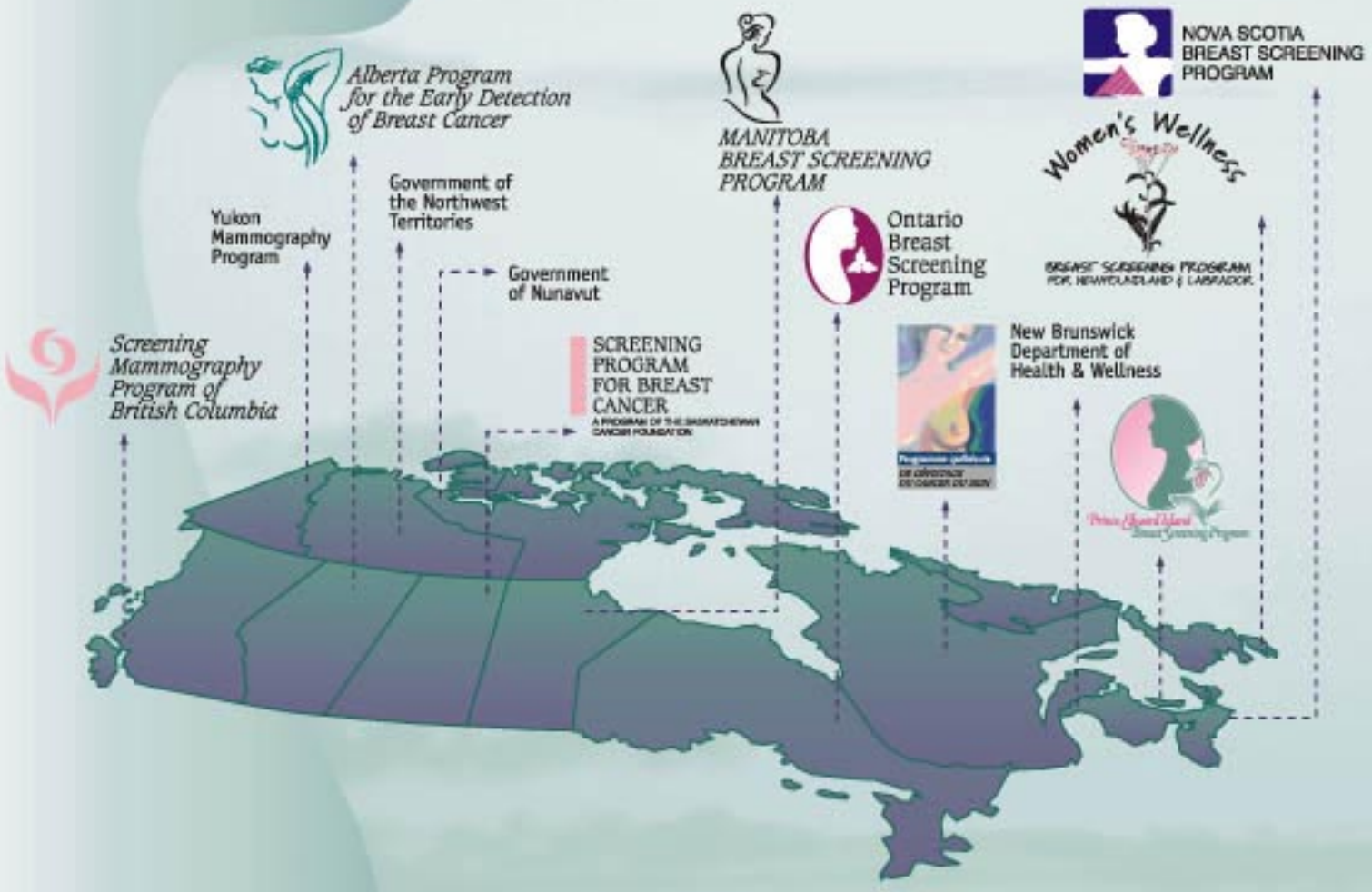
Health Canada Santé Canada

Organized Breast Cancer Screening Programs in Canada



1997 and 1998 Report

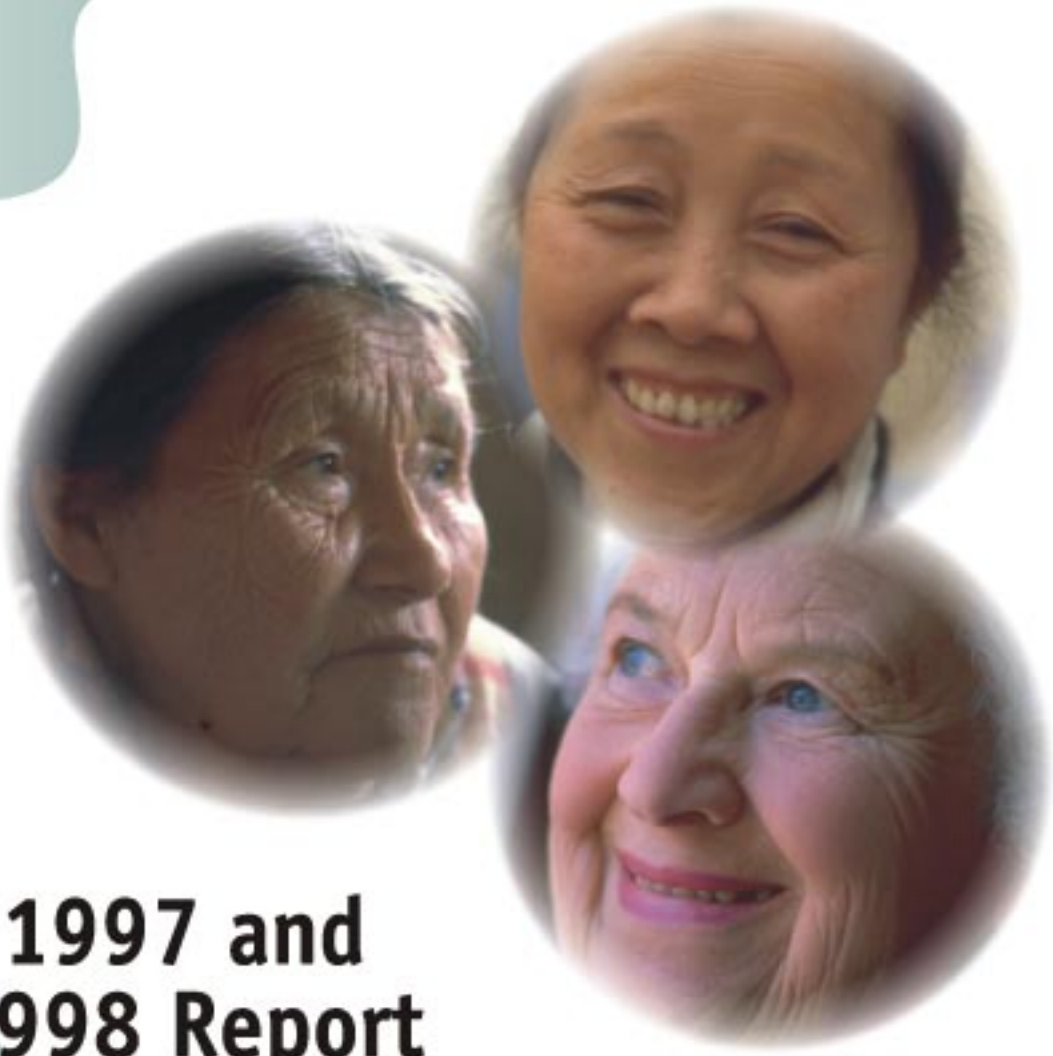
Canada

Our mission is to help the people of Canada
maintain and improve their health.

Health Canada

Cat. No. H1-9/13-1998
ISBN 0-662-65807-8

Organized Breast Cancer Screening Programs in Canada



1997 and 1998 Report

ACKNOWLEDGEMENTS

We would like to acknowledge the following contributors:

- Provincial organized screening programs, which supply the data to the Canadian Breast Cancer Screening Database at the Centre for Chronic Disease Prevention and Control, Health Canada.
- The Writing Committee of this report, which included Heather Bryant, Alberta Screen Test Program; Gregory Doyle, Breast Screening Program for Newfoundland and Labrador; Lisa Kan, Screening Mammography Program of British Columbia; Diane Major, Programme québécois de dépistage du cancer du sein; Ivo Olivotto, Screening Mammography Program of British Columbia; Christina Bancej and Gloria Low, Health Canada.
- The Database Management Committee (DMC) for its edits and reviews of this report.
- The Database Technical Subcommittee for reviewing and ensuring the accuracy of the data.
- Alex Madramootoo, Health Canada, Systems Analyst for the Canadian Breast Cancer Screening Database.
- Eleanor Paulson, Francine Boucher, Pam Fitch and Tracie St-Jean, Health Canada for preparing the document for dissemination.
- Françoise Bouchard, Leslie Gaudette and Ann Coombs, Health Canada for editing and reviewing this report.
- Special thanks to Diane Major, Programme québécois de dépistage du cancer du sein and Anne-Marie Ugnat, Health Canada for reviewing the French version.
- Production of this document was made possible through the Canadian Breast Cancer Screening Initiative.

For additional copies of this report, please contact the Cancer Bureau,
Centre for Chronic Disease Prevention and Control:
(613) 946-9967; Fax: (613) 941-5497
Email: cancer_bureau@hc-sc.gc.ca

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Breast cancer continues to be the most common cancer afflicting Canadian women and nearly half of all new cases occur among those aged 50 to 69. For women in this age group, randomized trials and demonstration projects initiated in the 1970s and 1980s indicated that breast screening delivered in an organized and systematic manner was an effective means of reducing the rate of death from breast cancer by approximately one third. In December 1992, under the Canadian Breast Cancer Screening component of the Canadian Breast Cancer Initiative, Health Canada was mandated to facilitate a federal/provincial/territorial working group on breast cancer screening to implement and evaluate breast cancer screening programs in Canada. In response, provincial/territorial breast cancer screening programs collaborated in the development of a national database to monitor and evaluate breast cancer screening delivered through organized provincial programs. This document, the second in a series of biennial reports, is a product of the continuous evaluation that organized breast cancer screening programs undergo to assure high standards are maintained in the provision of an effective service. It presents selected statistics for the 1997 and 1998 calendar years using data submitted by provincial screening programs to the Canadian Breast Cancer Screening Database.

Over the past decade, breast screening through provincially organized breast cancer screening programs has grown substantially, from a single program offering two-view mammographic screening to 9,371 eligible women in 1989, to nine organized programs screening a total of 470,876 women in 1998. The dramatic rise in the number of women screened through organized programs, and the establishment of new programs in several jurisdictions, heightens the importance of quality screening. This report demonstrates that women attending organized breast screening programs in Canada continue to receive screening that meets or exceeds most standards set by other countries. In 1997 and 1998, abnormal recall rates (mammography alone) on first and rescreen for women aged 50 to 69 were within the United Kingdom's recommendations. The benign to malignant open biopsy ratio of 1.6:1.0 and cancer detection rate on first and rescreen of 6.7 and 4.2

Provincial breast cancer screening programs have grown from a single program screening 9,371 eligible women in 1989, to nine programs screening 470,876 women in 1998.

per 1,000 screens respectively, were within targets set by other countries. Overall, 37.6% of detected invasive cancers were ≤ 10mm and 78.5% of cancers were lymph node negative, exceeding the recommendations of other national breast screening programs. Participation rates within organized Canadian programs remain sub-optimal, reaching between 11.5% and 54.7% of the target population. In order to reach a 70% participation rate, additional resources are necessary for the implementation of new programs and the expansion of existing ones. In addition, a significant number of women continue to receive opportunistic screening in the diagnostic sector across Canada. With the growth of organized screening, steady improvement towards achieving a cancer control target of 70% participation among women aged 50 to 69 is expected.

