



BC Cancer Agency
CARE & RESEARCH

An agency of the Provincial Health Services Authority

**SCREENING MAMMOGRAPHY
PROGRAM OF BC**

2005/2006 Annual Report

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MESSAGE FROM THE PROVINCIAL CHIEF RADIOLOGIST

It has been 18 years since the Screening Mammography Program of BC (SMPBC) was born in July 1988. From a single fixed centre, we now have 37 centres including 3 mobile services and 75 screeners.

In the year 2005 we performed the highest ever number of screening examinations at **256,942**. However, population growth accounted for most of the volume increase. The province wide participation for women ages 50 to 69 raised by 1% to 49% from the previous report.

The 2004 Ministry of Health's contribution of \$3 million dollars towards earlier breast cancer detection allowed for provision of additional screens, a new mobile unit, and a grant to the Canadian Breast Cancer Foundation's B.C./Yukon Chapter for a public awareness campaign. This excellent promotion has resulted in a measurable increase in new and returning participants.

The annual SMPBC Scientific Forum was held on October 15, 2005 and attracted 225 registrants. Invited lecturers included Dr. Edward Sickles, Emeritus of Radiology, University of California San Francisco School of Medicine, Dr. Dianne Phillips, Board Certified Women's Health Specialist, North American Menopause Association, Dr. Georgia Nemetz, Clinical Chief of Psychology, Royal Columbian Hospital, New Westminister BC, Ms. Anne Cheesman, Charge Technologist, Scarborough General Hospital's Breast Health Clinic, Toronto, and Dr. Christine Wilson, Clinical Assistant Professor, Department of Radiology, University of British Columbia.

The 2005 Forum focused on new technology including MRI, computer -aided detection as well as practice challenges, including imaging evaluation of asymmetries, menopause and stress management, interpretation of radiologist outcomes as well as breast cancer research project updates.

Screening Program representatives and scientists authored 11 publications in the radiologic literature as well as gave 32 lectures and presentations related to mammography screening. Additional manuscripts are in press or preparation.

This year, the Screening Mammography Program launched a new mobile unit providing screening

services to communities in the North and the Lower Mainland. There were significant challenges in the development phase. This service is built on the successful models of mobile services in the Interior/Kootenay and Coastal regions of B.C.

A new Standardized Interpretation Test for screening radiologists has been developed to replace the previous test known as Test 2. It is currently undergoing analyses and refinements and will soon be available to new screening radiologist candidates.

Our administrative staff, Ms. Lisa Kan, Screening Operations Leader, Ms. Debbie Leathem, SMPBC Technical Quality Management Leader and Ms. Elaine Simpson, SMPBC Operations Manager, continue to bring stability and innovation to our well established program. The work of Ms. Leathem, together with our enthusiastic Physics Support Group, and that of the centres, resulted in all of our screening centres either being accredited or in the process of being accredited by the Canadian Association of Radiologists Mammography Accreditation Program (CAR-MAP).

This year we welcomed Ms. Pamela Hoepfner as the new SMPBC Promotions Specialist. Ms. Hoepfner's enthusiasm and experience have provided important new directions for our public awareness campaign.

Ultimately, it is the determination, diligence, dedication, and personal attention extended by staff at all of the screening centres, the Central Office and that of health care professionals throughout the province which have contributed to the stability and ongoing success of the program.

What is not apparent from the data presented in the remainder of the report is the fact that the mortality rate reported by the Canadian Cancer Society from breast cancer has dropped from being the highest in Canada at the inception of the program to the lowest and has remained the lowest for several years.

With the support of the entire public, we are making a difference.

Dr. Linda Warren,
Provincial Chief Radiologist

PROGRAM OVERVIEW

The SMPBC provides two-view bilateral mammography with staff and equipment that meet the national standards, to women in British Columbia between the ages of 40 and 79 without doctor's referral. Women outside of this age group may be referred by their family physicians. Women are not eligible for screening if they have had breast cancer, breast implants, or if they currently have breast symptoms requiring diagnostic investigation.

The Screening Process

The basic screening process can be described in four stages:

1. Identification and invitation of the target population
2. Provision of the screening examination
3. Investigation of abnormality identified on screening examination
4. Reminder to rescreen at the appropriate interval

Promotion, Recruitment & Recall

The SMPBC develops and distributes promotion and educational material to doctor offices, health units, libraries and other interested organizations. The information brochures and tear-out pads are also available in a variety of languages.

A wide network of more than 300 volunteers has evolved informally since the start of the SMPBC. The volunteers assist with the recruitment of women in their communities and the creation of a warm and welcoming environment for the mobile screening sites.

The SMPBC information system facilitates invitation and recall reminder of eligible women for screening. With the support of the Ministry of Health, SMPBC accesses addresses from the Client Registry and generates individualized invitation letters for women turning 50 years of age each year. The SMPBC sends recall reminders to eligible women when they are due to return.

Facilitated Process to Diagnostic Investigation (Fast Track)

A linked "Fast Track" service for the diagnostic investigation of women with abnormal screening mammograms has been implemented with the cooperation of family doctors and diagnostic radiology facilities across the province.

This province-wide initiative reduces the time between an abnormal screening mammogram and the tests that will lead to a final diagnosis.

Fast Track aims to have the majority of women scheduled for further imaging studies within one week of the abnormal screening result.

Quality Assurance and Quality Control

Quality standards and systems in the SMPBC are developed based on recommendations from the Canadian Association of Radiologists (CAR), Public Health of Canada, the Canadian Association of Medical Radiation Technologists (CAMRT), the BCCA Physics Department and scientific literature.

To assure the public of a quality service, the SMPBC follows the Quality Management process:

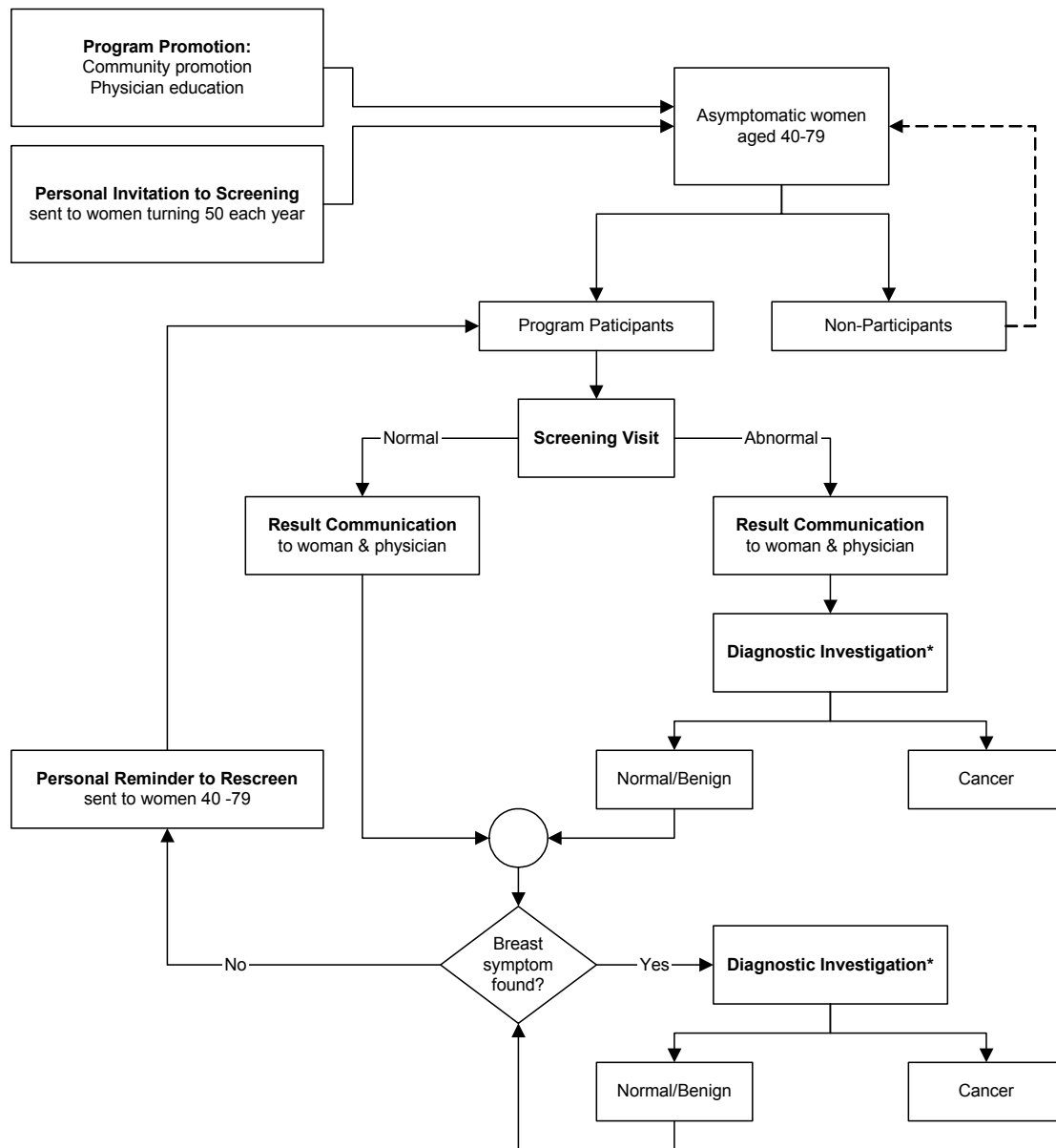
- Establish and regularly review Program standards
- Continually monitor processes to ensure established standards are met
- Take action to correct deficiencies in quality
- Follow up the action to ensure quality improvement

Quality screening is a shared responsibility of all staff. The SMPBC has dedicated resources to support quality assurance and quality control activities. For example, the Physicist Support Group monitors the mammography and film processing equipment and provides professional direction in equipment selection, acceptance testing and trouble-shooting. The Technical Quality Management Leader works collaboratively with the Physicists and the Provincial Chief Radiologist to monitor image quality and to support improvement by developing educational material, participate in trouble-shooting and providing in-services. The Canadian Association of Radiologists (CAR) Mammography Accreditation is mandatory for all SMPBC Centres.

