Rossland	100 Mile House
Fernie	Merritt	Saanichton	
Fort Nelson	Midway	Sandspit	
Fort Rupert	Mill Bay	Salmo	
Fort St. James	Mission	Salmon Arm	

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, Overwaitea Head Office, Pacific Blue Cross, Prince George Native Friendship Centre, Qwemtsin Health Society, TransLink, Urban Native Health Clinic Kamloops, Vancouver Primary Care Centre/Native Health, Work Safe BC (Richmond).

First Nations Communities

Community	Area
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
Haisla Nation	Kitamaat Village
Katzie First Nation	Pitt Meadows
Kwikwetlem First Nation	Coquitlam
Laxgalts First Nation	Greenville
Lil'wat Nation	Mount Currie
Lower Nicola Indian Band	Merritt
Lower Similkameen Indian Band	Keremeos
Musqueam Indian Band	Vancouver

Nadleh Whut'en First Nation	Fort Fraser
Nak'azdli First Nation	Fort St. James
Nazko First Nation	Quesnel
Nisga'a Village of Gitwinsihlkw	Gitwinksihlkw
Okanagan Indian Band	Vernon
Osoyoos Indian Band	Osoyoos
Pauquachin First Nation	Saanich
Penelakut First Nation	Penelakut Island
Penticton Indian Band	Penticton
Saik'uz First Nation	Vanderhoof
Seabird Island Band	Agassiz
Shuswap Band	Invermere
Simpcw First Nation	Barriere
Skeetchestn First Nation	Savona
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
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 cancer 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 cancer cases detected by core biopsy, where each open biopsy represents a case.

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

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

B_b Number of diagnostic core biopsies without breast cancer diagnosis.

M_b Number of diagnostic core biopsies with breast cancer diagnosis.

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

Diagnostic Interval: Percentage of women with an abnormal screening mammogram result who were diagnosed (benign or cancer) within the recommended time interval from the abnormal screen date.
- ≤ 5 weeks without a tissue biopsy
- ≤ 7 weeks with a tissue biopsy

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

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

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

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

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

B_b Number of diagnostic open biopsies without breast cancer diagnosis.

M_b Number of diagnostic open biopsies with breast cancer diagnosis.

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

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

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

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

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

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

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

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

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

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

TP   Number of screen-detected breast cancer cases.

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

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

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

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

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

APPENDIX 7 – ACKNOWLEDGEMENTS

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

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

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

BC Cancer Foundation
BC Radiological Society
Canadian Cancer Society
Canadian Partnership Against Cancer
College of Physicians and Surgeons of BC
Doctors of BC
Divisions of Family Practice
Society of General Practitioners
University of British Columbia

APPENDIX 8 – COMMITTEES

Alphabetical Listing – By Surname

Quality Management Committee (QMC)

Ms. Nancy Aldoff
Dr. Stephen Chia
Dr. Zuzana Kos
Ms. Lisa Kan
Mr. Javis Lui
Ms. Sheila MacMahon
Dr. Colin Mar – Chair
Ms. Mary Nagy
Ms. Janette Sam
Dr. Linda Warren
Ms. Rachel Berns

Quality Management Support Group

Ms. Nancy Aldoff
Ms. Amanda Hunter
Ms. Sheila MacMahon
Ms. Moira Pearson
Dr. Rasika Rajapakshe
Dr. Derek Wells
Dr. Joseph Yang

Screener's Advisory Committee (SAC)

Dr. Ken Bentley
Dr. John Lai
Dr. Eleanor Clark
Dr. Jennifer Dolden
Dr. Brenda Farnquist
Dr. Dellano Fernandes
Dr. Kevin Irish
Dr. Dennis Janzen
Dr. Rob Johnson
Ms. Lisa Kan
Dr. Tahir Khalid
Dr. Marie-Josee Cloutier
Dr. Grant Larsen
Dr. Brent Lee