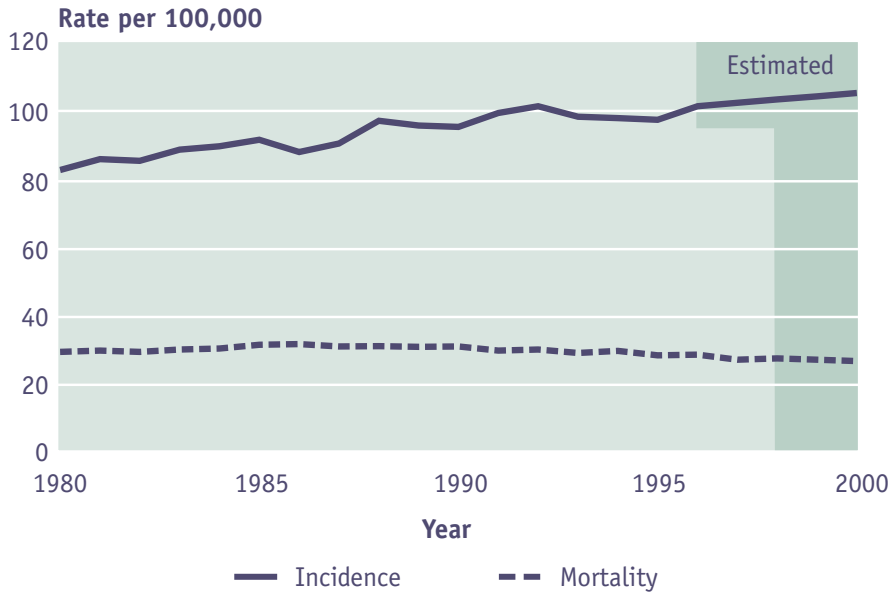
Although increasing recruitment to attain at least a 70% participation rate in organized screening among women aged 50 to 69 remains an important goal of organized programs, attention is also focused on ensuring that previously screened asymptomatic women continue to receive the benefits of regular breast screening. With respect to retention, organized breast cancer screening programs have fared remarkably well. Among women screened in 1994 and 1995 who were eligible for a repeat biennial mammogram, approximately 80% returned to their programs within 2.5 years of their previous screen. Compared with women who delayed their return to screening beyond 2.5 years, those who returned within 2.5 years had fewer abnormalities or cancers that were detected compared to women who returned in a less timely interval, while high positive predictive values of the screening examination were maintained.

In the coming years, organized screening programs will continue their efforts towards providing quality breast cancer screening. Programs are continually updating their efforts to achieve a population-based breast cancer mortality reduction by reviewing new evidence and contributing to the growing body of research on screening. The Canadian Breast Cancer Screening Database is contributing to this effort by supporting research activities that influence policy development in breast cancer screening.

BACKGROUND

Breast cancer continues to be the most common cancer among Canadian women and the second highest cause of cancer death in women, with 19,200 new cases and 5,500 deaths estimated for 2000[1]. A rise in the incidence of breast cancer has been observed over several decades paralleling an increase in mammographic screening. However, mortality rates have dropped, particularly since 1990, attributed, in part, to improved treatment and to early detection through mammography screening (Figure 1).

Figure 1
Age-standardized incidence and mortality rates for breast cancer in Canada, 1980-2000



Source: National Cancer Institute of Canada: Canadian Cancer Statistics 2000, Toronto, Canada, 2000.
Notes: Mortality rates for 1998-2000 and incidence rates for 1996-2000 are estimates. Rates are standardized to age distribution of 1991 population.

Nearly half of all new breast cancer cases occur among women aged 50 to 69 and it has been demonstrated these women benefit the most from breast screening.

Currently, there is insufficient knowledge about the causes of breast cancer for primary prevention strategies to reduce incidence in the population. Most known risk factors are not modifiable. Of the known risk factors, age has the strongest influence. Both the incidence and

mortality of breast cancer rise sharply with age, with the highest rates among women aged 60 and over[2]. Nearly half of all new cases occur among women aged 50 to 69[1]. It has been demonstrated, through randomized trials, that women in this age group benefit the most from breast screening. Delivery of regular, high quality breast screening to this group has the potential to reduce breast cancer mortality rates by approximately one third[3,4].

Breast Cancer Screening in Canada

In March 1988, expert representatives from government and key voluntary and professional organizations convened at a national workshop designed to review the evidence supporting breast cancer screening, and the procedures and systems used to deliver such early detection programs, with the aim of reaching a Canadian consensus. One recommendation made was that Canadian women aged 50 to 69 "*...be offered, and encouraged to participate in, an early detection program consisting of mammography, physical examination of the breasts by a health care professional, and teaching and monitoring of breast self-examination every 2 years.*" The programs were to be delivered through dedicated screening centres[5]. The federal/provincial/territorial Conference of Deputy Ministers of Health agreed to encourage exchange between key federal and provincial bodies involved in cancer control to facilitate the introduction and operation of breast cancer screening programs. Interchange '90 was organized as an initial step in achieving this goal. Out of this event, a National Committee on Breast Cancer Screening was formed, and since November 1990, Health Canada has supported semi-annual meetings and activities of this group[6].

In December 1992, the federal government launched the first phase of the Canadian Breast Cancer Initiative (CBCI), with stable, ongoing funding of $25 million over 5 years. Under the Canadian Breast Cancer Screening component of this initiative, Health Canada was mandated to enable a federal/provincial/territorial working group on breast cancer screening to implement and evaluate breast cancer screening programs in Canada. Following the November 1993 National Forum on Breast Cancer, the membership of the National Committee on Breast Cancer Screening was expanded and the group became formally known as the National Committee for the Canadian Breast Cancer Screening Initiative (CBCSI). Its activities included fostering the development

The national recommendation is that organized breast cancer screening programs actively screen women aged 50 to 69 every 2 years.

of quality, organized breast cancer screening programs in Canada with the following essential components: a population-based outcome goal; information about the target population; emphasis on hard-to-reach groups; meticulous quality assurance; outcome data and analysis; information systems and linkages; a woman-centred focus; and excellent coordination with high-quality diagnosis and follow-up[7]. Through its activities, a national database, derived from provincial breast screening program data, was developed in 1993. The National Committee for the CBCSI continues its work today as a component of Phase II (1998-2003) of the CBCI.

Organized Screening Programs in Canada

Organized screening programs began in British Columbia in 1988 and have since expanded to include all provinces, the Yukon and the Northwest Territories (Table 1). Breast cancer screening in all organized programs includes a bilateral two-view screening mammogram. Manitoba, Ontario, and Newfoundland also provide a clinical breast examination (CBE) carried out by a trained health professional, and Nova Scotia and Prince Edward Island provide a modified CBE by a technologist. In addition, all programs provide information and/or instruction on breast self-examination.

For the purposes of the Canadian Breast Cancer Screening Database, the target population is defined as asymptomatic women between the ages of 50 and 69 years with no prior diagnosis of breast cancer. All programs also screen some women outside the target age group. Screening program practices regarding women outside the ages of 50 to 69 are presented in Table 2.

Organized screening programs began in British Columbia in 1988 and have since expanded to include all provinces, the Yukon and the Northwest Territories.

The Screening Process

The process that an organized breast cancer screening program undergoes to reach its target population for screening can be described in three stages: identification and invitation of the target population; provision of the screening examination; and, if an abnormality is detected, further investigation. Figure 2 illustrates the pathway in more detail.

Table 1
Breast cancer screening programs in Canada – usual practices, 1997 and 1998 screen years

Program	Program Start Date	Mammography Interval	Clinical Breast Exam on Site	Target Population Age
British Columbia*	1988	Biennial	No	50-74
Yukon	1990	Biennial	No	50-69
Northwest Territories	1994	Biennial	No	50-69
Alberta	1990	Biennial	No	50-69
Saskatchewan	1990	Biennial	No	50-69
Manitoba	1995	Biennial	Nurse or technologist	50-69
Ontario	1990	Biennial	Nurse	50-69
Quebec	1998	Biennial	No	50-69
New Brunswick	1995	Biennial	No	50-69
Nova Scotia	1991	Biennial	Technologist	50-69
Prince Edward Island	1998	Biennial	Technologist	50-69
Newfoundland	1996	Biennial	Nurse	50-69

* Until mid-1997, British Columbia had annual recall frequency (mammography interval) for all women aged 40 and over.

Women of the target age are recruited to the screening program through either a letter of invitation, a physician referral, or self-referral. At the screening facility, which may be a mobile unit or a fixed site, women receive two-view mammography of each breast. In addition to mammographic screening, women attending programs in Ontario, Manitoba, Nova Scotia, Prince Edward Island, and Newfoundland receive a clinical breast examination performed by a trained health professional while the remaining programs encourage women attending screening to obtain regular clinical breast examination outside of the program from their family physicians (Table 1). All programs provide screening results to both the woman and her physician. If the screening result is normal, women who are still eligible are recalled by letter of invitation for another routine screen. This generally occurs after 2 years, although a minority of women are recalled annually based on age, mammographic results, family history, or other factors that vary across programs. Women with an abnormal screening result are informed, along with their family physician, of the need for further assessment.

Table 2
Breast cancer screening program practices for women outside the 50 to 69-year age group, Canada, 1997 and 1998 screen years

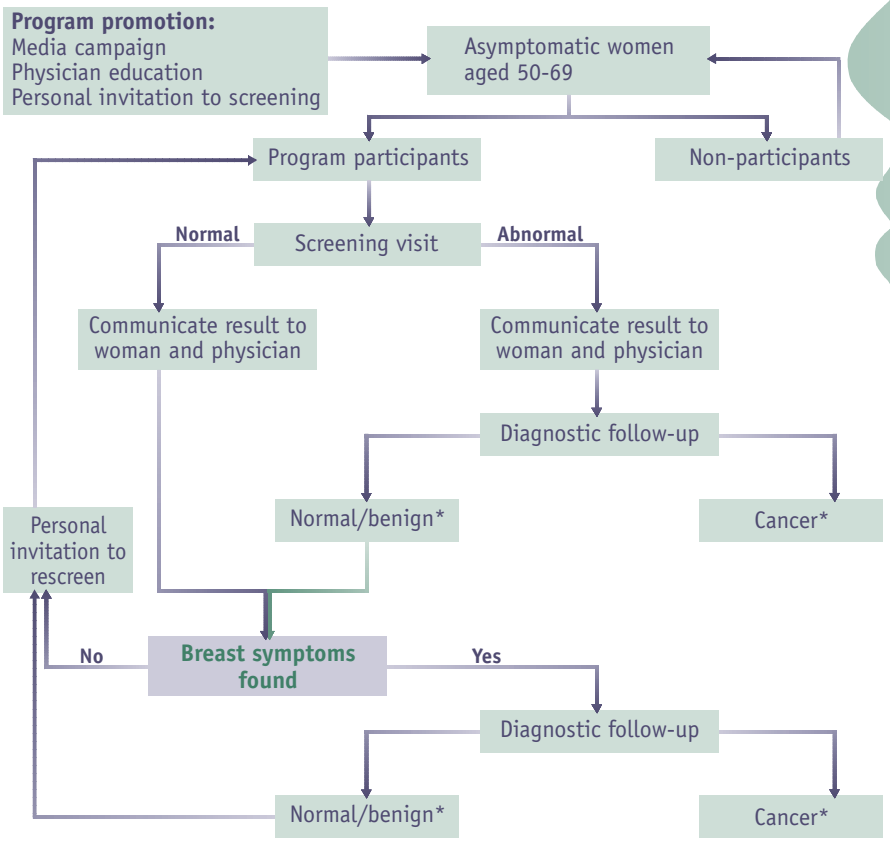
Program	Program Practices			
	Age Group	Actively Recruit	Accept	Recall
British Columbia*	40-49	×	✓	Annual
	70-74	✓	✓	Biennial
	75-79	×	✓	Biennial
	80+	×	✓†	×
Yukon	40-49	×	✓	×
	70+	×	✓	×
Northwest Territories	40-49	×	✓	Annual
	70+	×	✓	Biennial
Alberta	40-49	×	✓	Biennial
	70-74	×	✓	Biennial
	75+	×	✓	×
Saskatchewan	40-49	×	×	N/A
	70+	×	✓	Biennial
Manitoba**	40-49	×	✓	Biennial
	70+	×	✓	×
Ontario	40-49	×	×	N/A
	70+	×	✓	Biennial
Quebec	40-49	×	✓†	×
	70+	×	✓†	×
New Brunswick	40-49	×	✓†	×
	70+	×	✓†	×
Nova Scotia	40-49	×	✓	Annual
	70+	×	✓	Biennial
Prince Edward Island	40-49	×	✓	Annual
	70-74	×	✓	Biennial
Newfoundland	40-49	×	×	N/A
	70-74	×	✓	Biennial

* Until mid-1997, British Columbia had annual recall frequency for all women aged 40 and over.