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 **256,942** examinations to 256,803 women in 2005. During this period, 35,967 examinations were performed for women attending the SMPBC for the first time and the remaining 220,975 (86%) examinations were performed on returning participants.

Figure 1 shows that the number of first time attendees as well as those women returning for an examination in 2005 increased by more than 10% over the previous year.

In the 24-month period of 2004 and 2005, 412,308 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 49%, an increase of one percentage point from the last reporting period. In the Northern Health Authority, participation rates for women aged 50-69 in the Northeast and North Interior HSDAs improved by two and three percent respectively, while the Northwest participation rate declined by two percent. Overall, the Northern Health Authority participation rates for women aged 50-69 improved from 42.3% to 43.9%. The participation rate in the East Kootenay remains the lowest in the province at 30%, which was the same as in 2004/2005. The Okanagan Health Service Delivery Area has the highest participation rate at 55%.

Figure 1: SMPBC Annual Screening Volume between 2001 and 2005

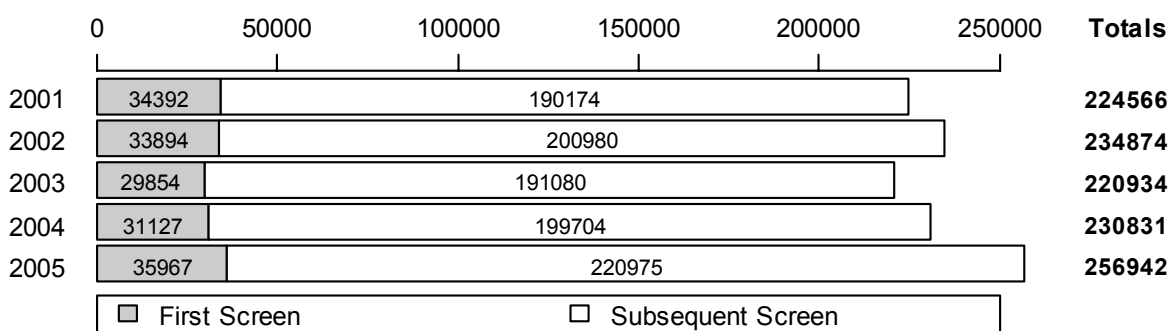


Table I: Regional Participation Rates by 10-Year Age Groups between 2004 and 2005 Inclusive

Health Service Delivery Area	10-Year Age Groups					Ages 50-69
	40-49	50-59	60-69	70-79	80-89	
Central Vancouver Island	32%	51%	58%	44%	3%	54%
East Kootenay	23%	29%	31%	25%	2%	30%
Fraser East	30%	45%	50%	42%	1%	47%
Fraser North	37%	45%	47%	40%	2%	46%
Fraser South	37%	47%	45%	32%	2%	46%
Kootenay Boundary	29%	39%	46%	36%	3%	42%
North Shore/Coast Garibaldi	33%	41%	44%	38%	2%	42%
North Vancouver Island	31%	50%	56%	42%	1%	52%
Northeast	22%	37%	39%	36%	2%	38%
Northern Interior	34%	50%	49%	38%	2%	49%
Northwest	23%	37%	37%	26%	2%	37%
Okanagan	36%	51%	60%	47%	2%	55%
Richmond	47%	51%	52%	46%	3%	51%
South Vancouver Island	33%	50%	54%	47%	3%	51%
Thompson Cariboo Shuswap	36%	52%	57%	44%	2%	54%
Vancouver	36%	50%	51%	39%	2%	51%
British Columbia	35%	47%	51%	40%	2%	49%

Based on the average of 2004 and 2005 female population estimates

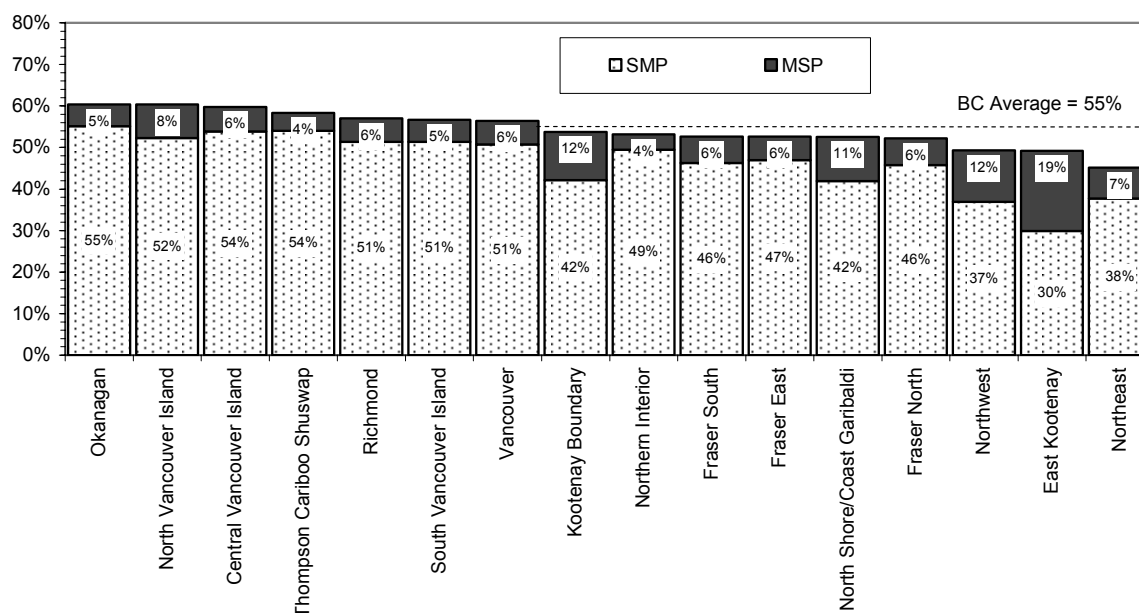
Notes:

1. Population data source: P.E.O.P.L.E. 30, Population Estimates (Sep 2005), BC STATS, BC Ministry of Labour & Citizens' Services.
2. Postal code translation file: TMF0606 (June 2006).
3. Population and postal code data acquired through: Health Data Warehouse, BC Ministry of Health
4. SMP data extraction date: July 25, 2006.

Bilateral mammography is used for both screening and diagnostic purposes. Data on bilateral mammography utilization were obtained from MSP. Historically, a significant proportion of the bilateral mammography services paid through the Medical Services Plan (MSP) was directly related to screening. In Health Service Delivery Areas with long standing SMPBC service, the proportion of women using MSP bilateral mammography has stabilized to 4% - 6%.

Figure 2 shows the proportion of women receiving bilateral mammography service through SMPBC and MSP. 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 2004 and 2005, 55% of BC women age 50-69 received bilateral mammography services. Overall, the SMPBC provided 90% of the bilateral mammography services for this age group. Regionally, the percent of women age 50-69 receiving bilateral mammography ranged from 60% to 45%.

Figure 2: Bilateral Mammography Utilization by Women Aged 50-69 Years in BC between 2004 and 2005



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 August 17, 2006 for services provided within years 2004 and 2005, excluding women who came for the service more than once in 2 years.
3. SMP data includes single screen per woman provided in calendar years 2003 and 2004.
4. 2004 and 2005 Estimated Population Data Source: P.E.O.P.L.E. 30, BC Ministry of Health Planning
5. SMP data extraction date: July 25, 2006.

Ethnic origin data was collected at the time of SMPBC registration (29% 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.

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

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

Table II: Regional Ethnic Representation of Women Aged 50-74 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%	2.5%	1.0%	2.1%	0.6%	1.1%
12 Kootenay Boundary	0.5%	1.3%	1.2%	2.1%	0.2%	0.5%
13 Okanagan	0.7%	0.9%	1.4%	1.8%	0.8%	1.1%
14 Thompson Cariboo Shuswap	3.6%	3.9%	1.3%	2.7%	1.3%	1.7%
21 Fraser Valley	1.3%	1.2%	1.7%	2.5%	6.4%	5.9%
22 Simon Fraser	0.5%	0.4%	18.8%	26.4%	4.6%	5.0%
23 South Fraser	0.4%	0.5%	6.1%	8.7%	10.5%	10.3%
31 Richmond	0.2%	0.2%	38.7%	49.2%	6.0%	6.1%
32 Vancouver	0.8%	0.7%	37.5%	43.3%	4.1%	5.3%
33 North Shore/Coast Garibaldi	1.5%	1.3%	5.5%	8.2%	2.2%	3.0%
41 South Vancouver Island	0.7%	0.9%	3.9%	5.3%	1.2%	1.9%
42 Central Vancouver Island	1.9%	1.3%	1.2%	1.5%	1.1%	1.3%
43 North Vancouver Island	2.2%	2.1%	1.3%	1.1%	0.3%	0.4%
51 Northwest	14.5%	20.4%	2.1%	2.5%	2.0%	2.8%
52 Northern Interior	3.5%	6.2%	1.4%	2.2%	2.5%	3.3%
53 Northeast	5.1%	3.7%	1.1%	0.2%	0.0%	0.8%
British Columbia	1.4%	1.4%	11.0%	15.3%	3.8%	4.3%

SMPBC Data:

1. Women attended the SMPBC at least once in 2004-2005 inclusive.
2. *East/South-East Asians* include Chinese, Japanese, Korean, Filipino, Thai, Vietnamese, Indonesian, Malay, Mongolian, Tibetan, Taiwanese, Asian n.i.e and East/Southeast Asian n.i.e
3. *South Asians* include Punjabi, Singhalese, Tamil, Bangladeshi, East Indian, Pakistani, Sri Lankan.
4. SMP data extraction date: July 25, 2006.

Population Data

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

The effectiveness of regular screening mammography is universally recognized for women over age 50. The SMPBC recommends screening at least every two years for women age 40-79. However, research evidence indicates that the sojourn time* 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.

*Sojourn time is the duration that the disease remains in the pre-clinical, screen-detectable phase.

