BC Cancer Agency
CARE + RESEARCH
An agency of the Provincial Health Services Authority

Screening Mammography Program

2006/2007 Annual Report

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MESSAGE FROM THE PROVINCIAL CHIEF RADIOLOGIST

In July of 2008 our Program will have been in operation for 20 years. But by that time we expect to have performed over 3.5 million examinations. We currently have 38 centres including 3 mobile services and 77 radiologist screeners.

Our annual volume continues to increase. In 2006, a record number of 266,792 examinations were completed. Province-wide participation increased an additional 1% to 50% compared with the previous report.

Professional and Academic Activities

Our annual Scientific Forum was held on October 21, 2006 with a record 250 registrants. The larger venue at the Renaissance Vancouver Hotel Harbourside enabled us to increase our capacity. Invited lecturers included Dr. Simon Sutcliffe, President, BC Cancer Agency, Dr. Edward Sickles, Professor Emeritus of Radiology, University of California San Francisco School of Medicine, Dr. Don Wilson, Medical Director, Functional Imaging, BC Cancer Agency, Dr. Elizabeth A. Rafferty, Instructor in Radiology, Harvard Medical School, Associate Director of Breast Imaging, Avon Comprehensive Breast Center, Massachusetts, General Hospital, Boston, and Ms. Debra H. Deibel, Mammography Consultant, Groton, Connecticut.

The forum focused on new and emerging technologies including digital mammography, PET and tomosynthesis. At the same time, the presentations on the challenges involved with diagnostic work-up and the ASK THE PROFESSOR, give opportunities for the registrants to identify with and relate directly to the speakers panel.

Again this year our screening program was well represented in radiologic literature with 17 publications and 5 lectures from the SMPBC representatives and scientists.

Earlier this year based on consultation between the Screener's Advisory Committee and the BCCA Breast Tumour Group, it was determined that training in breast density classification for screeners would be helpful to establish standardization mechanisms as well as help to maintain consistency. Based on this, a training module has been developed and will be available soon to radiologist screeners.

Two important reports were received this year. The first was the consultants' report "Introducing Digital Mammography into BC's Screening Mammography Program" prepared by Mr. Bert Boyd and Mr. Rick Roger. This report concluded that there are distinct advantages to the SMPBC in transitioning to digital mammography and that the Program should move in this direction. The authors recommended a staged approach with the establishment of a transition unit and mobile centre, development of information technology strategies and integration with the ten year plan of the Program, the goal of the latter to reach the National breast screening mammography target of 70% participation.

The second was the report "The Technologist Workforce: Supporting BC's Breast Cancer Screenings Targets" finalized in May. This report was long-awaited as it addressed the ongoing challenge of a shortage of medical technologists across imaging specialties. The recommendations included the establishment of a provincial task force, development of means by which the screening program can improve communication with technologists and encourages community involvement, as well as the establishment of educational and financial incentives.

Also this year, the status report on the use of facilitated "Fast Track" referral has been completed and the findings showed that facilitated referral can favorably reduce the time from abnormal screen to diagnosis. This manuscript has been submitted for publication.

Our administrative staff welcomed as our new Professional Practice Leader – SMP Technologist, Ms. Janette Sam. Janette brings extensive administrative and technical experience to her post. We also welcomed Ms. Ann MacDonald as our new SMPBC Promotion Specialist. Ann has already given a new look to our screening information brochure, based on results of focus group discussions.

Results of our 2006 client satisfaction survey are now available. Everyone can take credit for the very favorable results with satisfaction in six

categories including appointment scheduling, mammography experience, and result letters, ranging from 92 to 99%.

While these results were encouraging, perhaps most encouraging were the statistics which were presented by the Canadian Cancer Society in April of this year. These confirmed a 25% reduction in mortality from breast cancer over the last two decades throughout Canada. However, more important were BC specific data which showed not only the lowest mortality but the lowest incidence rate for breast cancer here in British Columbia. This success was underscored by our own study headed by Dr. Coldman published in late 2006 in the International Journal of Cancer which documented a 25% mortality reduction for screened versus non screened women.

Everyone involved with the SMPBC, and in particular our screenees who support our program in increasing numbers can take pride in our local, national, and international recognition.

We thank you all for your contributions.

Dr. Linda Warren
Provincial Chief Radiologist

PROGRAM OVERVIEW

The SMPBC provides standard two-view bilateral mammography to British Columbian women between ages 40 to 79 without doctor's referral. Women outside of this age group may be referred to the SMPBC by their family physicians, if they are at high risk.

Women are not eligible for screening if they have had breast cancer, breast implants, or if they currently have breast symptoms requiring a diagnostic investigation.

The Screening Process

The Screening Process is illustrated in a diagram at the end of this section. It basically consists of four stages:

1. Identify and invite the target population for screening
2. Conduct screening examination
3. Investigate abnormality identified on screening
4. Screening reminder at the appropriate interval

Screening Promotion

The SMPBC will launch the newly developed promotional/educational materials in Fall 2007. The renewed material incorporated a "call to action" to encourage women to take an active role in their breast health, and to promote SMPBC with friends and loved ones. As breast cancer risk increases with age, images of older women have greater prominence in the new materials.

Our core promotional materials (e.g. information brochures, posters, appointment pads) in a number of languages are distributed through doctors' offices, health units, libraries, community centres and other interested organizations. Our website (www.smpbc.ca) has enhanced content, including a short presentation on what happens when you have a mammogram in English, Punjabi and Chinese.

There are ongoing dialogues and projects with First Nations and ethnic community leaders to identify culturally sensitive ways to encourage participation.

Volunteers are a key to the SMPBC. A network of more than 300 volunteers assist with community promotion, and create a warm and welcoming setting for women using our mobile screening services.

With addresses provided by the Ministry of Health's Client Registry, SMPBC sends screening invitations to women turning age 50 each year. The SMPBC also sends recall reminders to women when they are due to return for another screening mammogram.

Quality Assurance and Quality Control

Quality standards and systems in the SMPBC 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 BCCA Physics Department and the scientific literature.

CAR Mammography Accreditation is mandatory for all SMPBC Centres. The SMPBC has a team of Medical Physicists and a Provincial Professional Practice Leader for Mammography Technologists to support imaging quality assurance, and to provide professional direction in equipment selection, acceptance testing and troubleshooting at screening centres around the province. The Program also supports continuing education for radiologists and technologists.

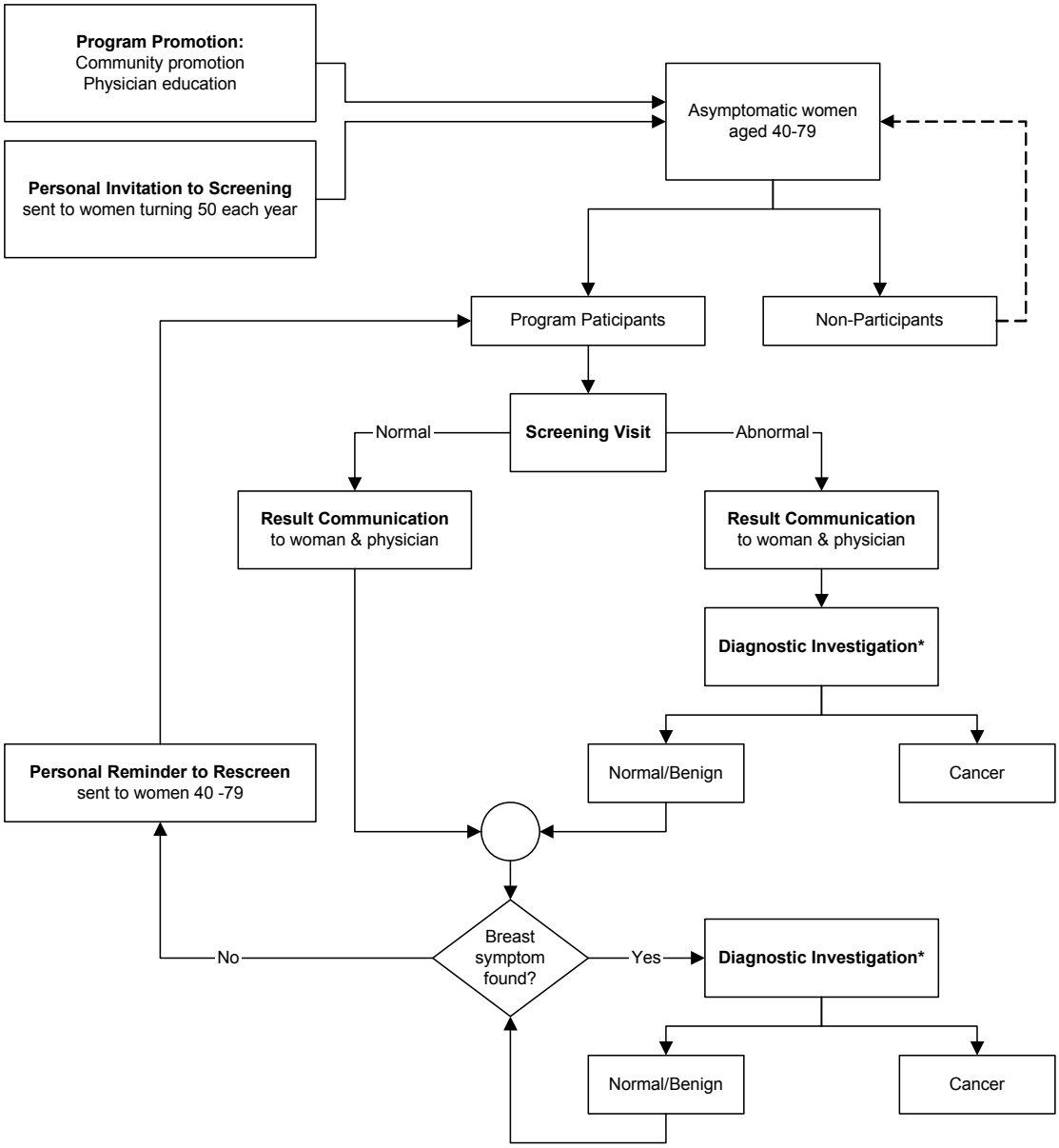
Fast Track - Facilitated Referral to Diagnostic Imaging

The SMPBC initiated in 1999 a voluntary facilitated referral to diagnostic imaging ("Fast Track") for patients with abnormal screening mammograms. Currently, 55% of general practitioners are enrolled in the Fast Track referral process. Analysis of data from January 2003 to June 2005 showed that the median time between abnormal screening report and the first assessment procedure is 1.5 weeks less for patients on Fast Track referral.