** As of July 1998, both age groups accepted to mobile unit.

† Accept with physician referral.

Figure 2
Pathway of a breast cancer screening program



* Breast screening programs obtain final diagnoses from sources such as physicians, pathology reports and cancer registries.

Generally, the diagnostic follow-up is coordinated by the woman's physician and is completed when a final diagnosis of either cancer or normal/benign is reached. Program participants are advised that although mammography is highly effective in detecting breast cancers early, there is a possibility that some cancers are undetectable by mammography. A small number of women may develop symptoms in the interval before their next screening visit and are encouraged to consult their physician as soon as possible.

Monitoring and Evaluation

The goal of breast cancer screening is a reduction in breast cancer deaths. Timely mammography screening is expected to prevent

approximately one third of breast cancer deaths after 7 to 10 years from the point at which full implementation among 70% of women in the target age group is achieved[3,4]. Because achieving a participation rate of 70% among women aged 50 to 69 is a gradual process, mortality rates are not immediately useful for monitoring program effectiveness. Analysis of mortality rates over time to determine the impact of screening will require a more complex research design, which takes into account the trends in screening and treatment for breast cancer. Indicators of the screening process that are valid, reliable and feasible to collect within the screening program are required to conduct interim evaluations of the impact of screening.

Interim measures used for ongoing evaluation of organized breast cancer screening programs at the national level include compliance rate, cancer detection rate, rate of advanced cancers, tumour size, and nodal status. Provincial programs also collect additional indicators that are not monitored at the national level.

Representatives of Health Canada and the breast screening evaluation community met in February 2000 as a first step towards developing a set of Canadian core indicators and targets for evaluating the performance and quality of organized breast cancer screening programs. In the meantime, provincial/territorial screening programs strive to achieve or exceed the national standards set by Sweden[8], the Europe Against Cancer program[9] the United Kingdom[10,11], and Australia[12] (Appendix 1).

Monitoring screening programs requires reliable, standardized information that is comparable across provinces. Some follow-up data must be obtained from external sources, thereby complicating the evaluation process. Many, but not all programs are directly linked to their provincial cancer registries to obtain cancer outcome data. Further complicating the evaluation process, some programs experience delays in obtaining registry data.

Organized screening programs can ensure quality control elements of the screening process.

In addition, analyses have shown that breast tumour data vary from one program to another. Health Canada and the Canadian Cancer Registry are collaborating to hold a breast cancer staging training workshop in 2001 to address this issue.

Canadian Breast Cancer Screening Database

The Canadian Breast Cancer Screening Database (CBCSD) is a national breast screening surveillance system that furthers collaboration in monitoring and evaluating organized breast cancer screening across Canada. Established in 1993, it is operated and maintained by the Cancer Bureau at the Centre for Chronic Disease Prevention and Control at Health Canada. Through the Canadian Breast Cancer Screening Initiative, the CBCSD is managed by the Database Management Committee (Appendix 2) and implemented by the Database Technical Subcommittee (Appendix 3).

Memoranda of Understanding (MOU) exist between the Centre for Chronic Disease Prevention and Control and 11 of the organized screening programs. The MOU clarify issues of ownership, access, accountability, and confidentiality with respect to data collected by the CBCSD.

The data collected by the CBCSD can be used to generate national statistics, compare data interprovincially and internationally, and provide a larger database to conduct research activities. Research priorities using the CBCSD were identified in October 1999.

The CBCSD currently contains screening information from program inception up to the end of 1998 for the following provinces: British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, and Newfoundland. Test data from Prince Edward Island are currently being analyzed. Because the Yukon and the Northwest Territories do not have a computerized information system, their data are not available to the CBCSD. For more detailed information regarding the data collected, please refer to the 1996 Report online at http://www.hc-sc.gc.ca/hpb/lcdc/publicat/obcsp-podcs/index.html and its publication in the October 31, 2000 edition of the Canadian Medical Association Journal[13].

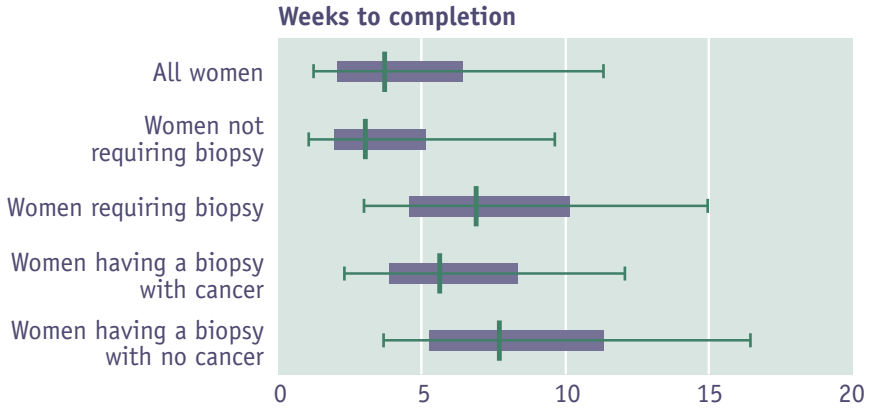
Research Activities Using the CBCSD

In addition to its primary use in evaluating and monitoring the effectiveness of organized breast cancer screening programs in Canada, the CBCSD is proving to be a valuable tool to carry out

research and to support policy development on issues related to breast cancer screening.

The CBCSD has supported activities of the Working Group on the Integration of Screening and Diagnosis sponsored by the Canadian Breast Cancer Screening Initiative National Committee. This working group was mandated to evaluate the current diagnostic process after an abnormal breast screening examination for Canadian women, and, if gaps were identified, propose steps to achieve timely and well-coordinated links between screening and assessment. Nationally, half of all women aged 50 to 69 who had a screen-detected abnormality waited nearly 4 weeks from their screening exam to obtain a diagnosis. Requiring a biopsy substantially increased the time required to reach a diagnosis (Figure 3). Taking into consideration factors such as the timeliness already achieved for half the women attending organized screening programs in Canada, the working group recommended timeliness targets for Canadian organized breast screening programs. A full report of the group's findings and recommendations was produced in 2000[14]. It can be accessed at the following website: http://www.hc-sc.gc.ca/hppb/ahi/breastcancer/publications.html.

Figure 3
Duration from abnormal screen to diagnosis among women aged 50-69 requiring follow-up, 1996



Notes: Evaluated with data from B.C., Alta., Sask., Man., Ont., N.S., and Nfld. Cutoffs indicate the point at which 10%, 25%, 50%, 75% and 90% of women have received a diagnosis.

The Canadian Breast Cancer Screening Database (CBCSD) is a national breast screening surveillance system that monitors and evaluates organized breast cancer screening across Canada.

In October 1999, more than 30 representatives from provincially organized breast cancer screening programs, the academic research community and Health Canada convened at a workshop held in Ottawa to reach consensus on priority research activities to be undertaken by the CBCSD. Projects that ranked highly and for which preliminary research plans were developed include the following: to evaluate the benefit of clinical breast examination in addition to mammography; to measure the occurrence of post-screen detected cancers; to assess strategies to increase recruitment and retention; and to determine the impact of screening on breast cancer incidence and mortality. Projects have been initiated in each of these priority areas.

1997 & 1998 RESULTS

This report presents selected statistics for the 1997 and 1998 calendar years using data submitted to the CBCSD up to June 2000. Unless otherwise noted, the summary statistics for all programs include data from the following provinces: British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, and Newfoundland. Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity. The Quebec program has incomplete cancer information due to incomplete data linkages. Therefore, some cancer-related data for Quebec are not reported in the results.

Participation in Screening Programs

The success of screening programs in reducing mortality from breast cancer in the population depends directly on achieving high attendance rates and a high frequency of screening at regular intervals. Organized breast cancer screening programs in Canada have grown substantially over the last decade from a single program screening 9,371 women in 1989 to nine programs screening a total of 470,876 women in 1998 (Table 3). Despite these gains, provincial participation rates of women aged 50 to 69 in 1997 and 1998 ranged from 11.5% to 54.7%, well below the 70% participation rate targeted by screening programs in other countries. On a more positive note, programs in Manitoba and New Brunswick, which were established in 1995, have already reached a participation rate of close to 40% (Figure 4).

Organized breast screening programs have grown substantially over the last decade; however, provincial participation rates of women aged 50 to 69 in 1997 and 1998 ranged from 11.5% to 54.7%, well below the 70% target.

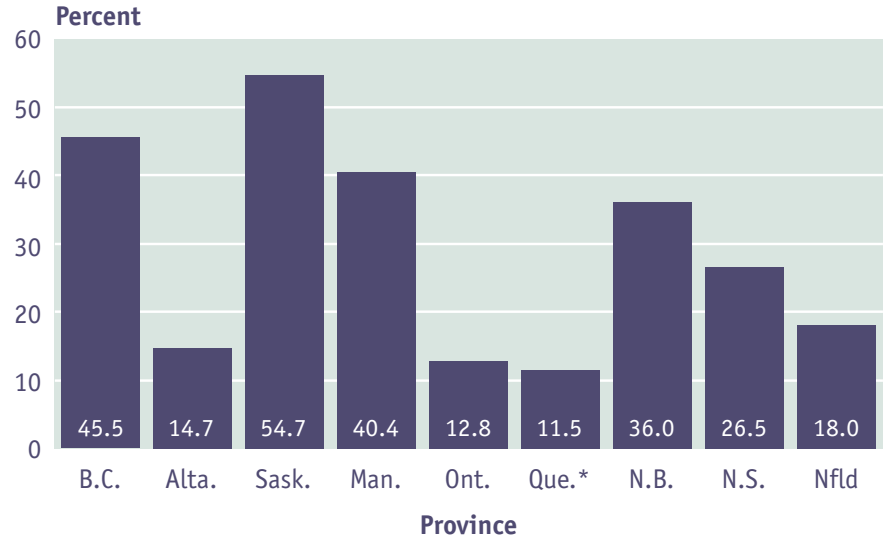
Another source of data on screening participation is the self-reported information from the 1998/99 National Population Health Survey (NPHS), which reflects mammography delivered within and outside of organized programs. Among Canadian women aged 50 to 69, approximately 66.3% (95% CI 63.5-69.1) reported receiving a screening or diagnostic mammogram in the previous 2 years. Provincial estimates ranged from 47.1% to 80.8%. The two provinces with the highest

Table 3
Annual screening volume by program 1989 to 1998, all ages

Program	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
B.C.	9,371	22,985	55,884	83,969	104,380	123,879	150,248	166,756	173,923	189,987
Alta.	—	616	5,873	15,442	16,148	15,373	14,182	14,696	23,376	18,896
Sask.	—	6,355	14,305	15,778	26,057	25,540	29,603	28,891	33,913	34,044
Man.	—	—	—	—	—	—	2,671	13,598	19,165	23,463
Ont.	—	591	15,404	40,335	45,591	55,494	58,316	67,763	80,178	98,591
Que.	—	—	—	—	—	—	—	—	—	49,700
N.B.*	—	—	—	—	—	—	5,827	18,709	18,161	25,220
N.S.	—	—	1,877	4,354	4,891	8,461	12,491	15,547	19,477	25,454
Nfld.	—	—	—	—	—	—	—	3,120	4,690	5,521
Canada	9,371	30,547	93,343	159,878	197,067	228,747	273,338	329,080	372,883	470,876

* Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

Figure 4
Proportion of women aged 50-69 who participated in provincial breast cancer screening programs in 1997 and 1998



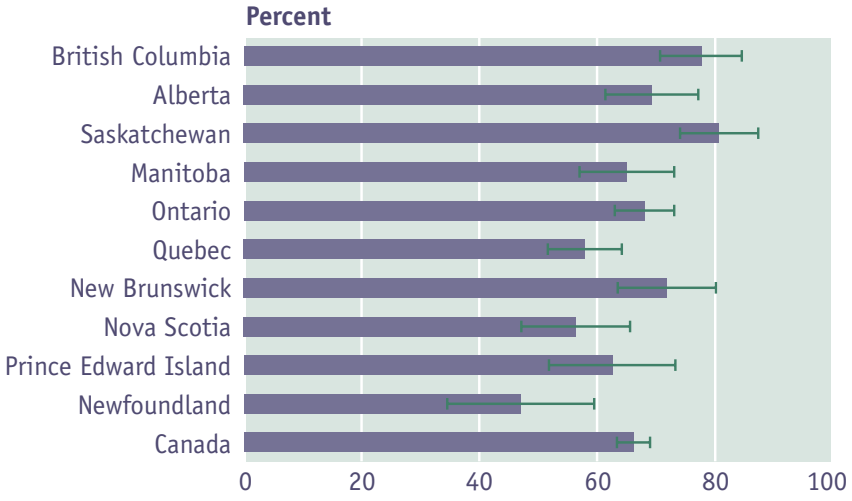
* The 1998 population estimate was halved for Quebec to approximate participation rates at least once every 2 years, as the program was implemented only in 1998. For other provinces, 1997 and 1998 population estimates were averaged.
Note: Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

participation in organized programs, Saskatchewan and British Columbia, also had the highest overall self-reported levels (Figure 5).