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. 24% of women age 50-69 screened in 2004 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

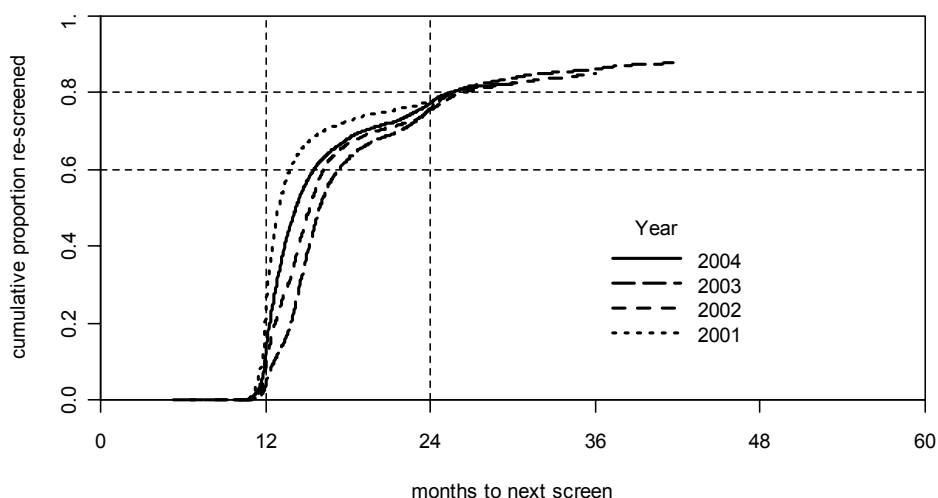


Figure 4: Return Rates by Calendar Year of Previous Screen of Women Aged 50-74 Years

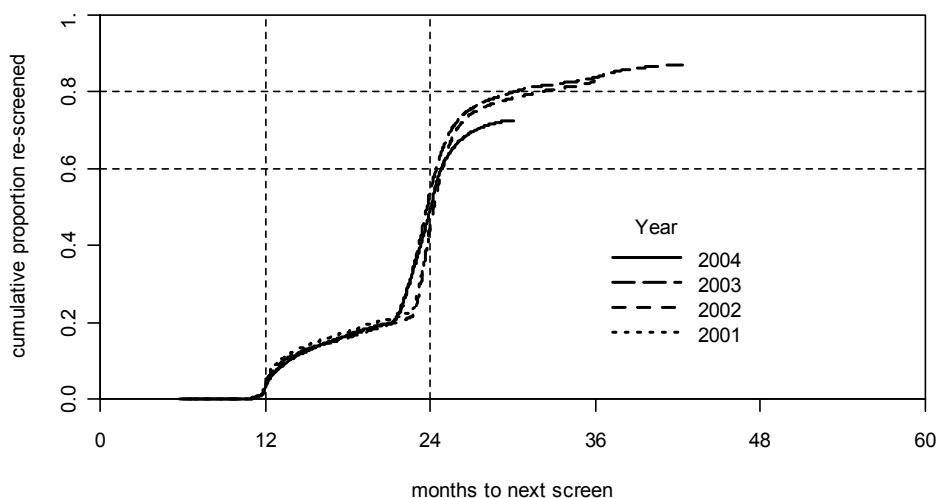


Table III summarizes the compliance (return) rate by the year of previous screening examination in 6-month intervals. The proportion of age 50-74 women

returning within 24 months has improved by around ten percentage points over the previous two years shown in the table

Table III: Cumulative Numbers and Proportions Rescreened of Women Aged 50-74 Years

Calendar Year of the Previous Screen	2001		2002		2003	
Total Number to be Re-screened	128,880		137,140		135,028	
Returned by						
▪ 18 months	22,461	17%	21,874	16%	22,017	16%
▪ 24 months	57,146	44%	61,529	45%	72,710	54%
▪ 30 months	102,510	80%	107,576	78%	107,987	80%
▪ 36 months	107,481	83%	113,671	83%	112,653	83%

2005 Screening Results

Table IV summarizes the outcome indicators for screening provided in the calendar year 2005 by 10-year age groups. Of the 256,942 screening mammograms performed, 18,573 had an abnormal result (7.2%) and 1048 breast cancers were reported as of July 25, 2006 (4.2 per 1,000 exams), including 245

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 9.0% to 5.2%. Cancer detection rates, positive predictive values and biopsy yield ratios increase with age

Table IV: SMPBC Outcome Indicators by 10-Year Age Groups in 2005

Outcome Indicators	Age at Exam						All
	<40	40-49	50-59	60-69	70-79	80+	
Number of Exams	263 0.1%	87,920 34.2%	82,779 32.2%	53,508 20.8%	31,213 12.1%	1,259 0.5%	256,942
Number of First Screens	228 0.6%	24,734 68.8%	7,046 19.6%	2,884 8.0%	974 2.7%	101 0.3%	35,967
Number of Cancers	0 0.0%	162 15.5%	299 28.5%	357 34.1%	218 20.8%	12 1.1%	1,048
Abnormal Call Rate	12.2%	9.0%	6.9%	6.0%	5.2%	6.4%	7.2%
▪ on first screens	12.3%	14.6%	17.2%	14.9%	14.5%	14.9%	15.1%
▪ on subsequent screens	11.4%	6.8%	6.0%	5.5%	4.9%	5.7%	5.9%
Overall Cancer Detection Rate (per 1,000)	0.0	1.9	3.7	6.9	7.2	10.0	4.2
▪ on first screens	0.0	2.4	6.0	7.4	20.1	11.6	4.0
▪ on subsequent screens	0.0	1.7	3.5	6.8	6.8	9.8	4.2
DCIS Detection Rate (per 1,000)	0.0	0.5	0.9	1.5	1.5	0.8	1.0
Positive Predictive Value of Screening Mammography	0.0%	2.2%	5.7%	12.1%	14.5%	19.4%	6.1%
Biopsy Yield Ratio	---	19.6%	37.6%	57.5%	62.9%	57.1%	40.2%
▪ Benign : Malignant	---	4.1 : 1	1.7 : 1	0.7 : 1	0.6 : 1	0.8 : 1	1.5 : 1

Notes:

1. See Glossary in the Appendix for definitions of terms.
2. Overall Cancer Rate includes ductal carcinoma in situ (DCIS).
3. 6619 screens were given to women who declined consent for their information to be used. Information from these screens is excluded from all entries in the table other than exam counts.
4. An additional 496 abnormal screens had incomplete or lost follow-up. Information from these screens is excluded from all entries in the table other than exam counts and abnormal call rates.
5. Out of 17,627 "abnormal" screens with consent and complete follow-up, there were 9 lobular carcinoma in-situ cases. The final number of cancers is still to be determined.
6. SMP data extraction date: July 25, 2006.

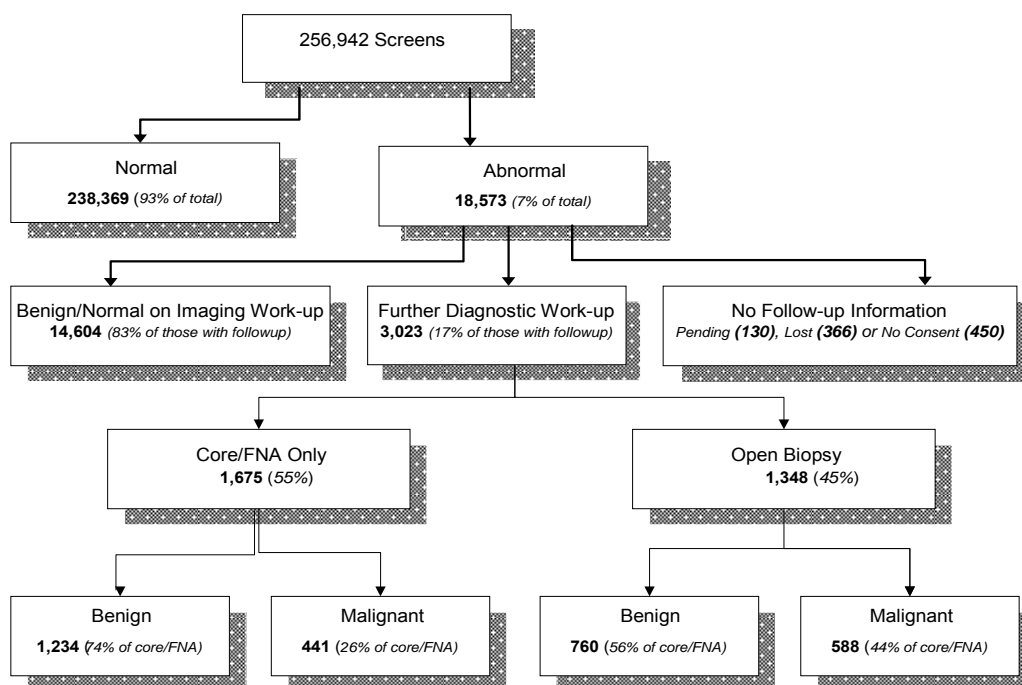
Diagnostic procedure information is available on 17,627 (95.0%) of the abnormal screening mammograms to date. Of these abnormal screens, 366 were lost to follow-up. **Table V** shows the proportion

of women receiving specific diagnostic procedures as part of the work-up on their screen detected abnormalities. Overall, 8% of women with abnormal screening mammograms had an open biopsy.