Dr. Colin Mar – Chair
Dr. Peter McNicholas
Dr. Darryn Maisonneuve
Dr. David O'Keeffe
Dr. Amie Padilla-Thornton
Dr. Catherine Phillips
Dr. Rasika Rajapakshe
Ms. Janette Sam
Dr. Karen Seland
Dr. Stuart Silver
Dr. Phil Switzer
Dr. Beth Tanton
Dr. Linda Warren
Dr. Marie-Josee Cloutier

APPENDIX 9 – RADIOLOGISTS SCREENERS

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

Abbotsford & Chilliwack

Dr. Amarjit Bajwa

Dr. Tahir Khalid*

Dr. Chung Ko

Dr. Marian Kreml

Dr. Caroline Pon

Burnaby & Richmond

Dr. Theodore Blake

Dr. Andy Chan

Dr. Bill Collins

Dr. Brian Ho

Dr. Henry Huey

Dr. Marty Jenkins

Dr. Vanindar (Vee) Lail

Dr. Kelly MacLean

Dr. Beth Tanton*

Dr. Betty Tuong

Comox

Dr. Kevin Irish

Dr. Grant Larson*

Dr. Jennifer Waterhouse

Coquitlam

Dr. Vishal Anand

Dr. Debra Chang

Dr. Jennifer Dolden*

Dr. Brad Halkier

Dr. Jian Li

Dr. Anita McEachern

Dr. Robert van Wiltenburg

Cranbrook

Dr. Daryn Maisonneuve*

Interior / Northern &

Lower Mainland Mobile

Dr. Marie-Jose Cloutier

Dr. Chung Ko

Dr. Kevin Ibach

Dr. Colin Mar*

Dr. Charlotte Yong-Hing

Kamloops

Dr. Donal Downey*

Kamloops (Continued)

Dr. Dellano Fernandez*

Kelowna

Dr. Brenda Farnquist*

Dr. Michael Partrick

Dr. Cathy Staples

Dr. Tim Wall

Langley

Dr. Tahir Khalid

Dr. John Lai*

Dr. Caroline Pon

Dr. Jerome Wong

Dr. Xing Wong

Nanaimo/Islands & Coastal Mobile

Dr. David Coupland

Dr. Robert Johnson*

Dr. Zenobia Kotwall

Dr. David O'Keefe* (Mobile Chief Screener)

Dr. Paul Trepanier

Dr. Peggy Yen

North Vancouver & Sechelt

Dr. Sven Aippersbach

Dr. Simon Bicknell

Dr. Bobbi-Jo Coldwell

Dr. Patrick Llewellyn

Dr. Catherine Phillips*

Dr. David Spouge

Penticton

Dr. Peter McNicholas*

Dr. Tracy Chandler

Dr. Meghan Van Vliet

Prince George (UHNBC)

Dr. Shyr Chui

Dr. Karen Seland*

Dr. Greg Shand

Surrey – JPOC

Dr. Sanjiv (Sonny) Bhalla

Dr. Guy Eriksen

Dr. Fin Hodge

Dr. Dennis Janzen*

Surrey – JPOC (Continued)

Dr. Dennis Lee

Dr. Amir Neyestani

Vancouver BC Women's Health Centre

Dr. Marie-Josee Cloutier*

Dr. Paula Gordon

Dr. Linda Warren

Vancouver – Mount St. Joseph Hospital

Dr. Jessica Farrell

Dr. Jennifer Jessup

Dr. Amie Padilla-Thornton*

Vancouver – Victoria Drive

Dr. Connie Siu

Dr. Phil Switzer*

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Dr. Theodore Blake

Dr. Paula Gordon

Dr. Nicola Lapinsky

Dr. Linda Warren*

Dr. Charlotte Yong-Hing

Vernon

Dr. Ken Bentley*

Dr. Ian Marsh

Dr. Glenn Scheske

Dr. Claire Thurgur

Victoria General Hospital / Victoria Ft. St.