Mirroring the increased growth in screening through organized programs, mammography obtained in the fee-for-service sector has also risen over the past decade. As of 1994, an estimated 80% of mammography obtained in the fee-for-service sector was done for screening purposes[15]. This development is of concern, because such screening mammography is delivered in an ad hoc fashion without targeting or recalling women who are most likely to benefit from mammography screening. Organized screening programs can ensure quality control elements of the screening process and monitor interim indicators that the program is on track towards achieving a breast cancer mortality reduction in the population. However, not all screening programs have the resources to reach all women in the target population adequately. Expansion of organized breast cancer screening programs and allocation of additional resources for the recruitment of target aged women would reduce barriers, such as waiting lists or lack of access to organized screening.

Figure 5

Proportion of women aged 50-69 with a self-reported mammogram in the past 2 years by province, 1998/99 National Population Health Survey



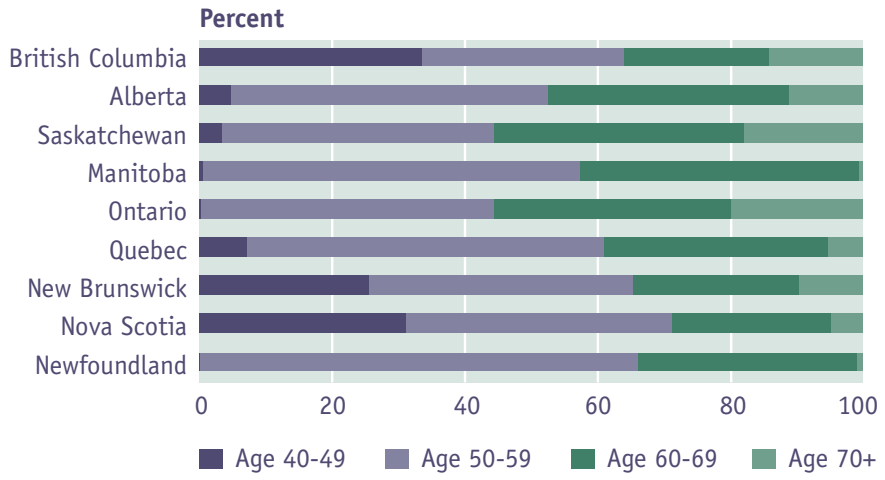
Data Source: 1998/99 NPHS Health Canada Share File
Note: Error bars indicate upper and lower 95% confidence intervals for population proportion using bootstrap resampling methods.

Recruitment and Retention

Organized breast cancer screening programs promote participation through a variety of recruitment methods. All Canadian organized breast cancer screening programs use letters of invitation to reach at least part of their target population. However, not all programs have access to population-based lists, which may contribute to lower participation rates. Other means of recruitment include physician referrals for screening, media campaigns and referrals from women themselves.

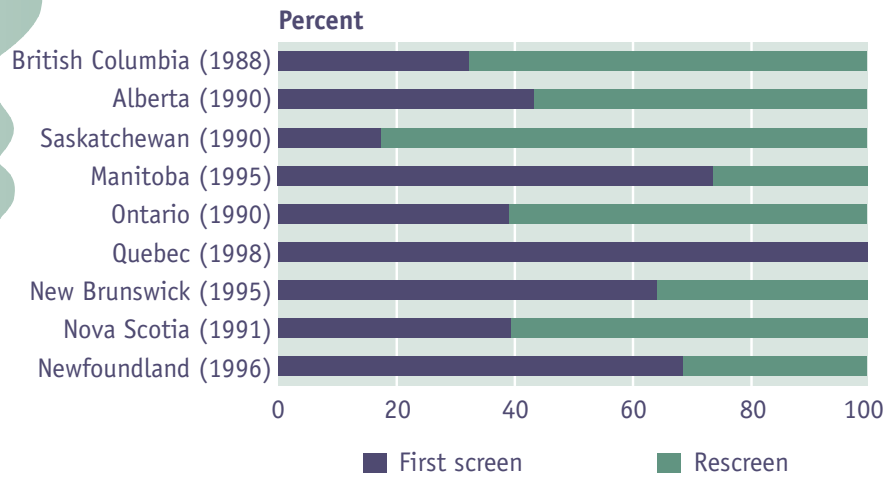
Consistent with the national recommendation, all programs currently actively encourage 50 to 69 year old women to attend a biennial screening examination. Some programs also screen women aged 40 to 49 and aged 70 and over. In 1997 and 1998, the percentage of total screens that were delivered to women aged 50 to 69 ranged by province from 52.3% to 99.1% (Figure 6). Programs still in their expansion phase, such as the newly initiated organized breast cancer screening program in Quebec, predominantly recruit women for their first-ever program screen. By contrast, for mature programs, women returning for subsequent screens can comprise more than 80% of the screened population (Figure 7).

Figure 6
Age distribution of program screens by province, 1997 and 1998



Note: Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

Figure 7
Distribution of first and subsequent program screens by province, women aged 40 and older, 1997 and 1998



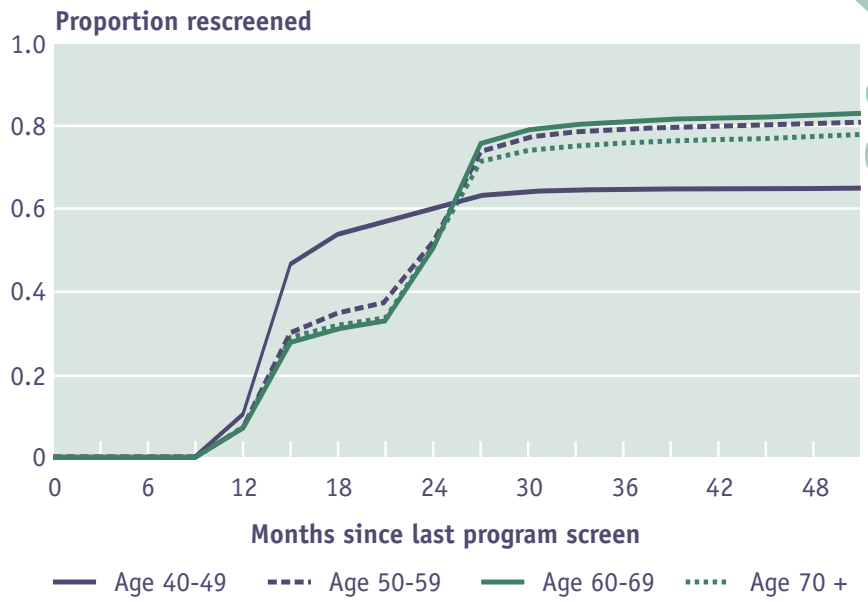
Notes: Number in brackets indicates program start date; programs with earlier start dates can be expected to have more rescreens. Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

Retention rates are indicators of the acceptability of screening to women. When it is time to return for another routine screening, eligible women are sent a reminder letter asking them to contact the program to set up an appointment. To determine the proportion of women returning to the screening program, those screened in 1994 and 1995 who were eligible for a subsequent screen were followed up until the end of 1998 and the probability of their returning for a subsequent screen were followed up until the end of 1998 (Figure 8). Among women aged 50 to 69, approximately 80% returned for their next screen by 2.5 years. This compares favourably with the target of a 75% retention rate in the Australian program (Appendix 1). Although they were more likely to return just beyond one year, overall, women aged 40 to 49 were less likely to return to screening programs, which may reflect less intensive targeting through promotional material, mixed policies regarding screening and weaker scientific evidence of the benefits of screening for women in this age group. Some women who were screened in their forties may decide to wait until they reach 50 before obtaining further screening.

Among women aged 50 to 69, approximately 80% returned for their next screen within 2.5 years, an indicator of the acceptability of screening programs.

A further consideration regarding returning for a subsequent screen is the tendency to stretch out the intervals between screening, a

Figure 8
Cumulative probability of returning for a subsequent program screen by age group, women screened in 1994 and 1995



Notes: In 1994 and 1995 annual screening frequencies were recommended by B.C. for women aged 40-49. Evaluated with data from B.C., Alta., Sask., Man., Ont., N.B., and N.S. Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

phenomenon labelled 'slippage'[16]. Many women returning to organized programs in Canada did so 3 to 6 months later than the recommended biennial interval, possibly reflecting the time it takes to act on their reminder letters, or to schedule an appointment given a waiting list. Suggestions to improve compliance with the screening schedule have been outlined by the Quality Determinants Working Group of the CBCSI's National Committee[17].

Results of Screening

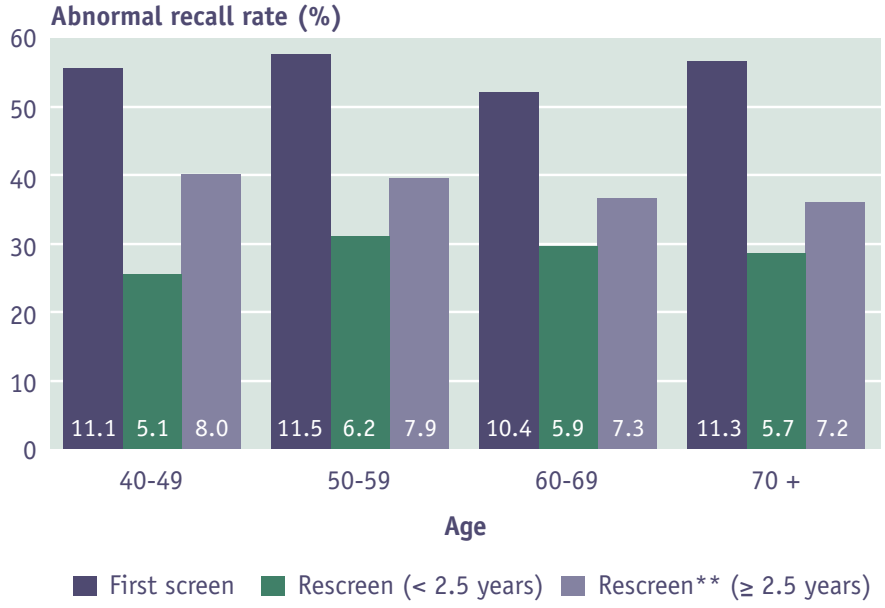
Organized breast cancer screening aims to ensure that all breast cancers are identified in asymptomatic women while minimizing the number of healthy women who experience unnecessary follow-up procedures.