Table V: Diagnostic Procedures Received by SMPBC Participants with “Abnormal” Screening Mammograms in 2005

Procedure	Age at Exam						All
	<40	40-49	50-59	60-69	70-79	80+	
Diagnostic Mammogram	83%	90%	92%	93%	93%	93%	91%
Ultrasound	59%	64%	62%	60%	61%	63%	62%
Fine Needle Aspiration	3%	5%	5%	6%	6%	10%	6%
Core Biopsy	3%	6%	7%	10%	10%	17%	7%
Surgical Biopsy	0%	5%	7%	11%	13%	11%	8%
▪ with Localization	0%	5%	7%	10%	12%	9%	7%
Number of cases with diagnostic assessment information available	29	7,518	5,429	3,036	1,545	70	17,627

Figure 5: Screening Outcome Summary 2005



2005 Cancer Detection

Histologic features of breast cancers detected by SMPBC in 2004 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 axillary 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, 64% were ≤15 mm, 24% had invasion of the regional lymph nodes and 25% were grade 3 (i.e. poorly differentiated) tumours. Of the grade 3 tumours, 44% 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 in 2004

Histological Features	Age at Exam					Age 40+
	40-49	50-59	60-69	70-79	80+	
Number of Cancers	161	296	264	192	11	924
▪ in situ	53 33%	84 28%	63 24%	39 20%	0 0%	239 26%
▪ invasive	108 67%	212 72%	201 76%	153 80%	11 100%	685 74%
TNM Staging						
▪ I	60 56%	125 59%	134 67%	116 76%	9 82%	444 65%
▪ II	42 39%	79 37%	62 31%	34 22%	2 18%	219 32%
▪ III+	6 6%	7 3%	5 2%	2 1%	0 0%	20 3%
▪ unknown stage	(0)	(1)	(0)	(1)	(0)	(2)
Invasive Tumour Size						
▪ ≤5 mm	14 13%	26 12%	13 6%	16 11%	0 0%	69 10%
▪ 6-10 mm	14 13%	46 22%	54 27%	53 35%	3 27%	170 25%
▪ 11-15 mm	35 32%	55 26%	59 29%	44 29%	4 36%	197 29%
▪ 16-20 mm	18 17%	34 16%	42 21%	18 12%	3 27%	115 17%
▪ >20 mm	27 25%	49 23%	33 16%	20 13%	1 9%	130 19%
▪ unknown size	(0)	(2)	(0)	(2)	(0)	(4)
Invasive tumour ≤ 15 mm	63 58%	127 60%	126 63%	113 75%	7 64%	436 64%
Node Involvement						
▪ no nodes sampled	5 5%	16 8%	6 3%	15 10%	2 20%	44 6%
▪ no	70 65%	136 64%	147 73%	115 75%	8 80%	476 70%
▪ yes	33 31%	60 28%	48 24%	23 15%	0 0%	164 24%
Histologic Grade						
▪ 1 - <i>well differentiated</i>	26 26%	60 31%	69 35%	51 37%	4 44%	210 33%
▪ 2 - <i>moderately differentiated</i>	44 44%	79 41%	81 42%	60 43%	4 44%	268 42%
▪ 3 - <i>poorly differentiated</i>	31 31%	55 28%	45 23%	28 20%	1 11%	160 25%
▪ unknown grade	(7)	(18)	(6)	(14)	(2)	(47)
Grade 3 tumour ≤ 15 mm	12 39%	24 44%	22 49%	12 43%	1 100%	71 44%

Notes:

1. TNM staging was determined by using mammographic measurement whenever pathologic measurement of the tumour was unavailable, by assuming N0 whenever nodes were not assessed and M0 unless otherwise informed.
2. SMP data extraction date: July 25, 2006.

Outcome Indicators by Calendar Year

The abnormal call rates on first screens have been increasing steadily. The overall abnormal call rate in 2005 of 7.2% was similar to the preceding 2 years, but slightly above the 5 year average of 7.0%. However, the overall cancer detection rate, as well as the rate for subsequent screens for 2005 are close to that of the respective 5 year averages, while the cancer detection rate for first screens seems slightly lower than previous years. This difference is possibly due to the number of cancers in 2005 not being complete. The biopsy yield ratio is higher than the previous two years, and is close to 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 60-69¹ and had recommended the target of >3.0 for organized screening programs². The annual prevalence to expected incidence ratios for age 50-79 have consistently been above 3 from 1995 onwards.

Table VII: SMPBC Outcome Indicators by Calendar Year between 2001 and 2005 Inclusive

Outcome Indicators	Calendar Year					5-Year Cumulative
	2001	2002	2003	2004	2005	
Number of Exams	224,566	234,874	220,934	230,831	256,942	1,168,147
% first screens	2.4%	2.4%	2.4%	2.4%	2.6%	
Number of Cancers	909	1,035	908	925	1,048	4,825
% on first screens	18.2%	15.7%	15.3%	16.2%	13.0%	
Abnormal Call Rate	6.9%	6.8%	7.1%	7.1%	7.2%	7.0%
▪ on first screens	13.4%	13.1%	14.3%	14.7%	15.1%	14.1%
▪ on subsequent screens	5.7%	5.7%	6.0%	5.9%	5.9%	5.8%
Overall Cancer Detection Rate (per 1,000)	4.2	4.5	4.2	4.1	4.2	4.2
▪ on first screens	5.0	5.0	4.8	5.0	4.0	4.7
▪ on subsequent screens	4.0	4.4	4.1	4.0	4.2	4.2
DCIS Detection Rate (per 1,000)	1.0	1.0	1.0	1.1	1.0	1.0
Positive Predictive Value of Screening Mammography	5.9%	6.5%	5.8%	5.7%	5.6%	5.9%
Biopsy Yield Ratio	42.2%	43.8%	38.2%	39.0%	40.3%	40.7%
▪ Benign : Malignant	1.4 : 1	1.3 : 1	1.6 : 1	1.6 : 1	1.5 : 1	1.5 : 1
Interval Cancer Rate (per 1,000)						
▪ 0-12 months	0.66	0.63	0.64	0.46	---	---
after first screens	0.36	0.86	0.49	0.23	---	---
after subsequent screens	0.72	0.59	0.66	0.49	---	---
▪ 13-24 months	0.75	0.64	0.63	0.29	---	---
Sensitivity (<i>i.e. 1 - false negative rate</i>)	86.2%	87.8%	86.9%	90.0%	---	---
Specificity (<i>i.e. 1 - false positive rate</i>)	93.5%	93.6%	93.3%	93.3%	---	---
Prevalence to Expected Incidence Ratio for Age 50-79 (<i>target² : >3.0</i>)	4.27	4.07	3.32	4.11	3.39	3.83

Notes:

1. SMPBC data extraction date: July 25, 2006.
2. The final number of cancers in 2005 is to be determined.
3. Overall Cancer Rate includes ductal carcinoma in situ (DCIS).
4. Number 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

In the 5-year period from 2001 to 2005, the SMPBC provided 1,168,147 screening mammography examinations to 526,795 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 2001 and 2005 Cumulative

Outcome Indicators	Age at Exam					All
	40-49	50-59	60-69	70-79	80+	
Number of Exams	400,814 34.3%	373,785 32.0%	239,675 20.5%	146,317 12.5%	6,036 0.5%	1,168,147
Number of Cancers	794 16.5%	1,468 30.4%	1,451 30.1%	1,053 21.8%	57 1.2%	4,825
Abnormal Call Rate	8.3%	6.9%	6.0%	5.4%	6.6%	7.0%
▪ on first screens	13.8%	15.4%	14.1%	12.8%	14.3%	14.1%
▪ on subsequent screens	6.3%	6.0%	5.5%	5.1%	5.5%	5.8%
Overall Cancer Detection Rate (per 1,000)	2.1	4.1	6.0	7.5	9.9	4.3
▪ on first screens	2.9	6.3	11.2	15.4	13.2	5.0
▪ on subsequent screens	1.8	3.9	5.7	7.2	9.4	4.1
DCIS Detection Rate (per 1,000)	0.6	1.1	1.4	1.4	0.7	1.0
Positive Predictive Value of Screening Mammography	2.6%	6.0%	10.1%	13.9%	15.1%	6.2%
Biopsy Yield Ratio	22.8%	39.5%	53.7%	60.9%	61.9%	41.1%
▪ Benign : Malignant	3.4 : 1	1.5 : 1	0.9 : 1	0.6 : 1	0.6 : 1	1.4 : 1
Interval Cancer Rate (per 1,000)						
▪ 0-12 months	0.54	0.61	0.57	0.76	0.22	0.60
after first screens	0.43	0.50	0.59	1.29	0.00	0.49
after subsequent screens	0.58	0.63	0.57	0.74	0.25	0.61
▪ 13-24 months	0.00	0.83	0.89	1.01	1.10	0.58
Sensitivity (i.e. 1 - false negative rate)	79.2%	87.0%	91.4%	90.8%	97.8%	87.7%
Specificity (i.e. 1 - false positive rate)	92.3%	93.6%	94.6%	95.3%	94.3%	93.6%

Notes:

1. SMPBC data extraction date: July 25, 2006.
2. The final number of cancers in 2005 is to be determined: the overall cancer detection rate and subsequent rows are based upon the first 4 years only.
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

From the start of the Program in July 1988 to December 2003, 9,664 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 than 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 2004

Histologic Features	Age at Exam					All
	40-49	50-59	60-69	70-79	80+	
Number of Cancers	1,623	2,744	2,899	2,208	182	9,664
▪ in situ	504 31%	720 26%	612 21%	401 18%	18 10%	2,258 23%
▪ invasive	1,119 69%	2,024 74%	2,287 79%	1,807 82%	164 90%	7,406 77%
TNM Staging						
▪ I	644 59%	1,282 64%	1,593 70%	1,314 73%	121 74%	4,958 68%
▪ II	412 38%	646 32%	616 27%	418 23%	37 23%	2,130 29%
▪ III+	34 3%	60 3%	59 3%	56 3%	5 3%	214 3%
▪ unknown stage	(29)	(36)	(19)	(19)	(1)	(104)
Invasive Tumour Size						
▪ ≤ 5 mm	109 10%	203 10%	196 9%	126 7%	14 9%	648 9%
▪ 6-10 mm	213 20%	478 24%	622 27%	566 32%	45 28%	1,925 26%
▪ 11-15 mm	309 28%	561 28%	741 33%	552 31%	51 31%	2,215 30%
▪ 16-20 mm	170 16%	341 17%	337 15%	267 15%	28 17%	1,144 16%
▪ >20 mm	291 27%	407 20%	373 16%	279 16%	25 15%	1,376 19%
▪ unknown size	(27)	(34)	(18)	(17)	(1)	(98)
Invasive Tumour ≤ 15 mm	631 58%	1242 62%	1559 69%	1244 69%	110 67%	4788 66%
Node Involvement						
▪ no nodes sampled	119 11%	202 10%	229 10%	295 16%	63 38%	908 12%
▪ no	701 63%	1,358 67%	1,618 71%	1,239 69%	82 50%	5,003 68%
▪ yes	299 27%	464 23%	440 19%	273 15%	19 12%	1,495 20%
Histologic Grade						
▪ 1 - <i>well differentiated</i>	276 28%	612 35%	711 35%	633 40%	52 37%	2,284 35%
▪ 2 - <i>moderately differentiated</i>	424 43%	714 41%	895 44%	685 44%	63 44%	2,783 43%
▪ 3 - <i>poorly differentiated</i>	284 29%	433 25%	415 21%	246 16%	27 19%	1,406 22%
▪ unknown grade	(135)	(265)	(266)	(243)	(22)	(933)
Grade 3 Tumour ≤ 15 mm	112 39%	212 49%	236 57%	119 48%	13 48%	702 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. The "All" column includes women less than 40 years of age.
4. SMP data extraction date: July 25, 2006.