Evaluation

Data is collected and analyzed on an ongoing basis to monitor the Program's effectiveness and to identify areas for improvement. Results of this analysis are presented in the "PROGRAM RESULTS" section of this report. Age specific breast cancer incidence and mortality rates are tracked in conjunction with the BC Cancer Registry.

SMPBC Screening Process Overview



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

PROGRAM RESULTS

Recruitment and Rescreening

The SMPBC provided 266,792 examinations to 266,682 women in 2006. During this period, 43,246 examinations were performed for women attending the SMPBC for the first time and the remaining 223,546 (84%) examinations were performed on returning participants.

Figure 1 shows that the number of first time attendees in 2006 increased by 20% and the number of those women returning for an examination in 2006 increased by 1% over the previous year.

In the 24-month period of 2005 and 2006, 441,550 women age 40 and over participated in the SMPBC. Age specific participation rates by Health Service Delivery Areas (HSDA) are shown in *Table I* on the following page. In each and every HSDA, the highest participation rates were seen in the 50-59 and 60-69 age groups. The overall participation rate for women aged 50-69 was 50%, an increase of one percentage point from the last reporting period. In the Northern Health Authority, participation rates for women aged 50-69 increased by one percent in the Northeast, two percent in the North Interior and four percent in the Northwest. Overall, the Northern Health Authority participation rates for women aged 50-69 improved from 43.9% to 45.8%. The participation rate in the East Kootenay remains the lowest in the province at 30%, which was the same as in 2005/2006. The Okanagan has the highest participation rate at 57%.

Figure 1
SMPBC Annual Screening Volume between 2002 and 2006

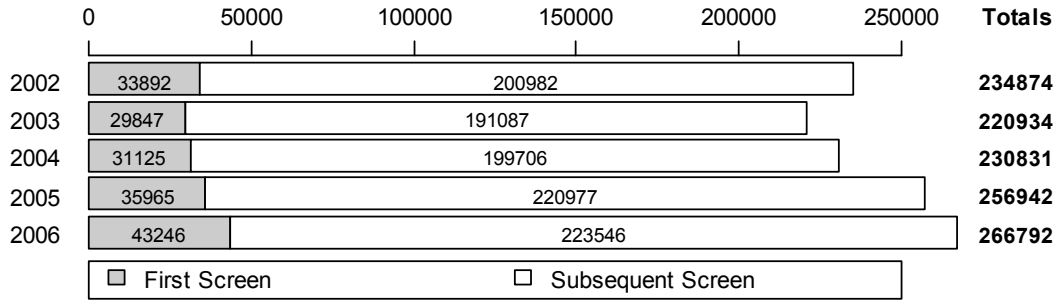


Table I
Regional Participation Rates by 10-Year Age Groups between 2005 and 2006 inclusive

Health Service Delivery Area	10-Year Age Groups					Ages
	40-49	50-59	60-69	70-79	80-89	50-69
East Kootenay	23%	29%	31%	25%	1%	30%
Kootenay Boundary	30%	40%	46%	38%	3%	43%
Okanagan	40%	53%	61%	47%	4%	57%
Thompson Cariboo Shuswap	40%	53%	58%	44%	3%	55%
Fraser East	34%	47%	51%	43%	2%	49%
Fraser North	40%	46%	48%	40%	3%	46%
Fraser South	38%	46%	47%	37%	2%	46%
Richmond	52%	52%	49%	42%	3%	51%
Vancouver	40%	52%	51%	37%	2%	52%
North Shore/Coast Garibaldi	37%	42%	45%	40%	3%	43%
South Vancouver Island	37%	51%	55%	48%	3%	53%
Central Vancouver Island	35%	54%	60%	46%	4%	56%
North Vancouver Island	35%	53%	59%	44%	2%	55%
Northwest	26%	41%	41%	29%	1%	41%
Northern Interior	38%	51%	51%	39%	2%	51%
Northeast	26%	39%	39%	37%	2%	39%
British Columbia	**38%**	**49%**	**51%**	**41%**	**3%**	**50%**

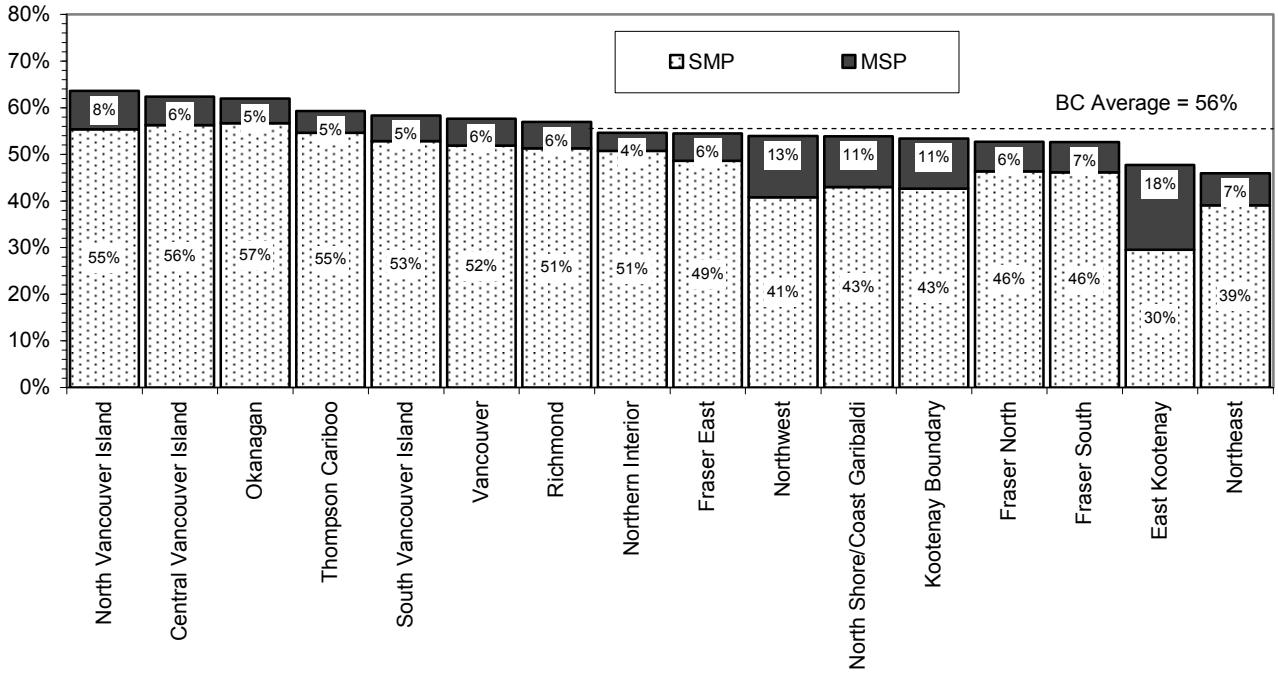
Notes:

1. Based on the average of 2005 and 2006 female population estimates.
2. Population data source: P.E.O.P.L.E. 31 population estimates (May 2006), BC STATS, BC Ministry of Labour and Citizens' Services.
3. Postal code translation file: TMF0705 (May 2007).
4. Population and postal code data acquired through the Health Data Warehouse and BC Ministry of Health.
5. SMP data extraction date: August 20, 2007

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

Figure 2 shows the proportion of women receiving bilateral mammography service through SMPBC and MSP. In Health Service Delivery Areas with long standing SMPBC service, the proportion of women using MSP bilateral mammography has stabilized to 4%-7%. Over the two-year period, some women may have had services through SMPBC, as well as MSP. The proportions presented may be slightly higher than the actual figures because of possible duplication. During the two years of 2005 and 2006, 56% of BC women age 50-69 received bilateral mammography services. The percent of women age 50-69 receiving bilateral mammography ranged from 46% to 64% across the province, with East Kootenay and Northeast with the lowest percentages. Overall, the SMPBC provided 88% of the bilateral mammography services for this age group.

Figure 2
Bilateral Mammography Utilization by Women Aged 50-69 Years in BC between 2005 and 2006



Notes:

1. MSP data includes only MSP FFS item 8611 on female patients only; all out of province claims are excluded.
2. MSP data contains payment data to July 15, 2007 for services provided within years 2005 and 2006, excluding women who came for the service more then once in 2 years.
3. SMP data includes single screen per woman provided in calendar years 2005 and 2006.
4. 2005 and 2006 Estimated Population Data Source: P.E.O.P.L.E. 31, BC Ministry of Health Planning.
5. SMP data extraction date: August 20, 2007

Ethnic origin data was collected at the time of SMPBC registration (28% of attendees did not specify their ethnicity and were excluded) and population estimates by Health Service Delivery Area were obtained from Statistics Canada's 2001 Census.

The regional representation of selected ethnic groups both in the SMPBC and in British Columbia is shown in *Table II.*

Ethnic population estimates, especially East/South East Asian population, may be under-represented in the Simon Fraser, Richmond and Vancouver Health Service Delivery Areas.