Abnormal recall rates on first screen are normally high, reflecting prevalent cancers among screened women. Abnormal recall rates

differed little among age groups, ranging from 10.4% to 11.5% of first screens (Table 4). For rescreens occurring less than 2.5 years from the previous screen, the abnormal recall rate was substantially lower (between 5.1% and 6.2%) (Figure 9). The lower rate may reflect either the value of having previous comparison mammograms or the likelihood that fewer cancers would develop between screens or both factors. The abnormal recall rates for rescreens occurring at least 2.5 years after the previous screen start to revert back towards the rates at first screen. This emphasizes the benefits of returning for a subsequent screen in a timely fashion.

The rate of abnormal screens was slightly higher for first screens in comparison with standards set by other national breast screening programs (see Appendix 1), which specify that fewer than 7% to 10% of first screens should be abnormal. However, these programs use mammography as the sole modality of screening, whereas several Canadian

Figure 9
Abnormal recall rate* by age group, 1997 and 1998



*Includes mammography and clinical breast examination as screening modalities.
**Half of the women who were rescreened 2.5 or more years from the previous screen returned for a screen by 3.4 years.
Note: Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

Table 4
Abnormal recall rates by mode of detection and age group, 1997 and 1998 screen years

Mode of Detection	40-49 %	50-59 %	60-69 %	70+ %	All Ages %
Abnormal by mammography alone					
Initial screen	10.7	9.6	8.7	9.4	9.6
Rescreen	5.2	5.1	4.7	4.6	4.9
Abnormal by both mammography and CBE*					
Initial screen	0.3	0.7	0.5	0.6	0.5
Rescreen	0.1	0.3	0.3	0.3	0.3
Abnormal by CBE* alone					
Initial screen	0.1	1.6	1.4	1.6	1.2
Rescreen	0.05	1.0	1.1	1.1	0.9
All modes of detection					
Initial screen	11.1	11.5	10.4	11.3	11.1
Rescreen	5.4	6.4	6.0	5.9	6.0

* Manitoba, Ontario, Nova Scotia, and Newfoundland provide CBE by a nurse or technologist; of these programs, all but Nova Scotia restrict program participation to women aged 50 and older.

Note: Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

programs also use clinical breast examination (CBE). For women aged 50 to 69, CBE alone accounted for approximately 12% to 17% of the abnormal screens and 5% to 7% of cancers detected. For women aged 50 to 69, the rate of abnormalities detected by mammography alone are within standards set by the UK and Australian programs for first screen, and within the UK standard for rescreens. In general, Canadian recall rates just slightly exceed the standards set by Sweden and Europe.

Diagnostic Investigations

Further evaluation of suspicious or uncertain findings following a breast screening examination is a normal part of screening. The success of screening programs in reducing breast cancer mortality in the population

depends on the adequacy of follow-up in women with abnormal screens. In 1997 and 1998, complete follow-up information was available for over 90% of women with abnormal screening examinations. Among women screened within organized breast screening programs, 8.1% were referred for additional assessment. For every 100 women with an abnormality found on screening, between six and seven women were subsequently diagnosed with cancer. Those found to be normal are again eligible for routine screening in another 2 years.

To establish or exclude the presence of cancer when a lump or lesion is detected through clinical breast examination or mammography screening, additional assessment is normally required. In Canadian screening programs, women with screen-detected abnormalities and their family physicians are notified by the screening program of the need for further assessment and, for the most part, family physicians coordinate follow-up. Because mammography screening is offered to well women and breast cancer is not present in the majority of women with screening abnormalities, morbidity associated with fear, anxiety and subsequent testing should be minimized by providing a well-coordinated follow-up that assures a firm diagnosis in a timely fashion with the minimum number of interventions.

Following an abnormal screening, further investigations may include clinical evaluation, radiologic work-up including diagnostic mammography with additional views, spot compression or magnification views, a comparison with previous mammograms, and ultrasonography. A majority of women aged 50 to 69 (85.7%) underwent some type of imaging procedure, either a diagnostic mammogram and/or ultrasound (Table 5). For 68.1% of women aged 50 to 69, this was the only assessment required. A further 11.1% did not undergo imaging or biopsy, but likely underwent a clinical assessment, and some may have immediately proceeded to a surgical consultation without further intervention (Figure 10).

The benign:malignant biopsy ratio of 1.6:1.0 is appropriately low, indicating that screening is not causing unnecessary morbidity in healthy women.

A small number of women may require a surgical consultation, fine-needle aspiration or core biopsy, and surgical biopsy as appropriate to achieve a final diagnosis[18,19]. More often, less invasive fine-needle aspiration or core biopsy is conducted before resorting to open surgical biopsy. In 1997 and 1998, 17.8% of women received an open surgical

Table 5
Diagnostic procedures after an abnormal screen in women aged 50-69, 1997 and 1998 screen years

	Modes of Detection			
	All Modes of Detection	Clinically Detected	Mammographically Detected	Mammographically and Clinically Detected
Diagnostic Procedure	Number* *(%)* *Range***	Number* *(%)*	Number* *(%)*	Number* *(%)*
Diagnostic mammogram	30,332 *(70.3)* *54.4-85.8*	538 *(8.7)*	28,324 *(81.8)*	1,470 *(62.4)*
Ultrasound	18,532 *(42.9)* *23.5-62.1*	1,749 *(28.3)*	15,428 *(44.6)*	1,355 *(57.5)*
Fine needle aspiration	2,173 *(5.0)* *0.4-7.4*	533 *(8.6)*	1,376 *(4.0)*	264 *(11.2)*
Core biopsy	2,241 *(5.2)* *0-26.7*	54 *(0.9)*	1,895 *(5.5)*	292 *(12.4)*
Open biopsy with or without fine wire localization	5,733 *(13.3)* *2.6-17.8*	530 *(8.6)*	4,654 *(13.4)*	549 *(23.3)*

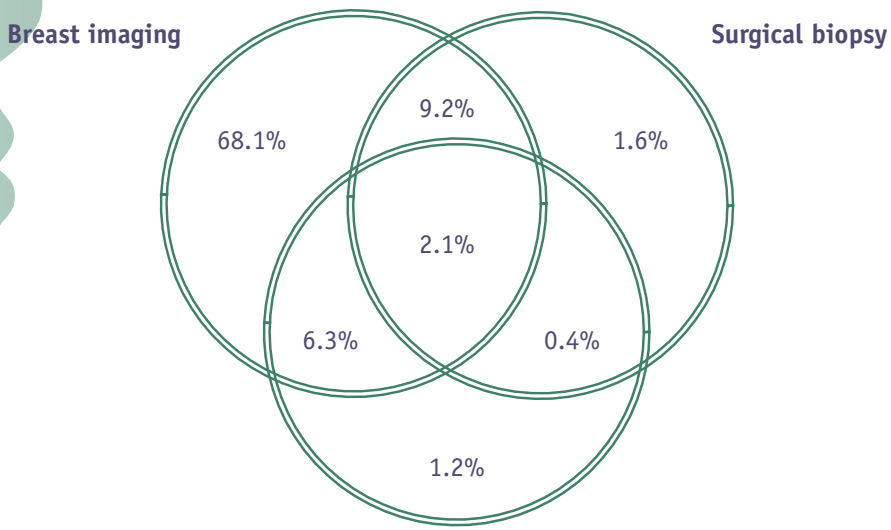
* All provinces combined.

** Range between provinces, reported as a percentage of women with abnormal findings.

Note: Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

biopsy to confirm their diagnosis. Of every 100 women having a surgical biopsy, approximately 38 were found to have cancer. This represents a benign:malignant biopsy ratio of 1.6:1.0, which is within the standards set by other countries (Appendix 1). Keeping the recall rate and the ratio of benign to malignant biopsies appropriately low are important indicators that screening is not inducing unnecessary morbidity in healthy women. Maintaining a low probability of false-positive findings and the resultant invasive procedures has been a challenge in some settings, particularly among women who follow the recommendation for regular screening[20].

Figure 10
Combinations of diagnostic procedures after an abnormal screen, women aged 50-69, 1997 and 1998



11.1% of women had none of the above procedures

Note: Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

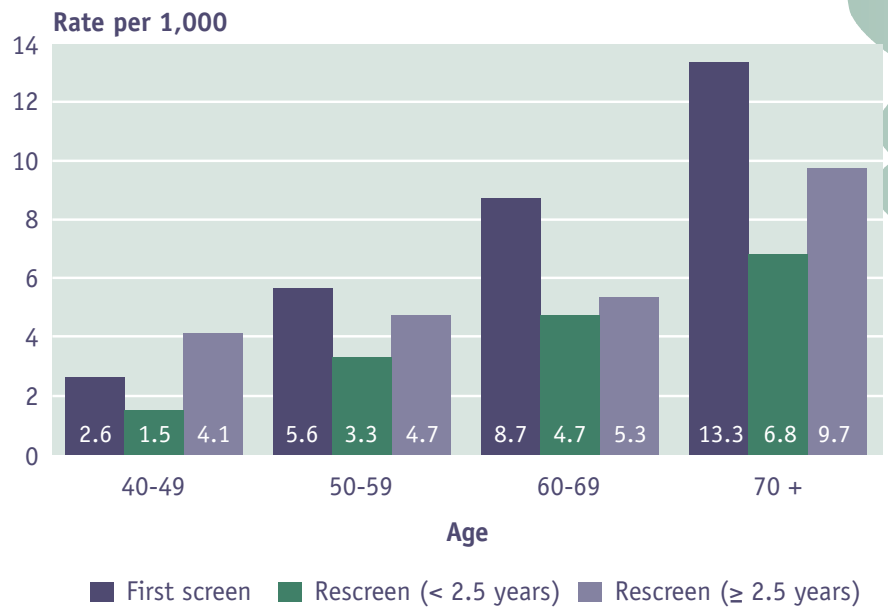
Preventing breast cancer deaths through mammographic screening depends on detecting cancers early, before they can be felt: 37.6% of invasive cancers were detected at ≤ 10 mm diameter and 78.5% were lymph node negative.

Cancer Detection

The cancer detection rate increased with age for initial and subsequent program screens (Figure 11). This rate is lower for rescreens occurring less than 2.5 years from the previous screen compared with rescreens occurring at least 2.5 years after the previous screen. This is anticipated as more cancers have the opportunity to develop if the interval between screens is extended. Table 6 shows that 5% to 7% of cancers were detected by clinical breast examination alone. Among women aged 50 and over, the cancer detection rates measure up well with the standards set by the UK and Australia (Appendix 1).

A total of 3,975 cancers were detected for the screen years 1997 and 1998, of which 80.2% were invasive and 19.8% were ductal carcinoma in situ (DCIS) (Table 7). The proportion of screen-detected cancers that were invasive increased with age. The overall proportion of in situ cancers (19.8%) is within Australian standards (10% to 20%).

Figure 11
Cancer detection rate per 1,000 screens by age group, 1997 and 1998



Notes: Quebec data are not included. Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

The secondary prevention of breast cancer death through mammographic screening depends on detecting cancers at an early stage, before they can be felt, leading to more treatment options, reduced recurrence and improved survival[21]. Nearly 90% of women with stage I cancers survive at least 5 years; this stage accounted for 50.9% of screen-detected cancers in women aged 50 to 69. Survival decreases as the stage of the cancer increases, reflecting larger tumours and more lymph node involvement. Five year survival rates are 75% for women with stage II cancers, just over 40% for stage III, and just under 20% for stage IV cancers[2].

The Europe Against Cancer guidelines recommend that to achieve a substantial reduction in mortality, 25% or more of screen-detected invasive cancers should be ≤ 10 mm in diameter. Swedish standards also recommend that at least 70% of screen-detected tumours should not have lymph node metastases. Once again, Canadian breast screening

Table 6
Cancer detection rates per 1,000 screens by mode of detection and age group, 1997 and 1998 screen years

Mode of Detection	40-49	50-59	60-69	70+	All Ages
Detected by mammography alone					
Initial screen	2.4	4.5	6.9	11.1	5.2
Rescreen	1.6	2.9	4.1	6.1	3.6
Detected by both mammography and CBE*					
Initial screen	0.3	1.0	1.6	2.1	1.1
Rescreen	0.1	0.4	0.5	0.8	0.5
Detected by CBE alone*					
Initial screen	0.1	0.3	0.3	0.3	0.3
Rescreen	0.2	0.4	0.3	0.5	0.3
All modes of detection					
Initial screen	2.6	5.6	8.7	13.3	6.4
Rescreen	1.8	3.5	4.8	7.1	4.2

* Manitoba, Ontario, Nova Scotia and Newfoundland provide CBE by a nurse or technologist; of these programs, all but Nova Scotia restrict program participation to women aged 50 and older.