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. 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 2004-2005
Participation Rate (1)	≥70% of the eligible population	49% (plus 8% MSP)
Retention Rate (2)	≥75% re-screened within 30 months	81%
Abnormal Call Rate (3)	<10% first screens	15.2%
	<5% re-screens	5.5%
Invasive Cancer Detection Rate (3)	>5 per 1,000 first screens	6.04 per 1,000
	>3 per 1,000 re-screens	4.72 per 1,000
In Situ Cancer Detection Rate (3)	Surveillance and Monitoring only, 04-1.0 per 1,000 in UK standards	1.12 per 1,000
Positive Predictive Value (3)	≥5% first screen	4.0%
	≥6% re-screens	8.6%
Benign to Malignant Open Biopsy Ratio (4)	≤2:1	1.2 : 1
Invasive Tumour size ≤10 mm (4)	>25%	34%
Positive Lymph Nodes in Cases with Invasive Cancer (4)	<30%	26%

Notes:

1. Screen years: (1) = 2004 & 2005, (2) = 2003 & 2004, (3) = 2005, (4) = 2004.
2. Population data source: P.E.O.P.L.E. 30, Ministry of Health Planning.
3. SMP data extraction date: July 25, 2006.

Cost Analysis

The SMPBC is funded by the provincial Ministry of Health through the Provincial Health Services Authority (PHSA). It manages one fixed screening centre directly, and 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/whoware/budget+accountability.

Table XI: Cost Comparison by Fiscal Year

Indicator	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006
Total Cost	\$12,560,751.00	\$13,016,098.00	\$13,005,918.84	\$13,401,773.09	\$15,759,715.00
Total cost per screen	\$55.81	\$55.87	\$58.44	\$57.11	\$60.08
▪ Central Services	\$8.90	\$9.07	\$8.85	\$8.16	\$8.24
▪ Other operating costs	\$31.35	\$31.29	\$34.26	\$33.75	\$36.67
▪ Professional Reading Fees	\$13.00	\$13.39	\$13.39	\$13.39	\$13.39
▪ Capital Allocation	\$2.56	\$2.13	\$1.93	\$1.81	\$1.78
Cost per cancer detected	\$12,667.67	\$12,927.68	\$13,641.52	\$13,681.37	Not available

Notes:

1. Number of cancers detected in 2005-2006 is not yet available.
2. The cost per screen is consistent with PHSA Finance data. The per screen payments to Screening Centres was increased in fiscal year 2005-2006 to address expenses incurred by Centres to provide screens.
3. "Other operating costs" includes the cost of tube replacement.
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. 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.

Centre Statistics

The following pages present centre profile and selected outcome indicators. Outcome indicators are influenced by the centre profile, and can vary greatly from time to time in small volume centres.

Table XII: SMPBC Centre Volume 2005

Screening Centre	Type	Total Exams	Ave per Day	Age Distribution of All Exams					First Exams		Age Distribution of First Exams				
				40-49	50-59	60-69	70-79	80+	n	% total	40-49	50-59	60-69	70-79	80+
Abbotsford	F	10,556	43	35%	31%	21%	13%	0%	1,603	15%	68%	20%	8%	3%	0%
Burnaby	F	15,160	56	36%	31%	20%	12%	1%	2,152	14%	73%	17%	7%	3%	0%
Comox	F	4,196	18	28%	32%	26%	14%	0%	602	14%	61%	22%	14%	3%	0%
Coquitlam	F	14,594	61	41%	32%	18%	9%	0%	2,057	14%	75%	16%	6%	2%	0%
Kamloops	F	8,784	36	34%	32%	22%	11%	0%	1,104	13%	78%	14%	6%	1%	0%
Kelowna	F	12,457	50	30%	28%	24%	17%	1%	1,571	13%	69%	18%	9%	3%	0%
Langley	F	6,898	30	39%	31%	19%	11%	0%	1,071	16%	72%	19%	7%	2%	0%
Nanaimo	F	10,050	36	28%	32%	25%	14%	1%	1,311	13%	61%	24%	12%	3%	0%
North Shore	F	11,120	44	35%	31%	20%	13%	1%	1,388	12%	73%	18%	5%	3%	1%
Penticton	F	3,938	21	26%	28%	26%	19%	1%	514	13%	54%	24%	14%	6%	0%
Prince George	F	5,990	26	38%	36%	18%	7%	0%	883	15%	77%	16%	3%	1%	0%
Richmond	F	14,576	50	39%	34%	17%	9%	0%	1,909	13%	74%	16%	7%	2%	0%
Surrey	F	15,689	58	38%	32%	19%	10%	0%	2,153	14%	73%	18%	7%	2%	0%
Vancouver - Mt. St. Joseph	F	7,603	25	40%	34%	18%	9%	0%	1,161	15%	71%	19%	6%	3%	0%
Vancouver - Victoria Drive	F	10,088	36	44%	31%	16%	9%	0%	1,778	18%	72%	16%	8%	3%	0%
Vancouver - West Broadway	F	14,477	65	38%	34%	18%	9%	1%	2,469	17%	69%	20%	7%	2%	0%
Vancouver - Vancouver Centre	F	9,926	40	36%	36%	18%	10%	0%	1,184	12%	76%	18%	5%	1%	0%
Vernon	F	6,674	23	28%	31%	25%	15%	1%	743	11%	64%	22%	9%	3%	1%
Victoria - Richmond Avenue	F	16,391	67	28%	34%	22%	15%	1%	2,055	13%	65%	23%	9%	3%	0%
Victoria - General Hospital	F	6,011	22	34%	33%	21%	11%	1%	754	13%	69%	21%	7%	2%	0%
White Rock	F	7,505	27	31%	32%	22%	14%	0%	802	11%	71%	16%	9%	4%	0%
Islands & Coastal Mobile	M	6,444	40	28%	30%	25%	16%	1%	974	15%	59%	24%	12%	3%	1%
Interior/Kootenay Mobile	M	14,499	51	28%	31%	25%	15%	1%	2,239	15%	56%	25%	13%	5%	0%
Lower Mainland/Northern Mobile	M	1,300	34	42%	33%	16%	8%	0%	247	19%	73%	17%	7%	2%	0%
Campbell River	A	2,681	19	33%	37%	20%	9%	0%	412	15%	63%	26%	8%	3%	0%
Chilliwack	A	3,289	21	22%	29%	28%	21%	0%	407	12%	58%	24%	14%	4%	0%
Dawson Creek	A	1,057	21	34%	34%	20%	12%	0%	171	16%	65%	21%	8%	5%	1%
Delta	A	3,122	22	35%	30%	22%	13%	1%	412	13%	74%	16%	6%	3%	1%
Duncan	A	2,629	11	25%	33%	25%	16%	1%	413	16%	51%	34%	10%	4%	1%
Fort St. John	A	1,049	20	35%	34%	20%	11%	0%	183	17%	68%	23%	7%	1%	0%
Kitimat	A	305	13	35%	33%	23%	9%	0%	33	11%	79%	9%	12%	0%	0%
Port Alberni	A	1,424	9	28%	34%	25%	12%	0%	203	14%	55%	31%	13%	1%	0%
Power River	A	1,282	23	26%	30%	27%	16%	0%	123	10%	62%	29%	7%	2%	1%
Prince Rupert	A	850	18	41%	33%	18%	8%	0%	150	18%	74%	17%	7%	1%	0%
Quesnel	A	1,418	17	33%	37%	20%	10%	0%	261	18%	70%	23%	4%	1%	0%
Terrace	A	1,414	9	36%	36%	21%	7%	0%	196	14%	74%	17%	8%	0%	0%
Williams Lake	A	1,496	10	34%	36%	22%	9%	0%	279	19%	61%	24%	11%	4%	0%
Program		256,942		34%	32%	21%	12%	0%	35967	14%	69%	20%	8%	3%	0%

Type: **A**=Ancillary centre (film taking only), **F**=Fixed centre, **M**=Mobile service