Table II
Regional Ethnic Representation of Women Aged 50-69 Years in the Population and within the SMPBC Participants

Health Service Delivery Area	First Nations		East/South-East Asians		South Asians	
	Population	SMPBC	Population	SMPBC	Population	SMPBC
11 East Kootenay	1.0%	2.8%	1.0%	2.0%	0.6%	1.1%
12 Kootenay Boundary	0.5%	1.2%	1.2%	1.9%	0.2%	0.3%
13 Okanagan	0.7%	1.0%	1.4%	1.7%	0.8%	1.1%
14 Thompson Cariboo Shuswap	3.6%	4.4%	1.3%	2.7%	1.3%	1.6%
21 Fraser Valley	1.3%	1.4%	1.7%	2.8%	6.4%	6.6%
22 Simon Fraser	0.5%	0.4%	18.8%	26.5%	4.6%	5.1%
23 South Fraser	0.4%	0.6%	6.1%	9.0%	10.5%	11.0%
31 Richmond	0.2%	0.2%	38.7%	50.2%	6.0%	6.3%
32 Vancouver	0.8%	0.8%	37.5%	42.3%	4.1%	5.5%
33 North Shore/Coast Garibaldi	1.5%	1.6%	5.5%	8.2%	2.2%	3.1%
41 South Vancouver Island	0.7%	1.0%	3.9%	4.9%	1.2%	1.8%
42 Central Vancouver Island	1.9%	1.4%	1.2%	1.7%	1.1%	1.3%
43 North Vancouver Island	2.2%	2.2%	1.3%	1.3%	0.3%	0.4%
51 Northwest	14.5%	20.8%	2.1%	1.9%	2.0%	2.9%
52 Northern Interior	3.5%	6.5%	1.4%	2.2%	2.5%	3.1%
53 Northeast	5.1%	5.1%	1.1%	0.3%	0.0%	0.9%
British Columbia	1.4%	1.6%	11.0%	15.1%	3.8%	4.5%

SMPBC Data:

1. Women attended the SMPBC at least once in 2005-2006 inclusive.
2. *East/South-East Asians* include Chinese, Japanese, Korean, Filipino, Thai, Vietnamese, Indonesian, Malay, Mongolian, and Tibetan.
3. *South Asians* include Punjabi, Singhalese, Tamil, Bangladeshi, East Indian, Pakistani, and Sri Lankan.
4. Data extraction data: August 20, 2007

Population Data:

1. Original data source - 2001 Census, Statistics Canada
2. E*ast/South-East Asians* include Chinese, Filipino, Burmese, Cambodian, Laotian, Thai, Vietnamese, Indonesian, Japanese, Korean, Malay, Mongolian, Taiwanese, Tibetan, Asian n.i.e and East/Southeast Asian n.i.e
3. *South Asians* include Bangladeshi, Bengali, East Indian, Hindu, Goan, Gujarati, Pakistani, Ismali, Muslim, Punjabi, Sikh, Sinhalese, Sri Lankan, Tamil, and South Asian n.i.e.

The effectiveness of regular screening mammography is universally recognized for women age 50-69. The BCCA Breast Tumour Group recommends screening at least every two years for women age 40-79. However, research evidence indicates that the sojourn time (i.e. the duration that the disease remains in the pre-clinical, screen-detectable phase) is shorter for women age 40-49 than for older women. Consequently, SMPBC reminds women age 40-49 to return annually.

The SMPBC sends recall reminders to women in accordance with the interval recommendation. A second letter is sent if there is no appointment scheduled within 4-6 weeks after the first letter. This two-letter reminder system is repeated again for another year if there is no response.

Figure 3 and *Figure 4* show the return rates by year of the previous screening examination for women age 40-49 and 50-69 respectively as of July 25, 2006. The last 6 months of the 2004 data for older subgroup should be interpreted with caution, because a significant proportion of the cohort was not yet due to return. Women who had breast cancer or implants or died after the screen examination were removed from the calculation (censored).

Most women are returning in accordance to the recommended screening interval for their age group. 29% of women age 50-69 screened in 2005 elected to return prior to receiving the SMPBC recall letter, which was sent approximately 22 months after the last screen.

Figure 3
Return Rates by Calendar Year of Previous Screen
of Women Aged 40-49 Years

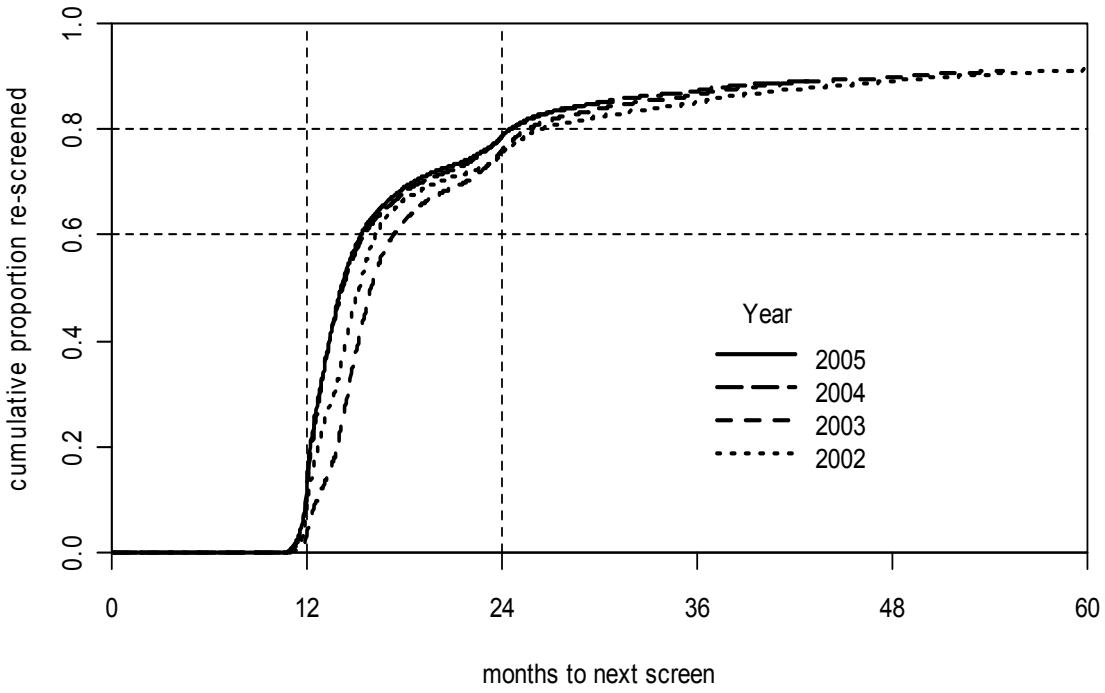


Figure 4
Return Rates by Calendar Year of Previous Screen
of Women Aged 50-69 Years

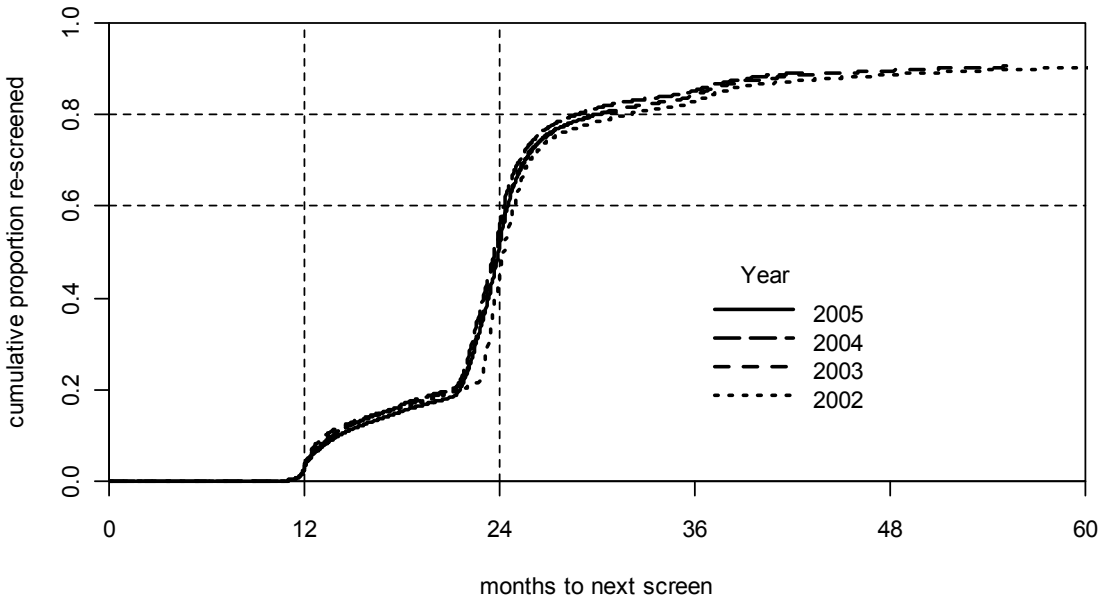


Table III summarizes the compliance (return) rate by the year of previous screening examination in 6-month intervals. The proportion of age 50-69 women returning within 24 months has improved by around one percentage point over 2003 and ten percentage points over 2002.

Table III
Cumulative Numbers and Proportions Re-screened
Women Aged 50-69 Years

Calendar Year of the Previous Screen	2002		2003		2004	
Total Number to be Re-screened	120,155		118,077		123,158	
Returned by						
▪ **18 months**	19,643	16%	19,739	17%	20,936	17%
▪ **24 months**	53,793	45%	63,296	54%	67,751	55%
▪ **30 months**	94,213	78%	94,289	80%	100,115	81%
▪ **36 months**	99,742	83%	99,517	84%	104,311	85%

SMP data extraction date: August 20, 2007

2006 Screening Results

Table IV summarizes the outcome indicators for screening provided in the calendar year 2006 by 10-year age groups. Of the 266,792 screening mammograms performed, 19,702 (7.4%) had an abnormal result and 1020 breast cancers were reported as of August 20, 2007 (3.9 per 1,000 exams), including 234 in-situ cancers. For every age group, the abnormal call rate is lower on subsequent screens than on first screens. The overall abnormal call rate decreased with age between 40-49 and 70-79 from 8.3% to 5.3%. Cancer detection rates, positive predictive values and biopsy yield ratios increase with age.

Table IV
SMPBC Outcome Indicators by 10-Year Age Groups
Year 2006

Outcome Indicators	Age at Exam						All
	<40	40-49	50-59	60-69	70-79	80+	
Number of Exams	300	94,720	85,613	54,037	30,806	1,316	266,792
	0.1%	35.5%	32.1%	20.3%	11.5%	0.5%	
Number of First Screens	263	28,164	9,104	2,966	980	91	41,568
	0.6%	67.8%	21.9%	7.1%	2.4%	0.2%	
Number of Cancers	0	184	295	309	221	11	1,020
	0.0%	18.0%	28.9%	30.3%	21.7%	1.1%	
Abnormal Call Rate	10.7%	8.3%	6.7%	5.9%	5.3%	6.2%	7.0%
▪ **on first screens**	10.6%	12.8%	13.3%	14.5%	14.4%	16.5%	13.1%
▪ **on subsequent screens**	10.8%	6.5%	5.9%	5.4%	5.0%	5.4%	5.8%
Overall Cancer Detection Rate (per 1,000)	0.0	2.0	3.5	5.9	7.4	8.8	3.9
▪ **on first screens**	0.0	3.2	6.1	15.7	16.1	0.0	5.0
▪ **on subsequent screens**	0.0	1.5	3.2	5.3	7.1	9.5	3.7
DCIS Detection Rate (per 1,000)	0.0	0.6	1.0	1.2	1.0	0.8	0.9
Positive Predictive Value of Screening Mammography	0.0%	2.2%	5.1%	10.1%	14.0%	13.9%	5.4%
Biopsy Yield Ratio	---	19.5%	34.4%	51.6%	58.0%	64.7%	36.3%
▪ **Benign : Malignant**	---	4.1 : 1	1.9 : 1	0.9 : 1	0.7 : 1	0.5 : 1	1.8 : 1

Notes:

1. See Glossary in the Appendix for definitions of terms.
2. Overall Cancer Rate includes ductal carcinoma in situ (DCIS)
3. 6780 screens were given to women who declined consent for their follow-up information to be used. Information from these screens is excluded from all entries in the table other than numbers of exams and abnormal call rates.
4. An additional 263 abnormal screens had incomplete or lost followup. Information from these screens is excluded from all entries in the table other than exam counts and abnormal call rates.
5. Out of 18984 "abnormal" screens with consent and complete follow-up, there were 15 lobular carcinoma in-situ cases. The final number of cancers is still to be determined.
6. SMPBC data extraction date: August 20, 2007.