Notes: The Quebec program has incomplete cancer information due to incomplete data linkages. Therefore, Quebec data are excluded from this table. Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

programs fared well as 37.6% of invasive cancers were detected at ≤ 10 mm diameter and 78.5% were lymph node negative (Table 8).

Even though abnormal recall rates did not differ with age (Table 4), the positive predictive value (PPV) increased with age (Figure 12), reflecting the increased number of cancers with advancing age and improved discriminating power of mammograms for less dense breasts. Delayed (≥ 2.5 years) intervals to rescreen tended to increase cancer detection rates. Within age groups, PPVs were similar on first and subsequent screens, but increased with age. This may reflect the fact that PPV values increase as the prevalence of cancer increases.

Table 7
Characteristics of cancers detected by age group, 1997 and 1998 screen years

	40-49		50-59		60-69		70+		All Ages	
	n	%	n	%	n	%	n	%	n	%
Number of cancers										
Invasive	222	68.1	1,037	77.9	1,131	83.0	797	83.4	3,187	80.2
DCIS	104	31.9	294	22.1	231	17.0	159	16.6	788	19.8
TNM staging										
0 *(in situ)*	104	31.9	294	22.1	231	17.0	159	16.6	788	19.8
I	136	41.7	475	35.7	568	41.8	404	42.4	1,583	39.9
II	69	21.2	222	16.7	205	15.1	114	12.0	610	15.4
III+	12	3.7	31	2.3	25	1.8	15	1.6	83	2.1
invasive (TNM stage missing)	5	1.5	307	23.1	329	24.2	261	27.3	902	22.7
Tumour size (invasive only)										
≤ 5 mm	19	8.8	82	8.5	87	8.2	51	6.7	239	8.0
6-10 mm	45	20.8	255	26.5	336	31.7	265	35.0	901	30.0
11-15 mm	66	30.6	265	27.5	308	29.1	202	26.7	841	28.1
16-20 mm	42	19.4	179	18.6	165	15.6	124	16.4	510	17.0
21+ mm	44	20.4	182	18.9	163	15.4	115	15.2	504	16.9
# unknown	(6)		(74)		(72)		(40)		(192)	
Median tumour size	14 mm		13 mm		12 mm		12 mm		13 mm	
Positive nodes (invasive only)										
0	150	75.0	704	78.0	762	78.6	520	84.4	2,136	79.5
1-3	39	19.5	147	16.3	156	16.1	67	10.9	409	15.2
4+	11	5.5	51	5.7	51	5.3	29	4.7	142	5.3
# unknown*	(22)		(135)		(162)		(181)		(500)	

* Includes missing values and cases in which dissection was not done.

Notes: The Quebec program has incomplete cancer information due to incomplete data linkages. Therefore, Quebec data are excluded from this table. Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

Summary of Outcomes

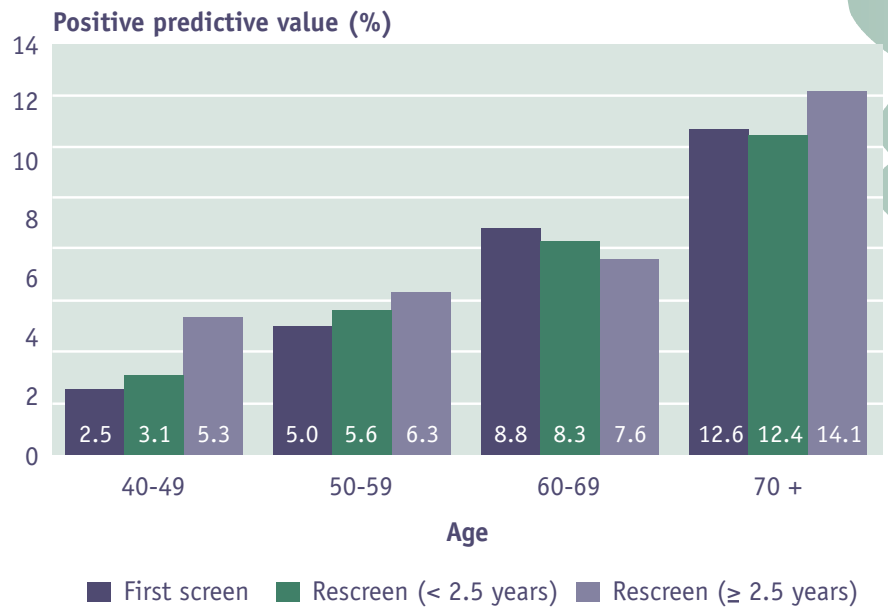
Table 8 summarizes outcomes for women within the target age group (50 to 69 years) by province. Quebec data capture information for the 1998 screen year only. Overall, the Canadian averages are in line with the standards of other national breast screening programs. The volume of screens and the proportion that are first screens varies greatly among provinces reflecting the length of time each program has been in operation. Abnormal recall rates drop substantially on subsequent

Table 8
Screening outcome summary by program, women aged 50-69 at screening, 1997 and 1998 screen years

Outcome	B.C.*	Alta.	Sask.	Man.**	Ont.**	Que.†	N.B.‡	N.S.§	Nfld**	Canada
Number of screens	190,013	35,520	53,472	42,135	142,982	43,587	27,444	28,819	10,123	574,095
Number of first screens	57,302	15,714	8,718	31,033	59,619	43,587	16,278	9,738	7,012	249,001
Abnormal recall rate (%)										
Initial screen	11.0	6.4	15.5	9.1	14.7	9.8	9.8	8.1	10.8	11.1
Rescreen	4.9	3.5	5.9	6.4	9.2	—	8.2	4.2	7.7	6.2
Number of cancers†	866	185	251	226	831	—	115	162	57	2,693
Cancer detection rate per 1,000 screens†										
Initial screen	6.9	6.4	6.6	5.9	7.0	—	4.2	7.3	5.7	6.7
Rescreen	3.6	4.2	4.3	4.0	5.0	—	—	4.8	5.5	4.2
PPV of abnormal screen (%)†	7.3	11.2	6.3	6.5	5.3	—	6.1	10.3	5.8	6.6
Benign to malignant open biopsy ratio	1.6:1	1.6:1	1.9:1	1.9:1	1.4:1	2.6:1	1.6:1	1.0:1	2.3:1	1.6:1
Benign to malignant core biopsy ratio	1.5:1	1.5:1	—	3.6:1	2.1:1	4.3:1	2.7:1	2.0:1	6.3:1	2.2:1
In situ (DCIS) cancers (%)	24.4	20.0	15.9	17.3	16.1	26.2	13.0	23.5	19.3	19.7
Node negative (%), (invasive only)¶	80.3	75.0	77.0	77.5	76.4	82.0	—	86.2	75.6	78.5
Invasive tumour size (%) ≤ 10mm¶	36.9	31.7	35.0	38.7	39.8	38.8	40.0	38.8	34.1	37.6

* The recall interval was annual in BC until mid-1997 and biennial in other provinces.
** Screening visit includes mammography and complete clinical breast examination.
† The Quebec program has incomplete cancer information due to incomplete data linkages. Therefore, some cancer-related data for Quebec are not reported. Data for 1998 only.
‡ Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.
§ Screening visit includes mammography and modified clinical breast examination by technician.
¶ Missing values were excluded from calculations.
— Not available

Figure 12
Positive predictive value of abnormal screening by age group, 1997 and 1998



Notes: Quebec data not included. Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

screening as prevalent cancers are screened out in the initial screening round and previous films are available for comparison to current examinations. The abnormal recall rate is similar at third and fourth screens compared to second screens.

Cancer detection rates per 1,000 screens compare favourably with the UK and Australian program standards. Positive predictive values were highest in Alberta and Nova Scotia, where abnormal recall rates were the lowest.

Nova Scotia's open biopsy yield ratio is particularly noteworthy. A low benign to malignant biopsy yield ratio reflects the overall effectiveness of the diagnostic evaluation in minimizing the number of women who do not have cancer but who undergo invasive procedures. Nova Scotia's team approach to diagnosis involving the primary care physician, diagnostic radiologist, pathologist, and surgeon and frequent use of imaging-directed core biopsy has greatly decreased the need for surgery in benign lesions of the breast[22].

The 1997 and 1998 results show that organized breast screening programs in Canada compare favourably with the standards set by other countries.

Tumour size and lymph node status are reliable determinants of survival[23]. Mammography screening aims to prevent breast cancer deaths by detecting tumours at an early stage and while they are lymph node negative. Canadian breast screening programs are on track with the standards set by other countries.

Table 9 summarizes screening outcomes by age group. Most screens were within the target age group of women aged 50 to 69. The proportion of first screens was highest among women aged 50 to 59 (47.9%) and lowest in women aged 70 and over (28.5%). The abnormal recall rate differed little among age groups. The cancer detection rate increased with age, as did the positive predictive value of abnormal screening. A high positive predictive value reflects the effectiveness of screening by determining the proportion of women who had an

Table 9
Screening outcome summary by age group, 1997 and 1998 screen years

Outcome	40-49	50-59	60-69	70+	All Ages
Number of screens	155,670	330,211	243,884	112,265	842,030
Number of first screens	70,780 (45.5%)	158,300 (47.9%)	90,701 (37.2%)	32,027 (28.5%)	351,808 (41.8%)
Abnormal recall rate (%)					
Initial screen	11.1	11.5	10.4	11.3	11.1
Rescreen	5.4	6.4	6.0	5.9	6.0
Number of cancers*	326	1,331	1,362	956	3,975
Cancer detection rate per 1,000* screens					
Initial screen	2.6	5.6	8.7	13.3	6.4
Rescreen	1.8	3.5	4.8	7.1	4.2
PPV of abnormal screen (%)*	2.5	5.0	8.8	12.6	6.1
Benign to malignant open biopsy ratio	4.5:1	2.0:1	1.2:1	0.7:1	1.6:1
Benign to malignant core biopsy ratio	4.6:1	2.8:1	1.5:1	0.8:1	2.1:1
In situ (DCIS) cancers (%)*	31.9	22.1	17.0	16.6	19.8
Node negative (%), (invasive only)*	75.0	78.0	78.6	84.4	79.5
Invasive tumour size (%) ≤ 10mm*	29.6	35.0	39.9	41.7	38.0

* The Quebec program has incomplete cancer information due to incomplete data linkages. Therefore, some cancer-related data for Quebec are not reported.

Note: Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

abnormal screen and were subsequently diagnosed with cancer. The benign to malignant biopsy ratio was high in women aged 40 to 49, but improved with age. Older women had more favourable prognostic indicators (i.e. small tumour size, node negative).

Table 10 summarizes screening outcomes for women aged 50 to 69 for the screen years 1996, 1997, and 1998. The number of screens and cancers detected increased from 1996 to 1998 as new programs began. The proportion of first screens was higher in 1998 due to the inception

Table 10
Screening outcome summary by year, women aged 50-69 at screening

Outcome	Year of Screen		
	1996	1997	1998
Number of screens	215,717	246,431	327,664
Number of first screens	76,900 (35.7%)	93,189 (37.8%)	155,812 (47.6%)
Abnormal recall rate (%)			
Initial screen	11.2	10.9	11.2
Rescreen	5.5	5.9	6.5
Number of cancers*	1,053	1,317	1,376
Cancer detection rate per 1,000 screens*†			
Initial screen	6.7	7.0	6.4
Rescreen	3.9	4.3	3.9
PPV of abnormal screen (%)*	6.7	7.1	6.1
Benign to malignant open biopsy ratio	1.5:1	1.5:1	1.7:1
Benign to malignant core biopsy ratio	1.9:1	1.8:1	2.5:1
In situ (DCIS) cancers (%)*	17.6	18.2	20.8
Node negative (%), (invasive only)*‡	77.1	77.3	79.4
Invasive tumour size (%) ≤ 10mm*‡	36.2	36.8	38.4

* The Quebec program has incomplete cancer information due to incomplete data linkages. Therefore, some cancer-related data for Quebec are not reported.