Table XIII: Anonymous Listing of Outcome Indicators by SMPBC Centre

Centre	Type	Year: 2005					Preceding 2 Years: 2003-2004							
		% Called Abnormal	Cancer Detection Rate (per 1000)			PPV	% Called Abnormal	Cancer Detection Rate (per 1000)			PPV	In-Situ : Invasive (number)	% Invasive ≤15 mm	% Invasive with +iv nodes
			Overall	First Screens	Subsequent Screens			Overall	First Screens	Subsequent Screens				
A	F	7%	3.5	1.7	3.8	5%	8%	3.8	2.6	3.9	5%	17 : 49	71%	15%
B	F	9%	4.8	7.6	4.3	6%	9%	3.7	4.5	3.6	4%	9 : 35	57%	23%
C	F	5%	4.4	4.6	4.4	9%	5%	5.5	3.3	5.8	11%	17 : 71	73%	20%
D	F	6%	3.2	3.4	3.1	6%	6%	3.7	4.8	3.4	7%	17 : 46	61%	23%
E	F	6%	5.6	5.9	5.6	9%	6%	5.3	5.1	5.3	8%	9 : 28	64%	27%
F	F	6%	4.0	2.2	4.2	7%	5%	4.0	4.6	3.9	9%	31 : 62	68%	23%
G	F	5%	4.4	4.1	4.4	8%	6%	4.3	4.8	4.2	8%	10 : 40	68%	32%
H	F	4%	2.9	1.7	3.1	6%	5%	3.1	2.1	3.3	6%	7 : 15	73%	47%
I	F	7%	4.8	8.1	4.2	7%	7%	3.2	4.6	2.9	4%	11 : 33	73%	26%
J	F	9%	4.0	4.2	4.0	4%	9%	4.0	4.7	3.8	4%	35 : 86	55%	24%
K	F	4%	3.0	2.9	3.0	7%	4%	3.6	5.4	3.3	8%	18 : 88	57%	35%
L	F	7%	3.7	1.1	4.1	5%	6%	3.4	1.8	3.6	5%	5 : 28	54%	41%
M	F	8%	3.3	3.7	3.3	4%	8%	3.9	6.5	3.4	5%	29 : 68	66%	33%
N	F	11%	4.2	3.8	4.3	4%	11%	4.5	5.7	4.2	4%	21 : 55	55%	20%
O	F	9%	5.2	6.3	5.1	6%	11%	5.6	3.9	5.8	5%	18 : 60	78%	20%
P	F	11%	5.0	2.1	5.5	5%	11%	4.8	3.6	5.1	4%	35 : 64	69%	18%
Q	F	4%	3.6	3.2	3.7	8%	5%	3.9	6.2	3.6	8%	17 : 67	63%	33%
R	F	5%	4.9	2.7	5.2	10%	4%	3.5	3.1	3.6	9%	13 : 35	63%	32%
S	F	4%	4.0	4.0	4.0	11%	4%	3.2	1.9	3.4	9%	8 : 30	77%	10%
T	F	8%	3.3	2.5	3.4	4%	8%	3.6	4.4	3.5	5%	26 : 79	62%	25%
U	F	8%	5.2	6.1	5.0	6%	8%	4.6	7.6	4.2	6%	28 : 96	73%	17%
V	M	8%	1.5	4.1	1.0	2%	6%	2.7	0.0	3.3	5%	2 : 4	50%	0%
W	M	4%	4.5	4.1	4.6	10%	5%	4.9	5.2	4.8	11%	12 : 45	69%	20%
X	M	5%	3.7	3.6	3.7	8%	6%	4.4	4.7	4.3	8%	25 : 83	65%	29%
AC	A	6%	2.8	0.0	3.3	5%	8%	2.0	0.0	2.5	3%	1 : 3	67%	33%
AD	A	5%	6.5	2.4	7.2	13%	4%	3.4	1.7	3.7	9%	3 : 13	85%	38%
AE	A	6%	1.9	0.0	2.3	3%	6%	2.3	7.5	1.4	4%	1 : 3	100%	0%
AF	A	5%	5.2	2.5	5.7	11%	5%	6.0	7.2	5.8	13%	7 : 17	65%	33%
AG	A	11%	2.6	4.9	2.2	2%	9%	2.8	3.0	2.7	3%	1 : 13	69%	23%
AH	A	10%	5.2	10.0	4.5	5%	11%	4.7	5.5	4.6	4%	2 : 27	56%	8%
AI	A	4%	13.1	30.3	11.0	31%	6%	0.0	0.0	0.0	0%	0 : 0	0%	0%
AJ	A	5%	7.4	3.6	8.2	15%	4%	3.7	8.4	2.8	10%	2 : 7	86%	14%
AK	A	7%	3.8	5.9	3.4	5%	7%	3.4	8.4	2.6	5%	0 : 6	50%	33%
AL	A	6%	4.7	0.0	5.7	9%	6%	4.1	12.9	2.4	7%	1 : 5	60%	50%
AM	A	8%	2.8	7.7	1.7	4%	7%	4.0	4.6	4.0	6%	4 : 4	75%	67%
AN	A	4%	5.5	0.0	6.1	12%	5%	5.3	4.5	5.3	11%	4 : 9	67%	17%
AO	A	6%	4.9	5.0	4.9	8%	5%	4.9	17.6	3.0	10%	2 : 11	82%	30%
Program		7%	4.1	3.8	4.1	6%	7%	4.1	4.8	4.0	6%	Standard:	> 50%	< 30%

Individual centre identification is provided to the affected centre(s) only.
 Type: Ancillary centre, Fixed centre, Mobile service

Cancer Detection Rate is the proportion of cases found to have breast cancer by screening mammography.
 Positive Predictive Value (PPV) is the percent of abnormalities found to have breast cancer after screen-initiated diagnostic workup.

Appendix 1 - Cancer Screening Program Overview

Definition of Screening

Primary prevention of cancer 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 prevention of cancer is distinguished from primary prevention in that it is an intermediate intervention that targets disease in process¹. 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 preclinical signs of cancer is based on well-established criteria related to the disease in question and the screening tests that re-used to identify individuals who may have occult disease.^{3,4,5} Although the overall objective of a screening program is to reduce morbidity and mortality from cancer, the goal of screening per se is the “application of a relatively simple, inexpensive test to a large number of persons in order to classify them as likely, or unlikely to have the cancer which is the object of the screen.” 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 on 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.

Footnotes:

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 University 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

Age	Referral Required	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
80+	Yes	Will accept with primary health care provider referral

**a second reminder letter will be sent if no visit/appointment is made 4-6 weeks after the first reminder is sent*

SMPBC Eligibility Criteria

- B.C. women between the ages of 40 to 79 who:
- have no breast changes (e.g. new lumps, thickening, or discharge)**
- can provide the name of a doctor to receive the results
- have not had a mammogram within 12 months
- have not had breast cancer
- do not have breast implants
- are not pregnant or breast feeding

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

Age 40-79 (self-referral)

Following recommendations from the BCCA Breast Tumour Group, the SMPBC invites eligible women aged 40 to 79 to have a screening mammogram at least every two years. Research studies show that 25-30% fewer breast cancer deaths can be expected in women if they have regular screening mammograms between ages 50 and 69. To achieve this, at least 70% of eligible women in this age group must have regular screening mammography.

Age 80+

(with primary health care provider referral only)

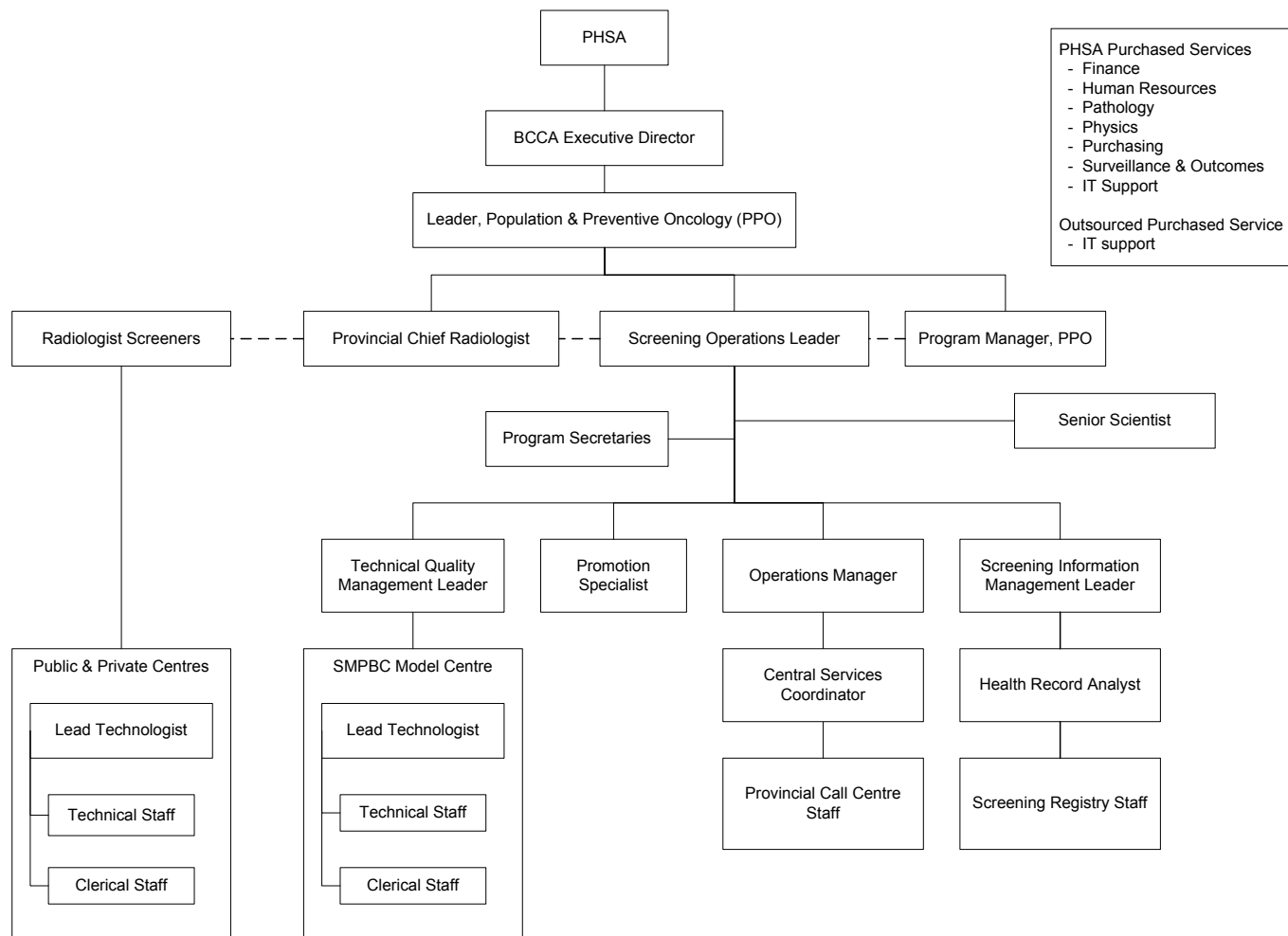
Primary health care providers may wish to refer women age 80+ in good general health (life expectancy of 10+ years), for screening at the SMPBC. The possible benefits of screening mammography in light of other potential health concerns at this age should be discussed with the women. Therefore, the SMPBC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