Diagnostic procedure information is available on 18,984 (96.0%) of the abnormal screening mammograms to date. Of these abnormal screens, 91 were lost to follow-up. *Table V* shows the proportion of women receiving specific diagnostic procedures as part of the work-up on their screen detected abnormalities. Overall, 7% of women with abnormal screening mammograms had an open biopsy.

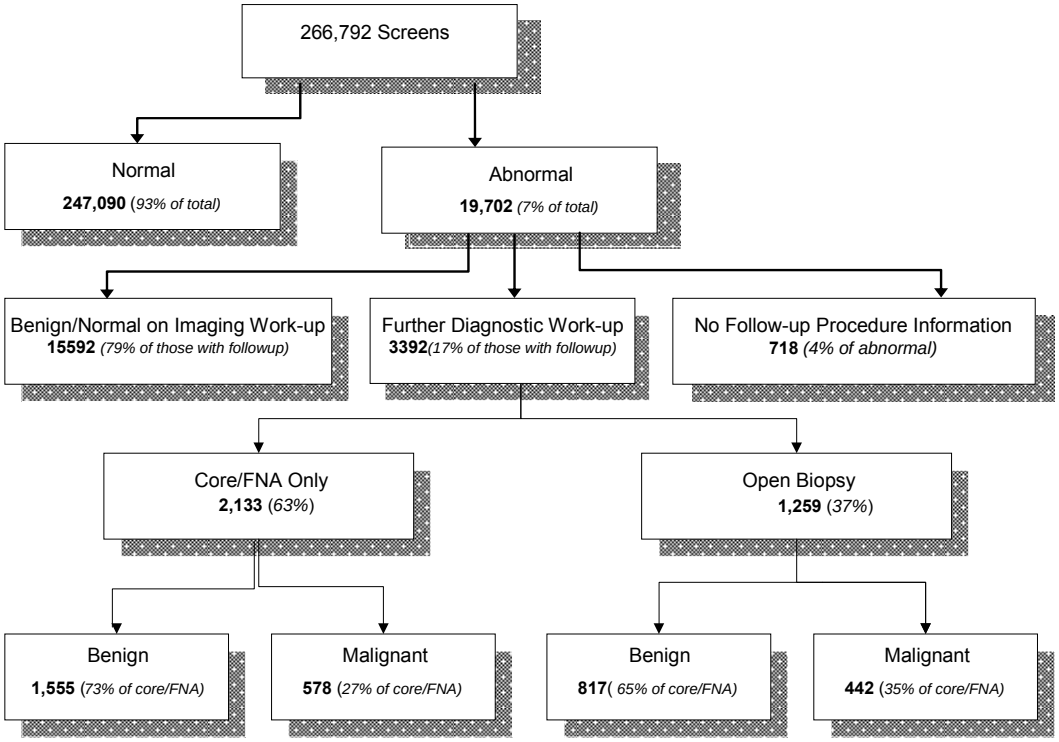
The last two tables present screening results by Health Service Delivery Areas (HSDA).

Table V
Diagnostic Procedures Received by SMPBC Participants with "Abnormal" Screening Mammograms in 2006

Procedure	Age at Exam						All
	<40	40-49	50-59	60-69	70-79	80+	
Diagnostic Mammogram	94%	90%	92%	93%	93%	92%	91%
Ultrasound	42%	65%	63%	62%	61%	46%	64%
Fine Needle Aspiration	6%	5%	5%	5%	5%	3%	5%
Core Biopsy	0%	8%	9%	10%	12%	13%	9%
Surgical Biopsy	6%	4%	7%	9%	11%	8%	6%
▪ **with Localization**	3%	4%	6%	9%	10%	8%	6%
Number of cases with diagnostic assessment information available	36	8,444	5,784	3,060	1,581	79	18,984

SMPBC data extraction date August 21, 2007

Figure 5
Screening Outcome Summary 2006



SMPBC Volume by Health Service Delivery Area (HSDA)
Year 2006

HSDA	Total Exams	Age Distribution of All Exams						First Exams		Age Distribution of First Exams					
		<40	40-49	50-59	60-69	70-79	80+	n	% total	< 40	40-49	50-59	60-69	70-79	80+
East Kootenay	3,154	0%	33%	32%	23%	11%	0%	484	15%	1%	57%	27%	11%	4%	0%
Kootenay Boundary	4,394	0%	29%	33%	24%	14%	0%	661	15%	0%	55%	29%	10%	5%	0%
Okanagan	24,662	0%	30%	30%	24%	15%	1%	3,604	15%	1%	62%	24%	10%	3%	0%
Thompson Cariboo	15,243	0%	33%	32%	24%	11%	0%	2,057	13%	1%	69%	21%	8%	2%	0%
Fraser Valley	14,451	0%	34%	30%	21%	14%	0%	2,633	18%	0%	66%	23%	8%	3%	0%
Simon Fraser	34,305	0%	41%	32%	17%	10%	0%	5,941	17%	0%	72%	19%	6%	2%	0%
South Fraser	36,250	0%	38%	32%	19%	10%	0%	6,057	17%	0%	71%	21%	6%	2%	0%
Richmond	13,329	0%	40%	34%	17%	9%	0%	1,945	15%	0%	72%	20%	6%	2%	0%
Vancouver	35,607	0%	39%	33%	18%	10%	0%	6,121	17%	0%	70%	21%	6%	2%	0%
North Shore / Coast Garibaldi	17,347	0%	36%	31%	20%	12%	0%	2,770	16%	1%	70%	21%	6%	2%	0%
South Vancouver Island	26,225	0%	30%	33%	22%	14%	1%	3,888	15%	0%	63%	26%	8%	3%	0%
Central Vancouver Island	18,296	0%	27%	32%	25%	15%	0%	2,719	15%	1%	57%	27%	12%	3%	0%
North Vancouver Island	7,974	0%	33%	33%	22%	11%	0%	1,350	17%	1%	63%	24%	10%	2%	0%
North West	3,234	0%	38%	35%	19%	9%	0%	668	21%	0%	67%	23%	7%	2%	0%
Northern Interior	8,726	1%	39%	34%	19%	8%	0%	1,410	16%	3%	72%	19%	5%	1%	0%
Northeast	2,610	0%	39%	35%	17%	9%	0%	624	24%	1%	66%	23%	7%	2%	0%
Program	266,792	36%	36%	32%	20%	12%	0%	43,246	16%	1%	67%	22%	7%	2%	0%

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Outcome Indicators by Health Service Delivery Area (HSDA)
Year 2006

HSDA	Year: 2006					Preceding 2 Years: 2004-2005							
		Cancer Detection Rate (per 1000)					Cancer Detection Rate (per 1000)				In-Situ : Invasive (number)	% Invasive ≤15 mm	% Invasive with +iv nodes
	% Called Abnormal	Overall	First Screens	Subsequent Screens	PPV	% Called Abnormal	Overall	First Screens	Subsequent Screens	PPV			
East Kootenay	5%	1.9	6.2	1.1	4%	5%	5.1	0.9	5.9	10%	3 : 28	54%	32%
Kootenay Boundary	5%	3.4	3.0	3.5	7%	5%	4.6	4.0	4.7	9%	13 : 27	67%	22%
Okanagan	5%	4.4	4.2	4.4	8%	5%	4.1	4.6	4.0	8%	49 : 138	66%	25%
Thompson Cariboo	5%	3.3	4.9	3.1	6%	5%	4.4	3.7	4.5	9%	23 : 105	64%	30%
Fraser Valley	11%	5.1	5.0	5.1	5%	11%	4.9	6.3	4.7	4%	22 : 105	56%	25%
Simon Fraser	8%	3.5	4.7	3.2	4%	8%	4.2	4.5	4.2	5%	78 : 184	70%	26%
South Fraser	9%	3.8	4.8	3.6	4%	9%	4.2	5.4	4.0	5%	64 : 223	63%	27%
Richmond	8%	3.2	5.7	2.7	4%	8%	3.4	4.1	3.3	4%	26 : 62	66%	29%
Vancouver	8%	4.0	5.0	3.8	5%	8%	4.1	4.3	4.1	5%	91 : 183	71%	23%
North Shore / Coast Garibaldi	6%	3.9	4.0	3.8	6%	6%	4.2	3.5	4.4	8%	35 : 93	76%	23%
South Vancouver Island	5%	3.1	2.8	3.1	6%	4%	3.2	3.6	3.2	8%	21 : 127	59%	29%
Central Vancouver Island	6%	5.0	6.3	4.8	9%	5%	5.4	6.3	5.2	10%	34 : 142	69%	23%
North Vancouver Island	5%	3.8	5.2	3.5	7%	5%	4.4	2.6	4.6	9%	16 : 44	73%	27%
Noth West	6%	3.1	4.5	2.7	5%	6%	3.9	3.7	3.9	7%	5 : 16	56%	38%
Northern Interior	7%	4.3	4.3	4.2	6%	7%	3.7	2.3	4.0	5%	16 : 41	56%	38%
Northeast	7%	2.3	1.6	2.5	3%	7%	3.2	4.4	3.0	4%	3 : 10	60%	20%
Program	**7%**	**3.8**	**4.7**	**3.7**	**5%**	**7%**	**4.2**	**4.5**	**4.1**	**6%**	**Standard:**	***> 50%***	***< 30%***

Notes:

Cancer Detection Rate is the proportion of cases found to have breast cancer by screening mammography.

Positive Predictive Value (PPV) is the percent of abnormals found to have breast cancer after screen-initiated diagnostic workup.