† Number of cancers as a proportion of screens with completed follow-up.

‡ Expressed as a proportion of invasive cancers with complete data on tumour size or number of positive nodes.

Note: Data for the New Brunswick program are incomplete and therefore do not comprehensively reflect program activity.

of Quebec's screening program and expansion of other programs. Given an increase in the number of screening programs, the overall outcome statistics remained stable during the 3-year period and were generally within the standards set by other countries for most indicators.

Post-Screen Cancers

Organized screening aims to ensure that a high proportion of asymptomatic women with breast cancer are identified by the screening process. Although highly sensitive in detecting even small tumours, mammography screening will not detect all breast cancers present at the time of screening. Some cancers, termed post-screen cancers, may be missed at screening or diagnosis or develop in the interval between screens (sometimes called 'interval cancers'). Others may occur among women who do not return for subsequent screening (sometimes called 'non-compliant cancers'). Post-screen cancers that are diagnosed in the interval between biennial screens need to be closely monitored because they are indicators of the sensitivity of screening and the appropriateness of the screening interval[24,25]. A high detection rate in the 24 months following a screen represents a negative outcome for a screening program.

At least every 6 months, provincial screening programs that track post-screen cancers link with their provincial cancer registries to identify cancers detected outside of the screening program in previously screened women. When post-screen cancers are detected, the previous screening film is reviewed by radiologists and, in some cases, technologists to arrive at a final decision, either by consensus or a majority of readers, regarding whether the cancers had newly developed in the interval between screens, or were missed at screening, or missed at diagnosis.

Because consistent classification of the end of a screening episode in the event of a screening abnormality has not yet been achieved among Canadian programs, the post-screen cancer rate in the 60 months following a *normal* screening examination is presented (Table 11). Women screened during 1994 and 1995 were monitored up to 60 months after their screening exam or, if it occurred sooner, until their next program screen.

Table 11
Cancers detected outside of program after normal screen among program participants aged 50-69 at screening, 1994 and 1995 screen years*

	Months After Screening**				Cumulative Out of Program Cancers
	≤ 12	13-24	25-36**	37-60**	≤ 60**
Number of cancers detected	120	197	70	36	423
Rate per 10,000 women per year	5.0	11.6	12.9	9.7	8.5

* Includes data from British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario.

** Cancers detected outside of program after 24 months represent non-compliant cancers, where the woman did not return for a subsequent screen within the recommended interval.

Comparisons of post-screen cancer rates between provinces and countries require complete and up-to-date breast cancer registration and the assurance that post-screen cancers are counted in the same way[26]. However, in Canada, post-screen cancer rates may also reflect the amount of screening delivered outside of screening program settings. Interim clinical breast exam and breast self-examination may also increase the rate at which post-screen cancers are detected in the interval between screening.

SUMMARY AND FUTURE DIRECTIONS

Canadian organized breast cancer screening programs have grown considerably in the last 10 years. Organized screening ensures that meticulous quality assurance practices are in place and allows monitoring and evaluation of screening performance.

The substantial increase in the number of women screened through organized programs and the establishment of new programs heightens the importance of quality screening. This biennial report of the 1997 and 1998 screen years demonstrates that organized breast cancer screening programs continue to meet or exceed a majority of the standards set by other countries.

Despite an increase in the number of women screened through organized programs, participation of women in the target age group remains sub-optimal, ranging by province from 11.5% to 54.7%. In order to reach a 70% participation rate among women aged 50 to 69, additional resources are required to establish new programs and expand existing ones. Another concern is the significant number of women who continue to receive screening in diagnostic settings across Canada. It is expected that participation rates will continue to improve with the growth of organized screening and the recognition of the benefits of breast screening in an organized setting.

Overall, the 1997 and 1998 results show that organized breast screening programs in Canada compare favourably with the standards set by other countries. Among women aged 50 to 69, 37.6% of invasive cancers were ≤ 10 mm in diameter, and 78.5% of invasive cancers did not have lymph node metastasis. Detecting invasive cancers when they are small and unlikely to have spread beyond the breast is necessary to achieve a reduction in breast cancer mortality.

The Canadian Breast Cancer Screening Database (CBCSD) continues to expand with the growth of organized breast screening programs. Ongoing efforts to improve the quality of the database ensure accurate

monitoring and evaluating of screening performance. Collaboration with partners to organize a breast cancer staging training workshop in 2001 will help to address discrepancies in tumour data collected for the CBCSD. In addition, efforts continue in developing a set of indicators for evaluating the performance and quality of organized screening programs in Canada. The CBCSD is gradually expanding its research capacity with research projects initiated in a number of priority areas. This further encourages the broad, creative, and optimal use of the CBCSD for the evaluation of breast cancer screening in Canada.

REFERENCES

1. National Cancer Institute of Canada. *Canadian Cancer Statistics 2000*. Toronto, Canada, 2000.
2. Gaudette LA, Silberberger C, Altmayer CA, Gao RN. *Trends in breast cancer incidence and mortality*. Health Rep 1996;8:29-37.
3. Kerlikowske K, Grady D, Rubin SM, Sandrock C, Ernster VL. *Efficacy of screening mammography. A meta-analysis*. JAMA 1995;273:149-54.
4. Fletcher SW, Black W, Harris R, Rimer BK, Shapiro S. *Report of the International Workshop on Screening for Breast Cancer*. J Natl Cancer Inst 1993;85:1644-56.
5. The Workshop Group. *Reducing deaths from breast cancer in Canada*. Can Med Assoc J 1989;141:199-201.
6. Health Canada. *Canadian Breast Cancer Initiative: National Committee for the Canadian Breast Cancer Screening Initiative*. 1995 Summer.
7. Health Canada. *Report on the National Forum on Breast Cancer*. Minister of Supply and Services Canada, 1994. Cat. No. H39/305/994E.
8. Tabar L, Fagerberg G, Duffy SW, Day NE, Gad A, Grontoft O. *Update of the Swedish two-county program of mammographic screening for breast cancer*. Radiol Clin North Am 1992;30:187-209.
9. Europe Against Cancer. *European guidelines for quality assurance in mammographic screening*. Luxembourg: Office for Official Publications of the European Commission, June 1996.
10. *Standards for the NHS Breast Screening Programme* (updated August 1998). Sheffield, England: NHSBSP publication.
11. Muir Grey JA. *A draft set of criteria for evaluation and quality assurance*. NHSBSP, Oxford: Screening Publications, 1990.

12. Commonwealth Department of Human Services and Health. *National program for the early detection of breast cancer: national accreditation requirements*. Canberra, Australia: Commonwealth Department of Human Services and Health, March 1994.

13. Paquette D, Snider J, Bouchard F, Olivotto I, Bryant H, Decker K et al. for the Database Management Subcommittee to the National Committee for the Canadian Breast Cancer Screening Initiative. *Performance of screening mammography in organized programs in Canada in 1996*. Can Med Assoc J 2000;163:1133-38.

14. Working group on the integration of screening and diagnosis of the Canadian Breast Cancer Screening Initiative. *Waiting for a diagnosis after an abnormal breast screen in Canada*. 2000. Cat. No. H39-526(2000E).

15. Gaudette LA, Altmayer CA, Nobrega KM, Lee J. *Trends in mammography utilization, 1981 to 1994*. Health Rep 1996;8:17-27.

16. Faux AM, Lawrence GM, Wheaton ME, Wallis MG, Jeffery CL, Griffiths RK. *Slippage in the NHS breast screening programme: an assessment of whether a three year screening round is being achieved*. J Med Screen 1998;5:88-91.

17. Health Canada. *Quality determinants of organized breast cancer screening programs*. National Committee for the Canadian Breast Cancer Screening Initiative. 1997.

18. The Steering Committee on Clinical Practice Guidelines for the Care and Treatment of Breast Cancer. *The palpable breast lump: information and recommendations to assist decision-making when a breast lump is detected*. Can Med Assoc J 1998;158(Suppl 3):S3-S8.

19. The Steering Committee on Clinical Practice Guidelines for the Care and Treatment of Breast Cancer. *Investigation of lesions detected by mammography*. Can Med Assoc J 1998;158(Suppl 3):S9-S14.

20. Elmore JG, Barton MB, Moceri VM, Polk S, Arena PJ, Fletcher SW. *Ten-year risk of false positive screening mammograms and clinical breast examinations*. N Engl J Med 1998;338:1089-96.

21. Olivotto IA, Mates D, Kan L, Fung J, Samant R, Warren Burhenne LJ. *Prognosis, treatment, and recurrence of breast cancer for women attending or not attending the Screening Mammography Program of British Columbia*. Breast Cancer Research and Treatment 1999;54:73-81.

22. Caines JS, Chantziantoniou K, Wright BA, Konok GP, Iles SE, Bodurtha A et al. *Nova Scotia Breast Screening Program experience: Use of needle core biopsy in the diagnosis of screening-detected abnormalities*. Radiology 1996;198:125-30.

23. Day NE, Williams DRR, Khaw KT. *Breast cancer screening programmes: the development of a monitoring and evaluation system*. Br J Cancer 1989;59:954-58.

24. Woodman CB, Threlfall AG, Boggis CR, Prior P. *Is the three year breast screening interval too long? Occurrence of interval cancers in NHS breast screening programme's north western region*. Brit Med J 1995;310:224-26.

25. Rickard MT, Taylor RJ, Fazli MA, El Hassan N. *Interval breast cancers in an Australian mammographic screening program*. Med J Aust 1998;169:184-87.

26. Faux AM, Richardson DC, Lawrence GM, Wheaton ME, Wallis MG. *Interval breast cancers in the NHS Breast Screening Programme: does the current definition exclude too many?* J Med Screen 1997;4:169-73.

APPENDIX 1

Standards for Breast Screening Programs

Indicator	Sweden[8]	Europe[9]	United Kingdom[10†]	Australia[12]
Attendance rate		≥ 60% (ages 50-64)	≥ 70% (ages 50-64)	70% (ages 50-69)
Retention rate				≥ 75% screened in the previous round (ages 50-69); of those rescreened, > 90% to be screened biennially
Abnormal recall rate (%)*	9 (overall)			
Initial screen		< 7	< 10	< 10
Rescreen		< 5	< 7	< 5
Cancer detection rate	≥ 3xIR** (overall)			
Initial screen		≥ 3xIR**	≥ 2.7*** per 1,000	> 5 per 1,000
Rescreen		1.5xIR**	≥ 3.0*** per 1,000	> 2 per 1,000
Benign to malignant biopsy ratio	< 3:1 (overall)		< 3:1 (overall)[11]	
Initial screen		< 2:1		≤ 2:1
Rescreen		< 1:1		≤ 1:1

Indicator	Sweden[8]	Europe[9]	United Kingdom[10†]	Australia[12]
Detected invasive cancers that are small	> 50% (< 15mm)	25% (≤10mm)	≥ 1.5 per 1,000 (< 15mm; initial screen) ≥ 1.65 per 1,000 (< 15mm; rescreen)	> 8 per 10,000 (≤ 10mm)
Percentage of cancers without lymph node invasion (%)	≥ 70%			
Detected cancers that are *in situ*				
Initial screen			0.4 - 0.9 per 1,000	10-20%
Rescreen			0.5 - 1.0 per 1,000	
Rate of cancers presenting between screening episodes			12 per 10,000 screened women within 2 years of screen	< 6 per 10,000 screened women within 1 year of screen

* Mammography alone as screening modality.

** IR = expected incidence rate in the absence of screening.

*** Invasive cancers only, excludes cancers that are purely in situ (noninvasive or intraductal).

† The United Kingdom recalls women for mammography every 3 years.