Dr. Richard Eddy

Dr. Chris King

Dr. Robert Koopmans

Dr. Brent Lee*

Dr. Stacey Piche

Dr. Nicola Proctor

Dr. Stuart Silver*

Dr. Rick Smith

Dr. Paul Sobkin

White Rock & Delta

Dr. Eleanor Clark*

Dr. Joanne Coppola

Dr. Jeff Hagel

Dr. Tarek Helou

APPENDIX 10 – PUBLICATIONS AND PRESENTATIONS

Publications

Colin Mar

Mar C. Breast screening for transgender, gender-diverse and non-binary people. Journal of Family Practice Oncology 2019; 33:14

Mar C, Sam J, McGahan C, DeVries K, Coldman A. Breast density and risk of screen detected and interval breast cancer in a Canadian breast screening program [abstract]. In: International Cancer Screening Network Conference 2019; 2019 Jun 3-5; Rotterdam, The Netherlands.

Coldman C, McGahan C, DeVries K, Sam J, Mar C. Risk of interval invasive breast cancer and predicted reductions with the addition of breast ultrasound [abstract].   In: International Cancer Screening Network Conference 2019; 2019 Jun 3-5; Rotterdam, The Netherlands.

Mar C, Sam J, McGahan C, DeVries K , Coldman AJ. The influence of breast density on breast cancer diagnosis: A study of participants in the BC Cancer Breast Screening Program. BC Medical Journal 2019; 61:344-352

Janette Sam

Mar C, Sam J, McGahan C, DeVries K, Coldman A. Breast density and risk of screen detected and interval breast cancer in a Canadian breast screening program [abstract]. In: International Cancer Screening Network Conference 2019; 2019 Jun 3-5; Rotterdam, The Netherlands.

Coldman C, McGahan C, DeVries K, Sam J, Mar C. Risk of interval invasive breast cancer and predicted reductions with the addition of breast ultrasound [abstract].   In: International Cancer Screening Network Conference 2019; 2019 Jun 3-5; Rotterdam, The Netherlands.

Mar C, Sam J, McGahan C, DeVries K , Coldman AJ. The influence of breast density on breast cancer diagnosis: A study of participants in the BC Cancer Breast Screening Program. BC Medical Journal 2019; 61:344-352

Lui J, Sam J, Britto H, Kan L. Poster – Operationalizing Research in Screening Program: Recall Initiative using Signed Family Physician Letters. BC Cancer Summit, Vancouver. November 2019

Lui J, Sam J, Britto H, Kan L. Poster – Screening Reminders: Colour Postcards or Black and White Letters. BC Cancer Summit, Vancouver. November 2019

Presentations, Interviews and Lectures

Colin Mar

Breast Cancer Screening, Family Practice Oncology Network's GPO Training Program; Vancouver; February 11, 2019

Breast screening for transgender, gender-diverse and non-binary people: a policy update. Webinar February 25, 2019

Dense Breast Plenary Panel. 2019 Canadian Society of Breast Imaging Conference. Quebec City; May 19, 2019

Optimization of quality: evidence-based approaches. CPAC-CBCSN Addressing the Trend in Abnormal Call Rate (ACR) in Breast Cancer Screening Workshop. Halifax; Jun 20, 2019

Optimization of Quality: Panel Discussion. CPAC-CBCSN Addressing the Trend in Abnormal Call Rate (ACR) in Breast Cancer Screening Workshop. Halifax; Jun 20, 2019

Breast Cancer Screening, Family Practice Oncology Network's GPO Training Program; Vancouver; September 16, 2019

CBC Daybreak North – Interview; Oct 1, 2019

Breast Density: Facilitating Discussions with Patients and Clinicians. Vancouver Imaging Review. Vancouver; Oct 5, 2019

Cancer Screening. Future of Health Forum – Cancer Care. Kelowna; Oct 18, 2019

CBC Radio White Coat Black Art – Interview.   Nov 20, 2019

Density Matters: Breast Cancer Screening Guidelines. Family Practice Oncology CME Day; Vancouver, Nov 23, 2019

Janette Sam

Vista Radio – Interview; Oct 1, 2019

Rasika Rajapakshe

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

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

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

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September 2020