Data extraction date August 20, 2007

2005 Cancer Detection

Histologic features of breast cancers detected by SMPBC in 2005 are summarized by 10-year age groups in *Table VI*. Histologic features of breast cancer cases were obtained from the pathology reviews if available, otherwise from the original diagnostic reports. Invasive tumour size was determined from the best available source: (1) pathological, (2) radiological, (3) clinical. The TNM cancer staging was determined by assuming no regional lymph node involvement (N0) whenever axilliary lymph nodes were not assessed and no distant metastases (M0) unless otherwise informed.

Overall, 74% of cancers detected were in situ or stage I. Of the invasive cancers detected, 66% were ≤15 mm, 25% had invasion of the regional lymph nodes and 27% were grade 3 (i.e. poorly differentiated) tumours. Of the grade 3 tumours, 50% were smaller than 15mm. These overall outcome indicators met international targets recommended for screening programs.

Table VI
Histologic Features of Breast Cancers Detected by SMPBC
Year 2005

Histological Features	Age at Exam					Age 40+
	40-49	50-59	60-69	70-79	80+	
Number of Cancers TNM Staging	174	319	373	229	14	1,109
▪ **in situ**	53 30%	81 25%	80 21%	45 20%	1 7%	260 23%
▪ **invasive**	121 70%	238 75%	293 79%	184 80%	13 93%	849 77%
▪ **I**	76 63%	142 61%	196 67%	132 72%	11 85%	557 66%
▪ **II**	42 35%	89 38%	90 31%	45 25%	2 15%	268 32%
▪ **III+**	3 2%	3 1%	5 2%	6 3%	0 0%	17 2%
▪ **unknown stage**	(0)	(4)	(2)	(1)	(0)	(7)
Invasive Tumour Size						
▪ **≤5 mm**	15 13%	14 6%	29 10%	20 11%	3 23%	81 10%
▪ **6-10 mm**	27 23%	60 26%	88 30%	57 31%	5 38%	237 28%
▪ **11-15 mm**	37 31%	56 24%	88 30%	56 31%	1 8%	238 28%
▪ **16-20 mm**	16 13%	51 22%	32 11%	30 16%	4 31%	133 16%
▪ **>20 mm**	24 20%	52 22%	54 19%	20 11%	0 0%	150 18%
▪ **unknown size**	(2)	(5)	(2)	(1)	(0)	(10)
Invasive with tumour ≤ 15 mm	79 66%	130 56%	205 70%	133 73%	9 69%	556 66%
Node Involvement in Invasive						
▪ **no nodes sampled**	12 10%	10 4%	16 5%	24 13%	1 8%	63 7%
▪ **no**	77 64%	161 68%	208 71%	120 65%	10 77%	576 68%
▪ **yes**	32 26%	67 28%	69 24%	40 22%	2 15%	210 25%
Histologic Grade of Invasive						
▪ **1 - *well differentiated***	29 25%	68 31%	85 30%	61 36%	9 69%	252 32%
▪ **2 - *moderately differentiated***	52 46%	86 39%	119 43%	74 43%	4 31%	335 42%
▪ **3 - *poorly differentiated***	33 29%	68 31%	75 27%	36 21%	0 0%	212 27%
▪ **unknown grade**	(7)	(16)	(14)	(13)	(0)	(50)
Grade 3 tumour ≤ 15 mm	19 58%	26 38%	39 52%	22 61%	0	106 50%

Notes:

1. TNM staging was determined by using mammographic measurement whenever pathologic measurement of the tumour was not available, and by assuming N0 whenever nodes were not assessed, and M0 unless otherwise informed.
2. Targets: >50% invasive tumours ≤ 15 mm, <30% invasive tumours with positive nodes, >30% grade 3 tumours ≤ 15 mm
3. SMPBC data extraction date: August 20, 2007.

Outcome Indicators by Calendar Year: 2002-2006

The overall abnormal call rate in 2005 of 7.0% is slightly less than the previous year (7.2%) and the 5 year average of 7.1%. The overall cancer detection rate, as well as the rate for subsequent screens for 2006 is lower than the respective 5 year averages, while the cancer detection rate for first screens seems slightly higher than previous years. This difference is possibly due to the number of cancers in 2005 not being complete. The biopsy yield ratio is lower than the previous two years, and is lower than the average during the 5-year period.

Regular record linkage with the British Columbia Cancer Registry enables the SMPBC to determine the number of non-screen detected (interval) cancers in SMPBC participants for each year. 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 VII*. The SMPBC conducts formal reviews, both blinded and retrospective, of all interval cancers in SMPBC 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 SMPBC, prevalent screens have been restricted to those women with no previous outside mammogram within 24 months of their first SMPBC encounter. Swedish two-county study showed a prevalence to expected incidence ratio of 3.09 for age 50-59 and 4.59 for age 60-69[1] and had recommended the target of >3.0 for organized screening programs[2]. The annual prevalence to expected incidence ratios for age 50-79 have consistently been above 3 from 1995 onwards.

References

1. Tabar L, Fagerberg G, Duffy, SW, Day NE, Gad A, Grontoft O. Update of The Swedish Two-Country Program of Mammographic Screening for Breast Cancer. Radiol Clin North Am 1992;30:187-209

2. Day NE, Williams DRR, Khaw KT. Breast cancer screening programmes: the development of a monitoring and evaluation system. Br J Cancer 1989;59:954-958

Table VII
SMPBC Outcome Indicators by Calendar Year between 2002 and 2006 inclusive

Outcome Indicators	Calendar Year					5-Year Cumulative
	2002	2003	2004	2005	2006	
Number of Exams	234,874	220,934	230,831	256,941	266,792	1,210,372
% first screens	14.4%	13.5%	13.5%	14.0%	16.2%	
Number of Cancers	1,035	909	925	1,109	1,020	4,998
% on first screens	15.7%	15.3%	16.2%	13.3%	19.6%	
Abnormal Call Rate	6.8%	7.1%	7.1%	7.2%	7.4%	7.1%
▪ **on first screens**	13.1%	14.3%	14.7%	15.1%	14.9%	14.4%
▪ **on subsequent screens**	5.7%	6.0%	5.9%	5.9%	5.9%	5.9%
Overall Cancer Detection Rate (per 1,000)	4.5	4.2	4.1	4.4	3.9	4.3
▪ **on first screens**	5.0	4.8	5.0	4.3	4.8	4.8
▪ **on subsequent screens**	4.4	4.1	4.0	4.5	3.8	4.3
DCIS Detection Rate (per 1,000)	1.0	1.0	1.1	1.0	0.9	1.0
Positive Predictive Value of Screening Mammography	6.8%	6.0%	5.9%	6.2%	5.4%	6.2%
Biopsy Yield Ratio	45.0%	39.2%	39.9%	42.8%	37.3%	41.7%
▪ **Benign : Malignant**	1.2 : 1	1.6 : 1	1.5 : 1	1.3 : 1	1.7 : 1	1.4 : 1
Interval Cancer Rate (per 1,000)						
▪ **0-12 months**	0.65	0.66	0.59	0.52	---	---
after first screens	0.89	0.52	0.37	0.55	---	---
after subsequent screens	0.61	0.69	0.62	0.51	---	---
▪ **13-24 months**	0.71	0.72	0.66	---	---	---
Sensitivity *(i.e. 1 - false negative rate)*	87.5%	86.4%	87.5%	---	---	---
Specificity *(i.e. 1 - false positive rate)*	93.6%	93.3%	93.3%	93.2%	---	---
Prevalence to Expected Incidence Ratio for Age 50-79 (*target*[2] *: >3.0*)	3.40	3.00	3.20	3.20	3.40	3.24

Notes:

1. SMPBC data extraction date: August 20, 2007
2. The final number of cancers in 2005 is still to be determined.
3. Overall Cancer Rate includes ductal carcinoma in situ (DCIS).
4. Numbers of cancers and related rates do not include data for women who declined consent for their information to be used or if the follow-up is incomplete.
5. See Glossary in the Appendix for definitions of terms.

Outcome Indicators by Age: 2002-2006

In the 5-year period from 2002 to 2006, the SMPBC provided 1,210,373 screening mammography examinations to 551,365 women. Outcome indicators for this 5-year period are summarized by 10-year age groups in *Table VIII*. The abnormal call rate is generally lower for older ages. Additionally, the risk of breast cancer increases with age, which is reflected by higher cancer detection rates for older women. An increasing trend with age is observed in the positive predictive value of screening mammography, biopsy yield ratio and specificity.

Table VIII
SMPBC Outcome Indicators by 10-Year Age Groups between 2002 and 2006 inclusive

Outcome Indicators	Age at Exam					All
	40-49	50-59	60-69	70-79	80+	
Number of Exams	414,045	390,644	249,255	148,898	6,082	1,210,372
	34.2%	32.3%	20.6%	12.3%	0.5%	
Number of Cancers	844	1,508	1,512	1,071	61	4,998
	16.9%	30.2%	30.3%	21.4%	1.2%	
Abnormal Call Rate	8.6%	6.9%	6.0%	5.4%	6.6%	7.1%
▪ **on first screens**	14.2%	15.6%	14.5%	13.0%	14.3%	14.4%
▪ **on subsequent screens**	6.5%	6.0%	5.5%	5.1%	5.8%	5.9%
Overall Cancer Detection Rate (per 1,000)	2.1	4.1	6.3	7.4	11.0	4.3
▪ **on first screens**	2.9	6.3	10.9	14.9	12.7	4.8
▪ **on subsequent screens**	1.8	3.9	6.1	7.2	10.8	4.3
DCIS Detection Rate (per 1,000)	0.6	1.0	1.4	1.4	0.7	1.0
Positive Predictive Value of Screening Mammography	2.6%	6.0%	10.7%	14.0%	16.6%	6.2%
Biopsy Yield Ratio	20.7%	36.9%	52.2%	59.6%	61.5%	38.6%
▪ **Benign : Malignant**	3.8 : 1	1.7 : 1	0.9 : 1	0.7 : 1	0.6 : 1	1.6 : 1
Interval Cancer Rate (per 1,000)						
▪ **0-12 months**	0.58	0.54	0.64	0.78	0.22	0.60
after first screens	0.55	0.55	0.72	1.49	0.00	0.59
after subsequent screens	0.60	0.53	0.64	0.75	0.25	0.60
▪ **13-24 months**	0.01	0.79	0.90	1.03	1.99	0.59
Sensitivity *(i.e. 1 - false negative rate)*	78.4%	88.4%	90.8%	90.5%	98.0%	87.8%
Specificity *(i.e. 1 - false positive rate)*	91.9%	93.6%	94.7%	95.4%	94.4%	93.5%

Notes:

1. SMPBC data extraction date: August 20, 2007.
2. The final number of cancers in 2005 is still to be determined.
3. Overall Cancer Rate includes ductal carcinoma in situ (DCIS).
4. The 'All' column includes women less than 40 years of age.
5. Rates and proportions involving cancer diagnoses are based upon the first 4 years only.
6. See glossary in the Appendix for definitions of terms.