Age <40

(with primary health care provider referral only)

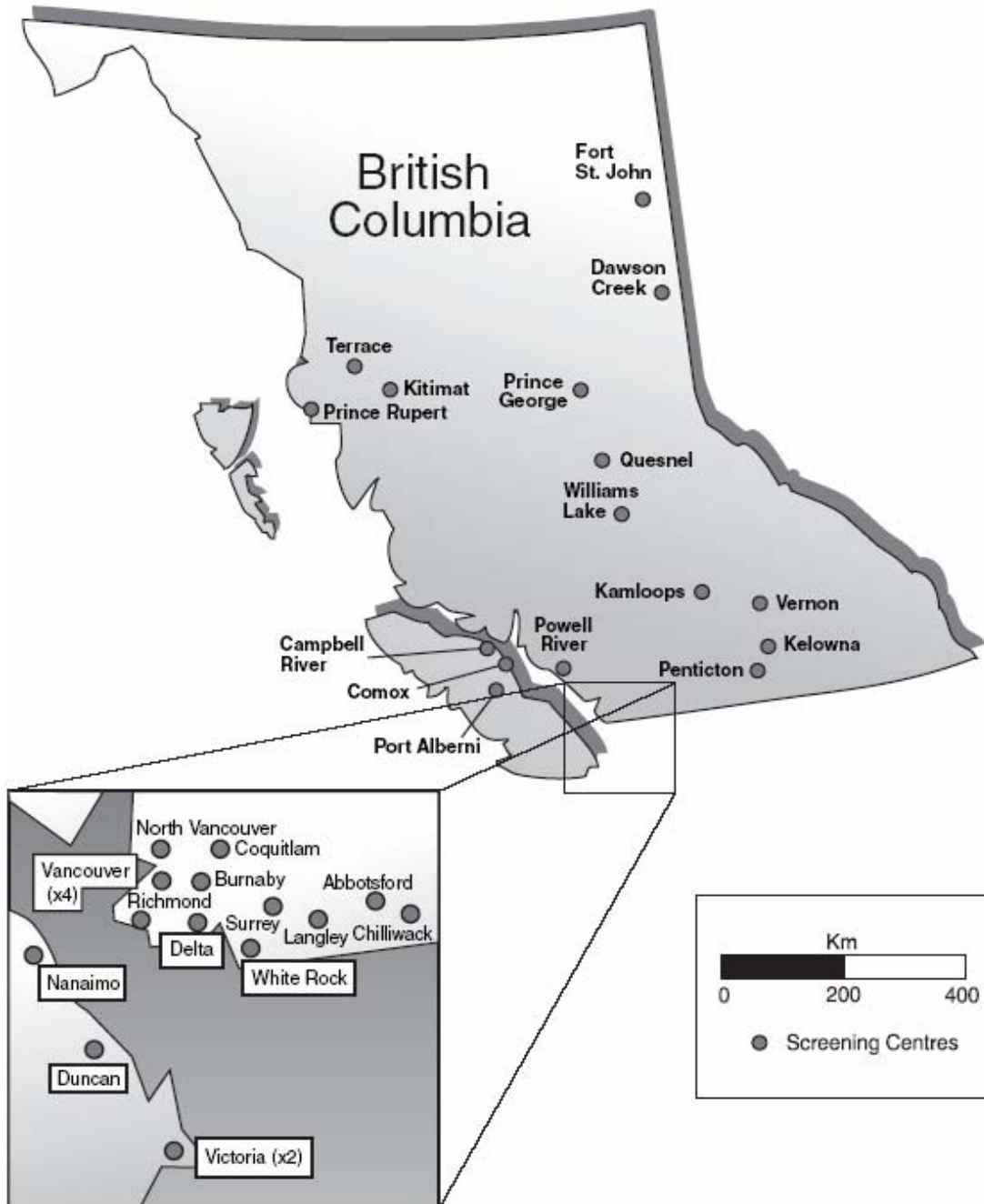
Primary health care providers may wish to refer women age <40 with a strong family history of breast or ovarian cancer (ie. 2 or more 1st degree family members), to be screened at the SMPBC. These women may also benefit from discussion of breast cancer risks including genetic counseling and testing. 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.

Appendix 3 - BCCA/SMPBC Organization & Communication Chart



September 22, 2006

Appendix 4 - Fixed Screening Centres



Appendix 5 - Screening Centre Contact Information

Fixed Screening Centres

• Abbotsford	604-851-7027	• Prince Rupert	1-800-663-9203
• Burnaby	604-436-0691	• Quesnel	1-800-663-9203
• Campbell River	1-800-663-9203	• Richmond	604-244-5505
• Chilliwack	1-800-663-9203	• Surrey	604-586-2772
• Comox	250-890-3020	• Terrace	1-800-663-9203
• Coquitlam	604-927-2130	• Vernon	250-549-5451
• Dawson Creek	1-800-663-9203	• White Rock	604-535-4512
• Delta	604-660-3639	• Williams Lake	1-800-663-9203
• Duncan	1-800-663-9203		
• Fort St. John	1-800-663-9203	Vancouver	
• Kamloops	250-828-4916	• B.C. Women's Health Centre	604-775-0022
• Kelowna	250-861-7560	• Mount Saint Joseph Hospital	604-877-8388
• Kitimat	1-800-663-9203	• 5752 Victoria Drive	604-321-6770
• Langley	604-514-6044	• #505-750 West Broadway	604-879-8700
• Nanaimo	250-716-5904		
• North Vancouver	604-903-3860	Victoria	
• Penticton	250-770-7573	• #230 - 1900 Richmond Avenue	250-952-4232
• Port Alberni	1-800-663-9203	• Victoria General Hospital	250-727-4338
• Powell River	1-800-663-9203		
• Prince George	250-565-6816		

Mobile Screening Service Delivery Areas Toll-Free 1-800-663-9203

Interior/Kootenay Mobile	Ashcroft Balfour Barriere Beaver Valley Castlegar Chase Christina Lake Clearwater Clinton Cranbrook Crawford Bay	Creston Elkford Enderby Ferne 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 Masset 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 BC Mobile	Burns Lake Chetynd Dease Lake	Fort St. James Fort Nelson Fraser Lake	Hazelton Houston Mackenzie	McBride Southside Stewart	Tumbler Ridge Valemount Vanderhoof
Lower Mainland Mobile	Locations will change from time to time. Latest visits include: Maple Ridge, Mission, New Westminster, Port Coquitlam, Vancouver - Chinatown, Downtown Eastside, Pacific Centre, Pricewaterhouse Cooper, YWCA, and Aboriginal Friendship Centre.				

Appendix 6 - Screening Programs Educational Material Order Form

Educational materials are free of charge. Pamphlets are in bundles of 25. Please indicate number of bundles.

Screening Mammography

Are you a woman over 40?

English _____
Chinese _____
Punjabi _____

**A translated version in other languages is available from our website: www.bccancer.bc.ca/breastscreening

What Happens When You Come for a Screening Mammogram?

English _____

After Your Screening Mammography

English _____

SMPBC Appointment Pads (25 tear-off sheets)

Lower Mainland Locations

English 1 pad 5 pads

1-800 # to book Mammography appointments

English 1 pad 5 pads
Chinese 1 pad 5 pads
Punjabi 1 pad 5 pads

Video or DVD

- *A Step Ahead of Breast Cancer* (Produced 1998) – Educational video about the importance of screening mammograms for the early detection of breast cancer.
- *A New Pathway to Women's Health* (Produced 2001 Cantonese and Mandarin) – Motivational message for Chinese women to attend Pap smear screening.
- *Speculum Exam and Pap Smear Video or DVD* (Produced 2000) – An instructional video about obtaining cervical smears for smear takers to improve the overall quality of the Pap smears submitted to the Cervical Cancer Screening Program.

Cervical Screening

Our brochures are currently being updated.

Technique for Obtaining Cervical Smears – Laminated Card

(Pages 6-7 of *Office Manual for Health Professionals*)

English 1 copy

Office Manual for Health Professionals

“Screening for Cancer of the Cervix”

**Available from the BC Cancer Agency website at:

www.bccancer.bc.ca/HPI/CancerManagementGuidelines/Gynecology/UterineCervix102/4Screening

Hereditary Screening

Hereditary Cancer: Is My Family at Risk?

English _____

NAME: _____ (print clearly)

ADDRESS: _____

CITY: _____ POSTAL CODE: _____

FAX to: 604-660-3645

Appendix 7 - Glossary

Abnormal Call Rate

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

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

Biopsy Yield Ratio

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

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

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**.

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

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

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".

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

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".

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

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

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

Prevalence to Expected Incidence Ratio

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.

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

Where N_i is the number of prevalent screens for age group i , $C a_i$ is the number of cancers detected in prevalent screens for age group i and R_i is the expected incidence rate for age group i . Prevalence to expected incidence ratio for 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.