APPENDIX 2

Database Management Committee

This committee advises on the content, management process, and use of the Canadian Breast Cancer Screening Database. It is responsible to the National Committee for the Canadian Breast Cancer Screening Initiative, and is advisory to the Cancer Bureau, Centre for Chronic Disease Prevention and Control, Health Canada.

Chair
Mr. Gregory Doyle
Breast Screening Program for Newfoundland and Labrador
38 Ropewalk Lane
St John's, Newfoundland A1E 5T2

Ms. Laurel Baldwin
Yukon Mammography Program
406 Lambert Street
Whitehorse, Yukon Y1A 1Z7

Dr. André Corriveau
Department of Health and Social Services
Government of the Northwest Territories
5022 - 49th Street, 6th floor
Centre Square Tower
PO Box 1320
Yellowknife, Northwest Territories X1A 2L9

Dr. Ivo Olivotto
Screening Mammography Program of British Columbia
686 West Broadway, 8th floor
Vancouver, British Columbia V5Z 1G1

Dr. Heather Bryant
Alberta Cancer Board
Tom Baker Cancer Centre
1331-29 Street NW
Calgary, Alberta T2N 4N2

Ms. Lois Harrison
Saskatchewan Cancer Agency
952 Albert Street
Regina, Saskatchewan S4R 2P7

Ms. Marion Harrison
Manitoba Breast Screening Program
5-25 Sherbrook Street
Winnipeg, Manitoba R3C 2B1

Dr. Verna Mai
Cancer Care Ontario
620 University Avenue, 15th floor
Toronto, Ontario M5G 2L7

Dr. Patricia Goggin
Ministère de la Santé et des services sociaux
Direction générale de la santé publique du Québec
1075, chemin Sainte-Foy, 3e étage
Québec, Québec G1S 2M1

Ms. Stephanie Smith
New Brunswick Department of Health and Wellness
520 King Street, 3rd floor, Carleton Place, PO Box 5100
Fredericton, New Brunswick E3B 5G8

Dr. Judy Caines
Nova Scotia Breast Screening Program
5916 Emscote Drive
Halifax, Nova Scotia B3H 1B3

Dr. Kim Hender
Queen Elizabeth Hospital
Riverside Drive, PO Box 6600
Charlottetown, Prince Edward Island C1A 8T5

Dr. Françoise Bouchard
Cancer Bureau
Centre for Chronic Disease Prevention and Control
Population and Public Health Branch, Health Canada
LCDC Building, Tunney's Pasture, AL 0602E2
Ottawa, Ontario K1A 0L2

Ms. Leslie Gaudette
Cancer Control Assessment and Surveillance Division, Cancer Bureau
Centre for Chronic Disease Prevention and Control
Population and Public Health Branch, Health Canada
LCDC Building, Tunney's Pasture, AL 0602E2
Ottawa, Ontario K1A 0L2

Ms. Christina Bancej
Cancer Control Assessment and Surveillance Division, Cancer Bureau
Centre for Chronic Disease Prevention and Control
Population and Public Health Branch, Health Canada
LCDC Building, Tunney's Pasture, AL 0602E2
Ottawa, Ontario K1A 0L2

Ms. Gloria Low
Cancer Control Assessment and Surveillance Division, Cancer Bureau
Centre for Chronic Disease Prevention and Control
Population and Public Health Branch, Health Canada
LCDC Building, Tunney's Pasture, AL 0602E2
Ottawa, Ontario K1A 0L2

APPENDIX 3

Database Technical Subcommittee

This committee develops and implements the strategies for the uniform collection and sharing of data in the Canadian Breast Cancer Screening Database. It is responsible to the Database Management Committee, and is advisory to the Cancer Bureau, Centre for Chronic Disease Prevention and Control, Health Canada.

Chair
Ms. Gloria Low
Cancer Control Assessment and Surveillance Division, Cancer Bureau
Centre for Chronic Disease Prevention and Control
Population and Public Health Branch, Health Canada
LCDC Building, Tunney's Pasture, AL 0602E2
Ottawa, Ontario K1A 0L2

Ms. Laurel Baldwin
Yukon Mammography Program
406 Lambert Street
Whitehorse, Yukon Y1A 1Z7

Mr. Robin Greig
Department of Health and Social Services
Government of the Northwest Territories
5022 - 49th Street, Centre Square Tower, PO Box 1320
Yellowknife, Northwest Territories X1A 2L9

Ms. Lisa Kan
Screening Mammography Program of British Columbia
686 West Broadway, 8th floor
Vancouver, British Columbia V5Z 1G1

Ms. Zeva Mah
Alberta Screen Test Program
Alberta Cancer Board
Suite 120, 1040 - 7th Avenue SW
Calgary, Alberta T2P 3G9

Mr. Jon Tonita
Saskatchewan Cancer Agency
4101 Dewdney Ave
Regina, Saskatchewan S4T 7T1

Ms. Kathleen Decker
Manitoba Breast Screening Program
25 Sherbrook Street, Unit 5
Winnipeg, Manitoba R3C 2B1

Dr. Anna Chiarelli
Cancer Care Ontario
620 University Avenue
Toronto, Ontario M5G 2L7

Dr. Diane Major
Centre d'expertise en dépistage
Direction systèmes de soins et services
Institut national de santé publique du Québec
1050, chemin Sainte-Foy, aile "L", 2e étage
Québec, Québec G1S 4L8

Mr. Chris Heissner
New Brunswick Department of Health and Wellness
520 King Street, 2nd floor, PO Box 5100
Fredericton, New Brunswick E3B 5G8

Ms. Julie Gallant
Nova Scotia Breast Screening Program
Halifax Shopping Centre
Tower 1, Suite 103 - 7001 Mumford Road
Halifax, Nova Scotia B3L 4H6

Ms. Norah Smith
PEI Breast Screening Clinic
Queen Elizabeth Hospital
Riverside Drive, PO Box 6600
Charlottetown, Prince Edward Island C1A 8T5

Mr. Gregory Doyle
Breast Screening Program for Newfoundland and Labrador
38 Ropewalk Lane
St. John's, Newfoundland A1E 5T2

Ms. Christina Bancej
Cancer Control Assessment and Surveillance Division, Cancer Bureau
Centre for Chronic Disease Prevention and Control
Population and Public Health Branch, Health Canada
LCDC Building, Tunney's Pasture, AL 0602E2
Ottawa, Ontario K1A 0L2

Mr. Alex Madramootoo
Information Technology Management Division
Management Planning Operations Directorate
Population and Public Health Branch, Health Canada
LCDC Building, Tunney's Pasture, AL 0602C
Ottawa, Ontario K1A 0L2

APPENDIX 4

Glossary

Abnormal Recall Rate

proportion of screening mammography examinations determined to require further diagnostic assessment (i.e. called 'abnormal').

$$\text{Abnormal recall rate} = \frac{\text{number of abnormal screens with completed follow-up}}{\text{number of normal screens} + \text{number of abnormal screens with completed follow-up}} \times 100$$

Biopsy Yield Ratio

proportion of cases women undergoing biopsy that resulted in a diagnosis of breast cancer.

$$\text{Biopsy yield ratio} = \frac{M_b}{B_b + M_b}$$

$\mathbf{B_b}$ number of women with benign diagnosis on screen-initiated biopsy

$\mathbf{M_b}$ number of women found to have breast cancer on screen-initiated biopsy

Biopsy yield ratio, 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

includes malignant and ductal carcinoma in situ (DCIS) of the breast.

Cancer detection rate

proportion of screened women found to have breast cancer upon further investigation of an 'abnormal' screening result.

$$\text{Cancer detection rate} = \frac{\text{number of screen-detected cancers}}{\text{number of normal screens} + \text{number of abnormal screens with completed follow-up}} \times 1000$$

Confidence interval

a 95% confidence interval for a parameter is an interval computed from sample data by a method that has 95% probability of producing an interval containing the true value of the parameter.

Core biopsy

removal of a cylindrical sample of breast tissue under a local or general anaesthetic through a needle for microscopic examination.

Ductal carcinoma in situ (DCIS)

a non-invasive tumour of the breast, arising from cells that involve only the lining of a breast duct. The cells have not spread outside the duct to other tissues in the breast.

Fine-needle aspiration biopsy

a technique used to differentiate cystic from solid lesions in the breast. A needle is inserted into the lesion and material drawn out using a syringe. If the material is solid, it can be stained and the cells examined in a laboratory to determine whether or not they are benign or malignant.

Interval cancer

any invasive breast cancer diagnosed in the interval following a 'normal' screening result and before the next scheduled screening examination.

Invasive cancer

cancer cells invading beyond the basement membrane of the milk duct or lobule.

Open biopsy

surgical removal of a breast mass under local anaesthesia for subsequent microscopic examination by a pathologist.

Positive predictive value (PPV)

proportion of 'abnormal' cases with completed follow up found to have breast cancer after diagnostic work up.

$$\text{PPV} = \frac{\text{number of screen-detected cancers}}{\text{number of abnormal screens with completed follow-up}} \times 100$$

Post-screen cancer

breast cancer detected outside of the program after a 'negative' screen, including breast cancers detected after a program-initiated work up that did not reveal any cancer.

$$\text{Post-screen cancer rate} = \frac{\text{number of women with new cancers over the time period of interest}}{\text{total number of woman-years at risk}}$$

The rate per woman-year of being diagnosed with post-screen cancer. If a woman is at risk over several years, then she would contribute a count in the denominator for each year or fraction of a year in the period of interest.

Rescreening

subsequent screening according to policy following initial screening under the program. This includes women who miss a scheduled round of screening.

Screen-detected cancer

cancer detected as a result of a positive test with histologic confirmation attributed to screening findings at the program.

EVALUATION FORM

Fax to: Tracie St-Jean, Health Canada
Fax number: (613) 941-5497

1) How useful to your organization is this type of information that is provided in this report?

☐ Not at all Useful ☐ Somewhat Useful
☐ Very Useful ☐ Extremely Useful

2) If your organization makes use of this information, please indicate how such information is used (✔ all that apply):

☐ Displays/Posters/Brochures ☐ Fact Sheets
☐ Lobbying (e.g., justifying funding) ☐ Education Material
☐ Inform staff ☐ Basic Background Material
☐ Prioritizing Health Issues ☐ Setting Goals
☐ Counseling Material ☐ Raising Awareness (e.g., magnitude of problem)
☐ Other: _____

3) In which of your professional activities does this publication assist you? (✔ all that apply):

☐ Planning for cancer care and treatment services ☐ Research-clinical trials
☐ Health policy and planning
☐ Fund raising ☐ Planning cancer prevention programs
☐ Journalistic reporting ☐ Teaching
☐ Actuarial purposes ☐ Research
☐ Other: _____

4) What use will you make of the information in this report?

☐ As a reference document for use of breast cancer screening programs
☐ To compare national trends on breast cancer screening programs
☐ To compare trends on breast cancer screening between provinces
☐ To lobby for more resources for breast cancer screening programs
☐ Teaching

5) Please rate each section of the report for its usefulness?

	not useful	somewhat useful	very useful
☐ Background	☐	☐	☐
☐ Participation in screening programs	☐	☐	☐
☐ Recruitment and retention	☐	☐	☐
☐ Results of screening	☐	☐	☐
☐ Diagnostic investigations	☐	☐	☐
☐ Cancer detection	☐	☐	☐
☐ Summary of outcomes	☐	☐	☐
☐ Cancers detected outside programs	☐	☐	☐

6) Which figures and tables did you find most useful?

_____
_____
_____

7) Which figures and tables did you find least useful? or confusing?

_____
_____
_____

8) What additional information would like to see on breast cancer screening programs in the text, figures or tables of the next report?

_____
_____
_____

9) Do you have any additional suggestions to make this publication more useful to you?

_____
_____
_____

10) Would you like to receive future reports?

☐ YES ☐ NO

Name: _____
Organization: _____
Position: _____
Mailing Address: _____
_____
_____

Thank you for taking the time
to complete this evaluation form
simply fax it back (613) 941-5497.

Please feel free to attach additional comments.
Your input is very important to us!