Cancer Characteristics by Age Year: 2002-2006

From the start of the Program in July 1988 to December 2005, 9,886 women have been found to have breast cancer through screen-initiated work-up. Histologic features of breast cancers detected by SMPBC cumulative to and including 2004 are summarized by 10-year age groups in *Table IX*. The data for women younger then 40 are included in the totals but not listed in a separate column. Internationally recommended targets have been achieved in all age groups. However, invasive cancers found in women age 40-49 tend to be larger, more likely to have Grade 3 histology and more likely to involve nodes than cancers found in the older women.

Table IX
Histologic Features of Breast Cancers Detected by SMPBC
Cumulative up to and including 2005

Histologic Features	Age at Exam										All	
	40-49		50-59		60-69		70-79		80+			
Number of Cancers	1,666		2,846		2,956		2,229		182		9,886	
▪ **in situ**	524	31%	751	26%	640	22%	414	19%	18	10%	2,349	24%
▪ **invasive**	1,142	69%	2,095	74%	2,316	78%	1,815	81%	164	90%	7,537	76%
TNM Staging												
▪ **I**	670	60%	1,320	64%	1,611	70%	1,324	74%	121	74%	5,050	68%
▪ **II**	419	37%	691	33%	632	27%	418	23%	37	23%	2,198	29%
▪ **III+**	37	3%	60	3%	61	3%	58	3%	5	3%	221	3%
▪ **unknown stage**	(16)		(24)		(12)		(15)		(1)		(68)	
Invasive Tumour Size												
▪ **≤ 5 mm**	118	11%	202	10%	209	9%	136	8%	14	9%	679	9%
▪ **6-10 mm**	222	20%	501	24%	638	28%	559	31%	45	28%	1,966	26%
▪ **11-15 mm**	327	29%	569	28%	734	32%	557	31%	51	31%	2,239	30%
▪ **16-20 mm**	163	15%	367	18%	332	14%	277	15%	28	17%	1,169	16%
▪ **>20 mm**	293	26%	429	21%	389	17%	270	15%	25	15%	1,407	19%
▪ **unknown size**	(19)		(27)		(14)		(16)		(1)		(77)	
Invasive Tumour ≤ 15 mm	667	59%	1272	62%	1581	69%	1252	70%	110	67%	4884	65%
Node Involvement												
▪ **no nodes sampled**	101	9%	178	8%	217	9%	280	15%	63	38%	839	11%
▪ **no**	727	64%	1,411	67%	1,638	71%	1,249	69%	82	50%	5,112	68%
▪ **yes**	314	27%	506	24%	461	20%	286	16%	19	12%	1,586	21%
Histologic Grade												
▪ **1 - *well differentiated***	287	28%	645	35%	739	36%	646	41%	52	37%	2,369	36%
▪ **2 - *moderately differentiated***	441	43%	722	39%	883	43%	672	43%	63	44%	2,783	42%
▪ **3 - *poorly differentiated***	287	28%	466	25%	424	21%	252	16%	27	19%	1,458	22%
▪ **unknown grade**	(127)		(262)		(270)		(245)		(22)		(927)	
Grade 3 Tumour ≤ 15 mm	112	39%	212	45%	236	56%	119	47%	13	48%	702	48%

Notes:

1. TNM staging was determined by using mammographic measurement whenever pathologic measurement of the tumour was not available, and by assuming N0 whenever nodes were not assessed, and M0 unless otherwise informed.
2. Targets: >50% invasive tumours ≤ 15 mm, <30% invasive tumours with positive nodes, >30% grade 3 tumours ≤ 15 mm
3. The 'All' column includes women less than 40 years of age.
4. SMPBC data extraction date: August 20, 2007.

Comparison with Canadian Standards

The necessity to standardize evaluation of Canadian breast cancer screening programs was first recognized in 1990. In December 1992, the Canadian Breast Cancer Initiative (CBCI) was launched. Under the Canadian Breast Cancer Screening component of this initiative, Health Canada facilitated a federal/provincial/territorial network that enabled collaboration in the implementation and evaluation of breast cancer screening programs in Canada.

The Canadian Breast Cancer Screening Database (CBCSD) was first established in 1993. Currently all provincial programs 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.

In this section, SMPBC performance measures are presented against the targets set for Canadian breast cancer screening programs. These targets are presented in the report: Guidelines for Monitoring Breast Screening Program Performance, published in 2002[3]. 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. These national guidelines have recently been reviewed and it is anticipated that an update will be available in the very near future.

Table X
Comparison of SMPBC Performance with Canadian Breast Screening Standards for Women Aged 50-69 Years

Performance Measure	National Target	SMPBC 2005-2006
Participation Rate (1)	≥70% of the eligible population	50% (plus 7% MSP)
Retention Rate (2)	≥75% re-screened within 30 months	81%
Abnormal Call Rate (3)	<10% first screens <5% re-screens	16.3% 5.7%
Invasive Cancer Detection Rate (3)	>5 per 1,000 first screens >3 per 1,000 re-screens	8.47 per 1,000 4.07 per 1,000
In Situ Cancer Detection Rate (3)	Surveillance and Monitoring only, 04-1.0 per 1,000 in UK standards	1.08 per 1,000
Positive Predictive Value (3)	≥5% first screen ≥6% re-screens	5.2% 7.2%
Benign to Malignant Open Biopsy Ratio (4)	≤2:1	1.4 : 1
Invasive Tumour size ≤10 mm (4)	>25%	36%
Positive Lymph Nodes in Cases with Invasive Cancer (4)	<30%	26%

Notes:
1. Screen years: (1) = 2005 & 2006, (2) = 2004 & 2005, (3) = 2006, (4) = 2005 2. Population data source: P.E.O.P.L.E. 31, Ministry of Health Planning.

Reference:

Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Screening Program Performance. Health Canada 2002.

Cost Analysis

The SMPBC is funded by the provincial Ministry of Health through the Provincial Health Services Authority (PHSA). It contracts with both public and private facilities to operate screening centres, including mobile services, throughout the province. The SMPBC Central Office provides overall program administration and coordination, including a provincial toll-free call centre, result mail-out, invitation and recall reminder system, follow-up tracking, quality management, promotion, program evaluation and research support.

Costing analysis by fiscal year is summarized in *Table XI*.

Financial reports for PHSA and BCCA are available at the PHSA website: www.phsa.ca/whoweare/budget+accountability

Table XI
Cost Comparison by Fiscal Year

Indicator	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Total Cost	$13,016,098	$13,005,919	$13,401,773	$15,759,715	$16,732,061
Total cost per screen	$55.87	$58.44	$57.11	$60.08	$62.18
▪ Central Services	$9.07	$8.85	$8.16	$8.24	$8.74
▪ Other operating costs	$31.29	$34.26	$33.75	$36.67	$37.99
▪ Professional Reading Fees	$13.39	$13.39	$13.39	$13.39	$13.39
▪ Capital Allocation	$2.13	$1.93	$1.81	$1.78	$2.06
Cost per cancer detected	$12,924.26	$13,606.66	$13,682.80	$14,006.58	$13,584.88

Notes:

1. Number of cancers detected in 2006-07 and cost per cancer is estimated because the final number of cancers is not determined yet.
2. The cost per screen is consistent with PHSA Finance. The per screen payments to Screening Centres were increased in fiscal year 2006-07 to address expenses incurred by Centres to provide screens. reports includes under and overpayments to screen providers.
3. Other operating costs include the cost of tube replacement. Excludes increase in publicly funded screening centres for funding provided directly to Health Authority for salary increases per April 1, 2006 contracted salaries.
4. Capital allocation includes 1) capital differential allocated to privately administered centres in their annual operating budget and 2) amortization of equipment purchased through BCCA/PHSA 3) one-time only extraordinary transaction to w/o equipment in F2006-2007. Also includes increase in operating leases for privately run centres.. Capital allocation does not include capital expenditures capitalized and amortized through host hospitals.
5. The professional reading fee is $13.39 per screen was effective April 2002.
6. Cost per cancer detected is based upon screens with consent and complete follow-up.

Appendix 1
Cancer Screening Program Overview

Definition of Screening

Screening is a prevention strategy. The Primary cancer prevention strategy involves changes of behavior or habits that reduce a risk e.g., stop smoking, low fat diet, etc.

Screening for cancer is a secondary prevention strategy. Secondary cancer prevention strategy targets disease in process[1].

A secondary prevention can reduce cancer morbidity and mortality by diagnosing invasive disease at an earlier, more favorable 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."[2]

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 used to identify individuals who may have occult disease.[3,4,5]

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 and screening tests fail to identify some individuals who do not have the disease.

The comparative evaluation of accuracy versus error 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.

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
6. Evaluation/Research Partnerships

The success of screening is a shared responsibility of the team of individuals who work together to develop goals, set standards, monitor progress and continue improvement in each of the six components.

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

[2] Morrison A: Screening in Chronic Disease. New York, Oxford Press, 1992

[3] Cole P, Morrison AS: Basic issues in cancer screening. In Miller AB (ed); Screening in Cancer. Geneva, International Union Against Cancer, 1978, p7

[4] Miller AB; Fundamentals of Screening. In Screening for Cancer. Orlando, Academic Press, 1985, p3

[5] Wilson JMG, Junger G; Principles and Practice of Screening for Disease. Geneva, World Health Organization, 196

Appendix 2
SMPBC Screening Recommendations

The SMPBC offers screening mammography to eligible women aged 40 to 79 without doctor referral.

Age	Referral	Recall Frequency
<40	Yes	Will accept with primary health care provider referral
40-49	No	Reminders* for 12-month and 24-month anniversary
50-79	No	Reminders* for 24-month and 36-month anniversary to age 79
80+	Yes	Will accept with primary health care provider referral

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 doctor 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.