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 - Acknowledgment

The Screening Mammography Program of BC 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 also like to thank the following organizations for their ongoing support:

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

Appendix 9 - Contributors

(Alphabetical listing)

Ms. Margaret Bangen
Program Manager, Population & Preventive
Oncology

Dr. Andrew Coldman
Acting Vice President, Population Oncology

Ms. Lisa Kan
Screening Operations Leader

Mr. Chuck Paltiel
Biostatistician

Ms. Jennifer Sentell
Program Secretary

Dr. Linda Warren
Provincial Chief Radiologist

Appendix 10 - Committees

(Alphabetical listing)

Breast Leadership Committee

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

Quality Management Committee

- Ms. Margaret Bangen
- Dr. Andy Coldman
- Mr. Larry St. Germain
- Dr. Malcolm Hayes
- Ms. Lisa Kan
- Ms. Debbie Leathem
- Ms. Sheila MacMahon
- Mr. Chuck Paltiel
- 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. Debbie Leathem
- Dr. Rasika Rajapakshe
- Dr. Linda Warren

Screeener'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

Appendix 11 - Radiologist Screeners (75)

Abbotsford

- Dr. Lynn Jacobsen
- Dr. John Kreml
- Dr. Caroline Pon
- Dr. Tyrone Soodeen

Burnaby

- Dr. Lynette Thurber
- Dr. Nancy Graham
- Dr. Brian Ho
- Dr. Elizabeth Tanton

Comox

- Dr. Jose Zambilowicz
- Dr. Anthony Chilton
- Dr. Dave McKeown

Coquitlam

- Dr. Heather MacNaughton
- Dr. Maria Kidney
- Dr. Carol Miller
- Dr. Philip Uhrich
- Dr. Anita McEachern

Interior/Kootenay Mobile & Northern/Lower Mainland Mobile

- Dr. Kelly Silverthorn

Kamloops

- Dr. Michael Clare
- Dr. Donal Downey

Kelowna

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

Langley

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

Nanaimo/

Islands & Coastal Mobile

- Dr. Zenobia Kotwall
- Dr. Rob Johnson
- Dr. David O'Keeffe
- Dr. Paul Trepanier
- Dr. David Coupland

North Vancouver

- Dr. Alistair Martin
- Dr. Barry Irish
- Dr. Patrick Llewellyn
- Dr. Catherine Phillips

Penticton

- Dr. Peter McNicholas
- Dr. Blake Terriff

Prince George

- Dr. Alasdair Leighton
- Dr. Chong Lim
- Dr. Larry Breckon
- Dr. Greg Shand

Richmond

- Dr. Marty Jenkins
- Dr. Vee Lail
- Dr. Henry Huey
- Dr. Terry Warner
- Dr. Charles Coffey

Surrey

- Dr. Don Coish
- Dr. Guy Eriksen
- Dr. Dennis Janzen
- Dr. John Sisler
- Dr. Earl Tregobov

Vancouver - BC Women's Health Centre

- Dr. Linda Warren
- Dr. Paula Gordon
- Dr. Patricia Hassell

Vancouver -

Mount St. Joseph Hospital

- Dr. Richard Lee

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Victoria Drive

- Dr. Phil Switzer
- Dr. Lorna Fulton
- Dr. Connie Siu

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- Dr. Nicola Lapinsky

Vernon

- Dr. Ken Bentley
- Dr. Glenn Scheske
- Dr. Ian Marsh

Victoria -

Richmond Avenue & Victoria General Hospital

- Dr. Colin Lee
- Dr. Brent Lee
- Dr. Delmer Pengelly
- Dr. Stuart Silver
- Dr. John Wrinch
- Dr. Richard Eddy
- Dr. Frederick Smith
- Dr. George Hodgins
- Dr. Robert Koopmans

White Rock

- Dr. Eleanor Clark
- Dr. Susan Hacking
- Dr. Joanne Coppola

Appendix 12 - Publications & Presentations

The following is a list of publications and presentations relating to the SMPBC and/or breast screening:

Peer-Reviewed Publications

Dr. Linda Warren

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

Warren Burhenne, LJ. Correlation of Radiologist Rank as a Measure of Skill in Screening and Diagnostic Interpretation of Mammograms. *Breast Diseases A Year Book Quarterly* – Review 2006 (In Press)

Warren Burhenne, LJ. Organized Breast Screening Programs in Canada: Effect of Radiologist Reading Volumes on Outcomes, *Breast Diseases A Year Book Quarterly* - Review 2006 (In Press)

Computer-Aided detection with Screening Mammography in a University Hospital Setting, **Warren Burhenne, LJ**, *Breast Diseases A Year Book Quarterly* Review

Warren Burhenne, LJ. Diagnostic Radiology: Breast Imaging RSNA Categorical Course in Diagnostic Radiology (2005) 93-106

Dr. Andy Coldman

Coldman AJ, Major D, Doyle GP, D'yachkova Y, Phillips N, Onysko J, Shumak R, Smith NE, Wadden N. Organized breast screening programs in Canada: Effect of radiologist reading volumes on outcomes. *Radiology*. 2006 Mar;238(3):809-15.

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

Dr. Greg Hislop

Tu SP, Jackson SL, Yasui Y, Deschamps M, **Hislop TG**, Taylor VM. Cancer prevention screening: a cross-border comparison of United States and Canadian Chinese women. *Preventive Medicine* 2005; 41: 36-46.

Yavari P, **Hislop TG**, Abanto Z. Methodology to identify Iranian immigrants for epidemiological studies. *Asian Pacific Journal of Cancer Prevention* 2005; 6: 455-457.

Yavari P, **Hislop TG**, Bajdik C, Sadjadi A, Nourai M, Babai M, Malekzadeh R. Comparison of cancer incidence in Iran and Iranian immigrants to British Columbia, Canada. *Asian Pacific Journal of Cancer Prevention* 2006; 7: 86-90.

Boyd NF, Martin L, Li Q, Sun L, Chiarelli A, **Hislop TG**, Yaffe M, Minkin S. Mammographic density as a surrogate marker for the effects of hormone therapy on risk of breast cancer. *Cancer Epidemiology, Biomarkers and Prevention* 2006; 15: 961-966.

Presentations and Lectures

Dr. Linda Warren

Artifacts and Normal Variants in Mammography-Physics to Residents, University of British Columbia, Vancouver Hospital, April 26, 2005

“Evolving Issues in Percutaneous Biopsy” 7th Postgraduate Course Society of Breast Imaging – Panel October 15, 2005

Interval Cancers: Classification and Analysis 2005 Screening Mammography Forum October 15, 2005

Radiologists Outcome – Panel 2005 Screening Mammography Forum

“Proficiency in Mammography: Interpretive Skills, Computer-aided Detection and Double Reading Radiological Society of North America 91st Scientific Assembly and General Meeting, Chicago, Ill Presenter November 29, 2005

Computer-assisted Detection Radiological Society of North America 91st Scientific Assembly and General Meeting, Chicago, Ill Presiding Officer Scientific Sessions December 12, 2005

Mammography Physics, Artifacts and Normal Variants University of British Columbia, Vancouver Hospital 04/06/2006

Breast: New Techniques American Roentgen Ray Society 2006 Vancouver BC – Moderator 05/02/2006

CAD- Retrospective and Prospective Experience
American Roentgen Ray Society 2006 Vancouver BC
05/02/2006

Dr. Marilyn Borugian

Pan Canadian Study of Reader Volumes. Annual
meeting of the U.S. Breast Cancer Surveillance
Consortium. Vancouver, BC. April 18, 2005

Annual Forum of the Screening Mammography
Program of BC, "Inter-observer variability in
assessment of mammographic density". Vancouver,
B.C. October 15, 2005

Dr. Paula Gordon

Screening and Staging Breast Cancer with Ultrasound.
Practical Radiology
Feb 8, 2006 Whistler, BC

"Breast ultrasound screening: Fact or Fiction?"
Canadian Association of Radiologists Breast Imaging
Conference, June 16, 2006, Toronto, Ontario

Minicourse: Practical Answers for Complex Imaging
Questions—Hands-on/How to: Small Parts Ultrasound
("Hands-on" Workshop), Radiological Society of
North America Annual Meeting, Chicago, IL, Nov 30,
2005

Ultrasound Guided Breast Interventional Procedures
("Hands-on" Workshop), Radiological Society of
North America Annual Meeting, Chicago, IL, Dec 1,
2005.

Ultrasound-Guided Interventional Procedure in the
Breast. National Diagnostic Imaging Symposium.
Sponsored by Loma Linda University. Orlando,
Florida. Dec 4, 2005.

Supplementary Sonographic Screening for Breast
Cancer. National Diagnostic Imaging Symposium.
Sponsored by Loma Linda University. Orlando,
Florida. Dec 4, 2005.

Screening and Staging with Ultrasound. Current
Concepts in Breast Ultrasound. Sponsored by Loma
Linda University, March 12, 2006, Las Vegas, Nevada.

Technique of Ultrasound Intervention. Current
Concepts in Breast Ultrasound. Sponsored by Loma
Linda University, March 12, 2006, Las Vegas, Nevada.

Workshop: Ultrasound-guided Breast Biopsy. Current
Concepts in Breast Ultrasound. Sponsored by Loma
Linda University, March 12, 2006, Las Vegas, Nevada

Breast Ultrasound Screening. Advanced Breast
Imaging and Interventions 2006, Stanford School of
Medicine. April 29, 2006

Is that a Cyst? Diagnostic Dilemmas on Breast
Ultrasound. Advanced Breast Imaging and
Interventions 2006, Stanford School of Medicine. April
29, 2006

Ultrasound-Guided Breast Biopsy. Advanced Breast
Imaging and Interventions 2006, Stanford School of
Medicine. April 29, 2006.

Breast Ultrasound: Diagnostic Challenges. Annual
Meeting, American Roentgen Ray Society, Vancouver,
BC, May 3, 2006

Ultrasound-Guided Breast Intervention. World Class
Breast Imaging, Loma Linda University, Vancouver,
BC. August 7, 2006.

Minicourse: Practical Answers for Complex Imaging
Questions—Hands-on/How to: Small Parts Ultrasound
("Hands-on" Workshop), Radiological Society of
North America Annual Meeting, Chicago, IL, Nov 30,
2005

Ultrasound Guided Breast Interventional Procedures
("Hands-on" Workshop), Radiological Society of
North America Annual Meeting, Chicago, IL, Dec 1,
2005.

National Diagnostic Imaging Symposium. Sponsored
by Loma Linda University, Orlando, Florida. Dec 4,
2005.

World Class Breast Imaging. Sponsored by Loma
Linda University, March 12, 2006, Las Vegas, Nevada.

World Class Breast Imaging. Sponsored by Loma
Linda University, Aug 7, 2006, Vancouver, BC.

New BC Screening Mammography Guidelines
Women's Mid-Life Years; Heart/Breast/Bone: Putting
it all Together. UBC Interprofessional Continuing
Education. Vancouver, BC. April 8, 2005

Ultrasound Diagnosis and Intervention
Society of Breast Imaging - 7th Postgraduate Course.
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