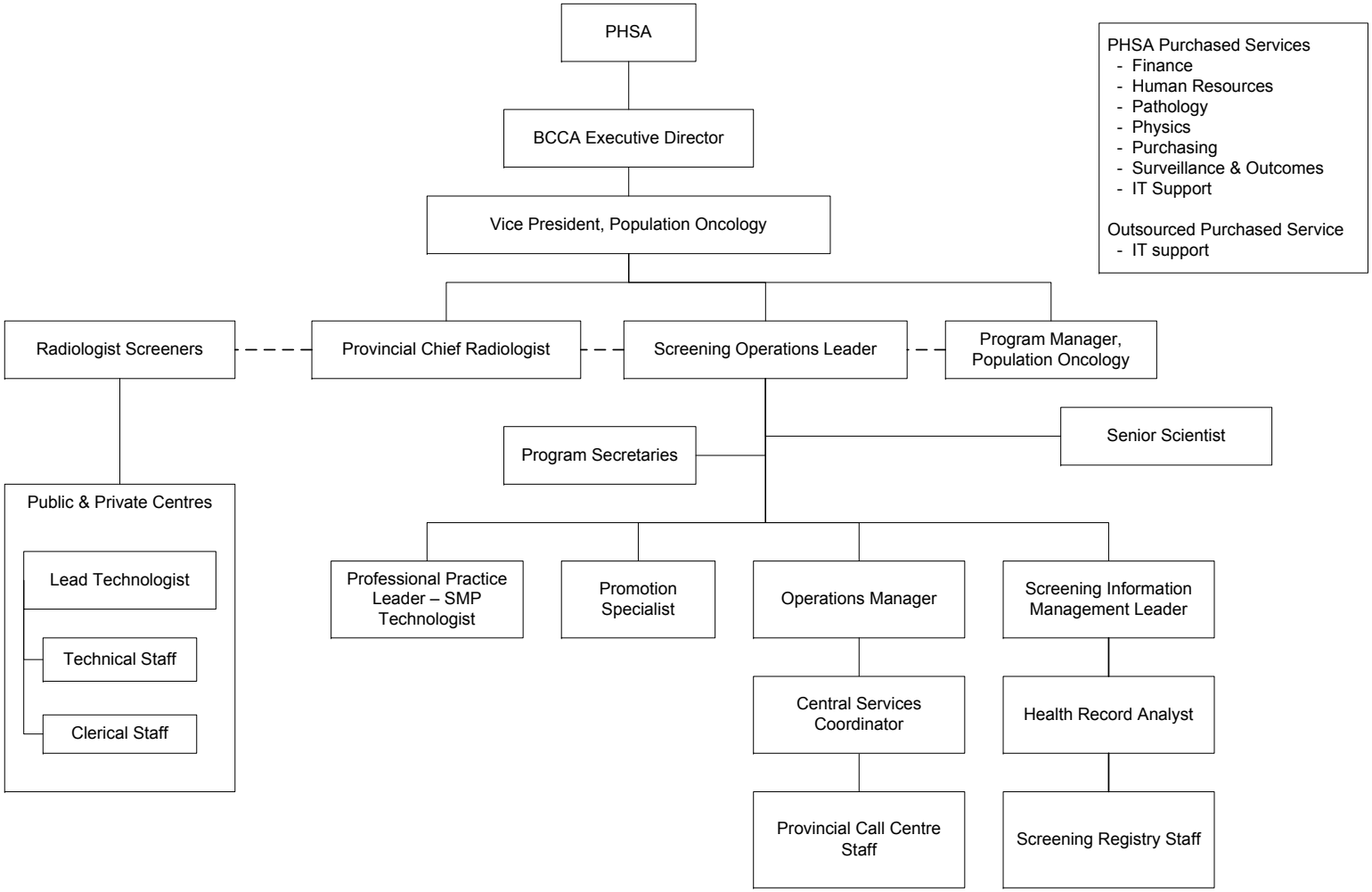
Age <40 – physician referral required

Primary health care providers may wish to refer women age <40 with a strong family history of breast cancer (ie. 2 or more 1st degree family members), for screening at the SMPBC. These women may also benefit from discussion of breast cancer risks including genetic counseling and testing. Screening mammography is only one component of care for these higher risk families. The SMPBC asks that each screening exam for women age <40 be arranged by primary health care providers after consultation with a radiologist at the SMPBC centre of choice. The primary health care provider should provide the woman with a referral slip citing the approving radiologist screener's name.

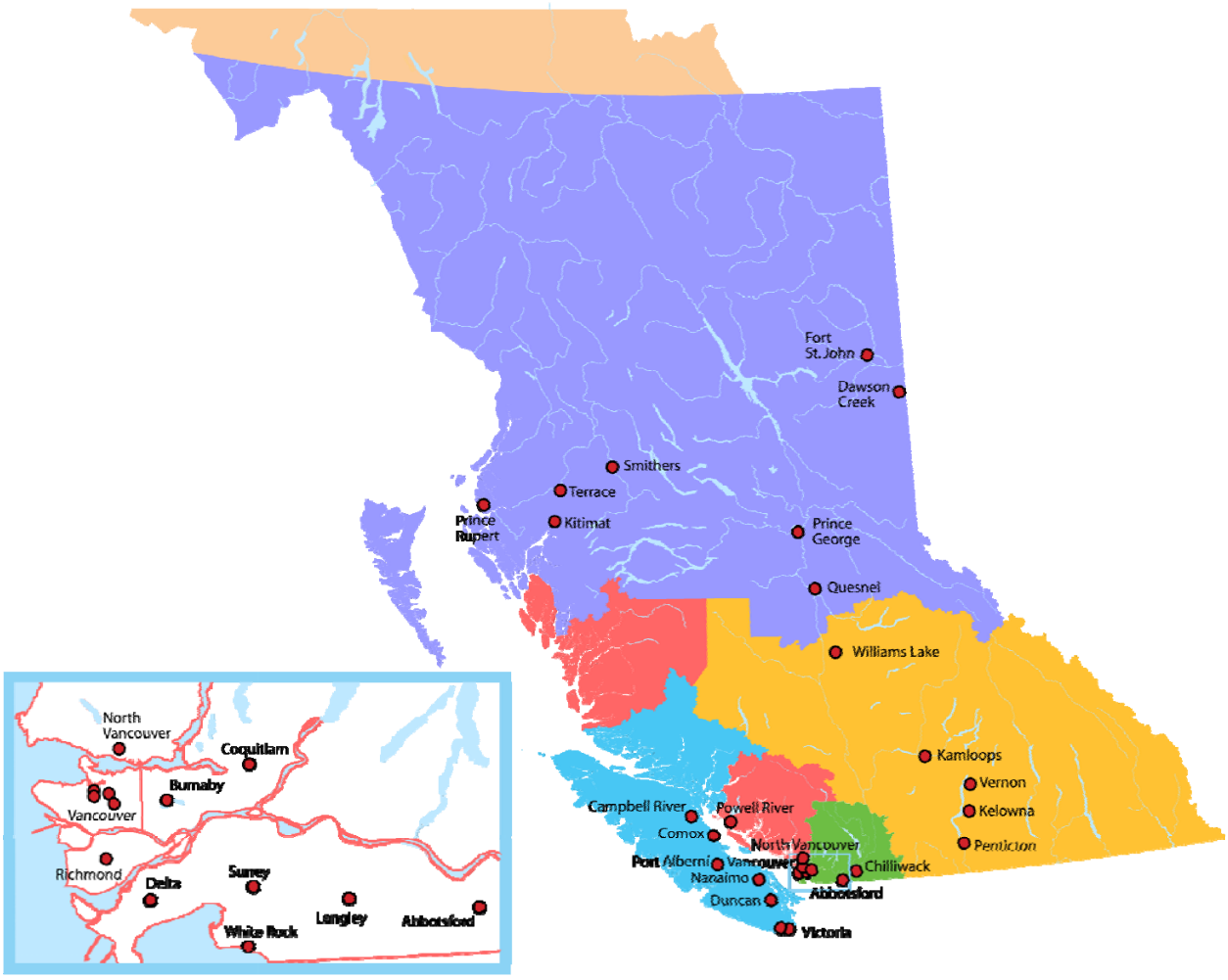
Age 80+ - physician referral required

Primary health care providers may wish to refer women age 80+ in good general health (life expectancy of 10 or more years), for screening at the SMPBC. The possible benefits of screening mammography in light of other potential health concerns should be discussed with the patient. Therefore, the SMPBC asks that each screening exam for women age 80+ be referred by primary health care providers to the SMPBC centre of choice. A requisition should be given to the woman to bring to the appointment.

Appendix 3
BCCA/SMPBC Organization & Communication Chart



Appendix 4
Map of Fixed Screening Centres



Appendix 5
Screening Centre Contact Information

Abbotsford	604-851-7027
Burnaby	604-436-0691
Campbell River	1-800-663-9203
Chilliwack	1-800-663-9203
Comox	250-890-3020
Coquitlam	604-927-2130
Dawson Creek	1-800-663-9203
Delta	604-660-3639
Duncan	1-800-663-9203
Fort St. John	1-800-663-9203
Kamloops	250-828-4916
Kelowna	250-861-7560
Kitimat	1-800-663-9203
Langley	604-514-6044
Nanaimo	250-716-5904
North Vancouver	604-903-3860
Penticton	250-770-7573
Port Alberni	1-800-663-9203
Powell River	1-800-663-9203
Prince George	250-565-6816
Prince Rupert	1-800-663-9203
Quesnel	1-800-663-9203
Richmond	604-244-5505
Smithers	1-800-663-9203
Surrey	604-586-2772
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

#230 - 1900 Richmond Ave	250-952-4232
Victoria General Hospital	250-727-4338

Mobile Screening Service Delivery Areas

Interior/Kootenay Mobile	Ashcroft Balfour Barriere Beaver Valley Castlegar Chase Christina Lake Clearwater Clinton Cranbrook Crawford Bay	Creston Elkford Enderby Fernie Fountain Golden Grand Forks Greenwood Hope Invermere Kaslo	Keremeos Kimberley Ktunaxa/Kinbasket Lillooet Logan Lake Lytton Meadow Creek Merritt Midway Nakusp Nelson	New Denver Oliver Osoyoos Princeton Radium Hot Springs Revelstoke Rock Creek Rossland Salmo Salmon Arm	Scotch Creek Sicamous Slocan Sorrento Sparwood Summerland Trail Windermere 100 Mile House
Islands & Coastal Mobile	Alert Bay Bella Bella Bella Coola Chemainus Fort Rupert Gabriola Gold River	Ladysmith Lake Cowichan Massett Mill Bay Mount Currie Parksville	Pauquachin Pemberton Pender Island Port Alice Port Hardy Port McNeill	Qualicum Beach Queen Charlotte City Saanichton Saltspring Island Sayward	Skidegate Sooke Squamish Tofino Ucluelet Whistler
Northern/Okanagan Mobile	Burns Lake Chetwynd Dease Lake	Fort St. James Fort Nelson Fraser Lake	Hazelton Houston Lumby Mackenzie	McBride Peachland Penticton Southside Stewart	Tumbler Ridge Valemount Vanderhoof Winfield
Lower Mainland Mobile	Locations will change from time to time. Latest visits include: Agassiz, Bowen Island, Chilliwack, Delta, Gibsons, Hope, Langley, Maple Ridge, New Westminster, Port Coquitlam, Port Moody, Richmond, Sechelt, Surrey, Vancouver - Chinatown, Downtown Eastside, Pacific Centre, PriceWaterhouse Building.				

BC Cancer Agency
CARE + RESEARCH
An agency of the Provincial Health Services Authority
Screening Mammography Program

Appendix 6
Educational Materials Order Form

Educational materials are free of charge and delivered in bundles of 25 and 50.

Number Requested	Item
	Screening Mammography Program
	Pass It On: Your Breast Health Has Support (Brochure)
_____	English
_____	Chinese
_____	Punjabi
	Lower Mainland Appointment Pad
_____	English
_____	Chinese
_____	Punjabi
	1-800# Appointment Pad
_____	English
_____	Chinese
_____	Punjabi
	Cervical Cancer Screening Program
_____	Cervical cancer: protect yourself with regular Pap tests (Brochure)
_____	HPV & cervical cancer: what you should know, and do (Brochure)
_____	Preventing cervical cancer (booklet)
_____	Abnormal pap smear: causes and proper followup (Booklet)
_____	Technique for Obtaining Cervical Smears (Laminated Instruction Card)
_____	Speculum Exam & Pap smear (DVD or Video - English)
_____	Hereditary Cancer: Is My Family at Risk? (Brochure - English)

Name: _____

Address: _____

_____

_____

MSC# _____

Please fax this form to 604-660-3645

Appendix 7
Glossary

Abnormal Call Rate

Proportion of screening mammography examinations determined to require further diagnostic assessment *(ie. called "abnormal").*

$$Abnormal\ call\ rate = \frac{number\ of\ exams\ called\ abnormal}{total\ number\ of\ exams}$$

Biopsy Yield Ratio

Proportion of cases biopsied that resulted in a diagnosis of breast cancer.

$$Biopsy\ Yield\ Ratio\ = \frac{M_b}{B_b\ +\ M_b}$$

B_b number of cases with without breast cancer on screen-initiated biopsy

M_b number of women found to have breast cancer on screen-initiated biopsy

Biopsy Yield Ratio which is sometimes referred to as **Positive Predictive Value of Biopsy**, can also be expressed as **Malignant: Benign Ratio** or **Benign : Malignant Ratio**.

$$Malignant : Benign\ Ratio \Rightarrow \frac{M_b}{B_b} : 1$$

$$Benign : Malignant\ Ratio \Rightarrow \frac{B_b}{M_b} : 1$$

Cancer Detection Rate

Proportion of screened cases found to have breast cancer upon further investigation of an "abnormal" screening result.

Prevalent Cancer Detection Rate is the cancer detection rate on first screening examinations

Incident Cancer Detection Rate is the cancer detection rate on subsequent screening examinations

Interval Cancer Rate

Proportion of women being diagnosed with breast cancer by within 12 months of having a “normal” screening result.

False Negative Rate

Probability of interpreting screening mammograms of breast cancer cases as “normal”.

$$False\ Negative\ Rate = \frac{FN}{TP + FN}$$

TP number of breast cancer cases found at screening

FN number of breast cancer cases diagnosed within 12 months of screening

False Positive Rate

Probability of interpreting screening mammograms of cases with no evidence of breast cancer as “abnormal”.

$$False\ Positive\ Rate = \frac{FP}{TN + FP}$$

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"

Positive Predictive Value (PPV) of Screening Mammography

Proportion of "abnormal" cases found to have breast cancer after diagnostic workup.

$$PPV = \frac{number\ of\ 'screen\ -\ detected'\ cancers}{number\ of\ abnormals - number\ of\ unknowns}$$

Prevalence to Expected Incidence Radio

Comparison between rate 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 5-year age group obtained from the BC Cancer Registry were chosen as the comparison reference.

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

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 age 50-79 would be calculated by summing over age groups 50-54, 55-59, 60-64, 65-69, 70-74 and 75-79 in the numerator and denominator.

Retention

Proportion of women returned for rescreen.

$$\text{Retention Rate} = \frac{Number\ of\ Women\ \text{Returned}\ for\ \text{Re}screen}{Number\ of\ Women\ Eligible\ for\ \text{Re}screen}$$

Sensitivity

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

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

TP number of breast cancer cases called "abnormal"

FN number of breast cancer cases called "normal"

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.

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

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 8
Acknowledgement & Contributors

The Screening Mammography 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 process and read the screening mammograms
- Family doctors 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:

- Canadian Breast Cancer Foundation
- BC Medical Association
- Women's Health Bureau
- College of Physicians and Surgeons
- Alliance for Breast Cancer
- BC Women's Health Centre

Contributors *(alphabetical)*

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- Dr. Andrew Coldman, Vice President, Population Oncology
- Lisa Kan, Screening Operations Leader
- Jennifer Sentell, Program Secretary
- Dr. Linda Warren, Provincial Chief Radiologist

Appendix 9
Committees

Screener's Advisory Committee

Dr. Ken Bentley
Dr. Larry Breckon
Dr. Ron Campbell
Dr. Michael Clare
Dr. Don Coish
Dr. Joanne Coppola
Dr. Henry Huey
Dr. Lynn Jacobsen
Dr. Rob Johnson
Ms. Lisa Kan
Dr. Brent Lee
Dr. Richard Lee
Dr. Patrick Llewellyn
Dr. Heather MacNaughton
Dr. Peter McNicholas
Dr. David O'Keeffe
Dr. Rasika Rajapakshe
Dr. Stuart Silver
Dr. Kelly Silverthorn
Dr. Catherine Staples
Dr. Phil Switzer
Dr. Lynette Thurber
Dr. Linda Warren - Chair
Dr. Jose Zanbilowicz

Breast Leadership Committee

Dr. Diponkar Banerjee
Dr. Andy Coldman - Chair
Dr. Karen Gelmon
Ms. Lisa Kan
Dr. Linda Warren

Quality Management Committee

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Dr. Andy Coldman
Mr. Larry St. Germain
Dr. Malcolm Hayes
Ms. Lisa Kan
Ms. Janette Sam
Ms. Ann MacDonald
Ms. Sheila MacMahon
Ms. Christina Chu
Ms. Elaine Simpson
Dr. Linda Warren - Acting Chair

Academic Committee

Dr. Marilyn Borugian
Dr. Andy Coldman
Dr. Paula Gordon - Chair
Dr. Malcolm Hayes
Dr. Greg Hislop
Ms. Lisa Kan
Ms. Janette Sam
Dr. Rasika Rajapakshe
Dr. Linda Warren

Appendix 10
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Dr. Tyrone Soodeen

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Dr. Marty Jenkins
Dr. Vee Lail
Dr. Brian Ho
Dr. Henry Huey
Dr. Elizabeth Tanton
Dr. Nancy Kim
Dr. Bill Collins

Comox
Dr. Jose Zanbilowicz
Dr. Anthony Chilton
Dr. Dave McKeown

Coquitlam
Dr. Heather MacNaughton
Dr. Maria Kidney
Dr. Carol Miller
Dr. Philip Uhrich
Dr. Anita McEachern
Dr. Nancy Dolden

Interior/Kootenay Mobile
Dr. Kelly Silverthorn

Kamloops
Dr. Michael Clare
Dr. Donal Downey

Kelowna
Dr. Catherine Staples
Dr. Wayne Middelkamp
Dr. Timothy Wall

Langley
Dr. Kathryn Miller
Dr. Ron Campbell
Dr. John Matheson

Nanaimo/ Islands & Coastal Mobile
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Dr. David O'Keeffe
Dr. Zenobia Kotwall
Dr. Paul Trepanier
Dr. David Coupland

Northern/Okanagan/Lower Mainland Mobile
See Interior/Kootenay Mobile

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Appendix 11
Publications & Presentations

Dr. Linda Warren

Coldman AJ, Phillips N, **Warren L**, Kan L. The Effect of Screening Mammography on Breast Cancer Mortality in Women aged 40-69. Int. J. Cancer 2006

Gordon P, Borugian MJ, **Warren Burhenne LJ**. A true screening environment for review of interval breast cancers: A pilot study to reduce bias Radiological Society of North America, Chicago Il. November 28, 2006

Gordon P., Borugian MJ, **Warren Burhenne LJ**. A True Screening Environment for Review of Interval Breast Cancers: Pilot Study to Reduce Bias. Radiology 2007 (In Press)

Warren Burhenne LJ, The pathological and radiological features of screen-detected breast cancers diagnosed following arbitration of discordant double reading opinions. Review Breast Diseases: A Year Book Quarterly June 2006 (In Press)

Warren Burhenne LJ, Mammography Physics, Artifacts, and Normal Variants University of British Columbia Vancouver BC Physics Presentation 04/06/06

Warren Burhenne LJ, CAD – Retrospective and Prospective Experience RRS 2006 Vancouver, BC Presentation 05/02/06

Warren Burhenne LJ, Proficiency in Mammography: Interpretive Skills, Computer-Aided Detection and Double Reading 92nd Annual Radiological Society of North America Chicago, Ill Presentation 1/28/06

Dr. Andrew Coldman

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Dr. Marilyn Borugian

Gordon P, **Borugian MJ**, Warren Burhenne L. A true screening environment for review of interval breast cancers: Pilot study to reduce bias. 2007 Radiology (In press).

Gordon PB, **Borugian M**, Warren-Burhenne LJ. A true screening environment for review of interval breast cancers: a pilot study to reduce bias. Radiological Society of North America, Chicago IL, Nov 28, 2006.

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Dr. Greg Hislop

Balneaves LG, Bottorff JL, **Hislop TG**, Herbert C. Levels of commitment: exploring complementary therapy use by women with breast cancer. Journal of Alternative and Complementary Medicine 2006; 12: 459-466.

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Appendix 12
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