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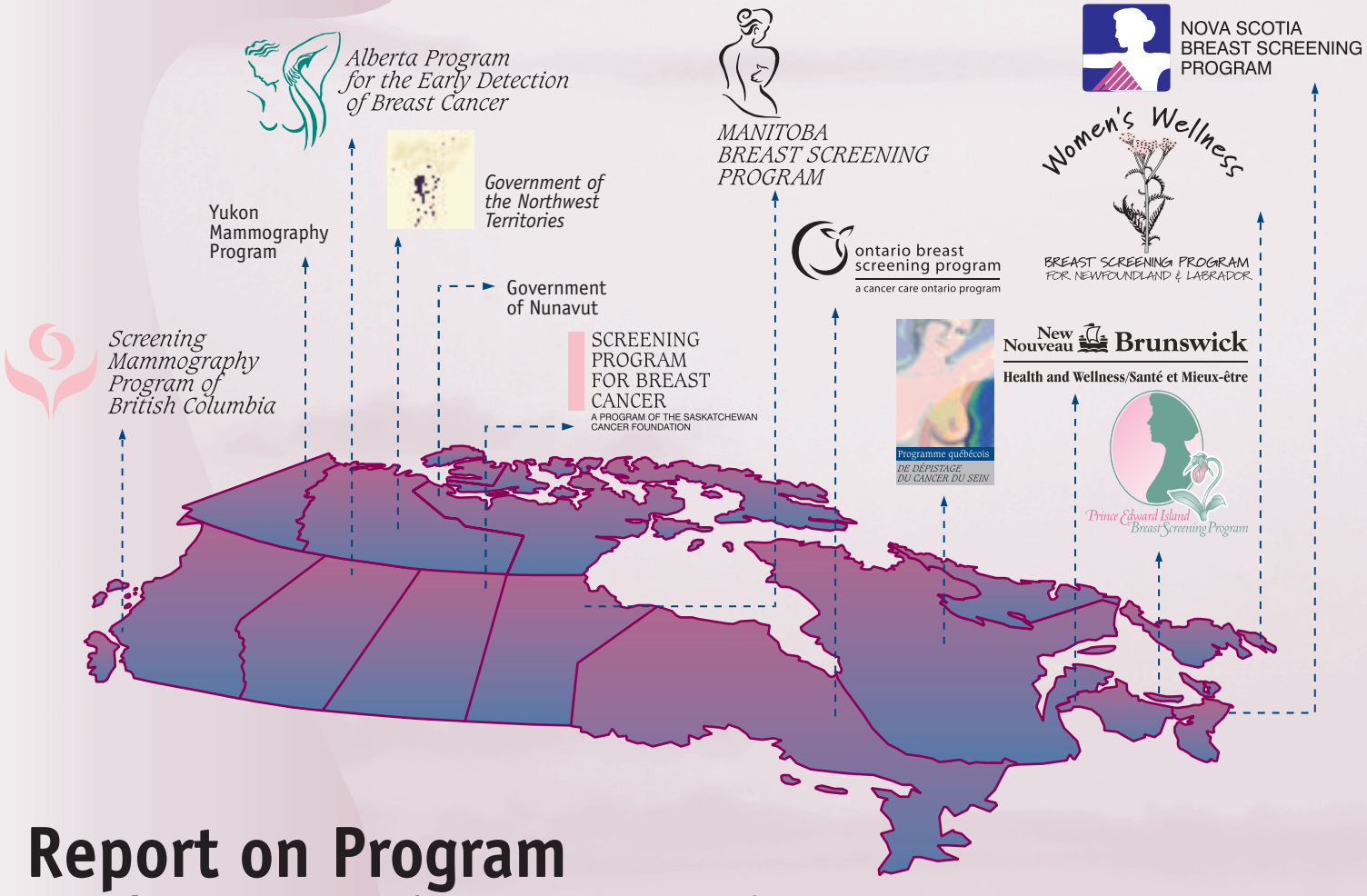
# Organized Breast Cancer Screening Programs in Canada




## Report on Program Performance in 2001 and 2002

Canada

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# Organized Breast Cancer Screening Programs in Canada

## Report on Program Performance in 2001 and 2002

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# EXECUTIVE SUMMARY

Although mortality has declined over the past decade, breast cancer continues to be the most common cancer afflicting Canadian women with 21,600 new cases estimated for 2005. According to 1998 estimates, breast cancer cost Canadians more than $1 billion in terms of the value of years of life lost due to premature death. Nationally, the majority of new cases of breast cancer occur among women aged 50 to 69. Early detection through organized breast cancer screening combined with effective treatment remains the best option currently available to reduce breast cancer deaths among women in this age group.

The goal of monitoring and evaluating organized breast cancer screening programs in Canada is to promote high-quality screening, leading to reductions in breast cancer mortality and morbidity, while keeping potential harms of screening to a minimum. This document presents an evaluation of the performance of organized breast cancer screening programs in Canada for the 2001 and 2002 calendar years using data submitted to the Canadian Breast Cancer Screening Database (CBCSD) by 10 provinces. Currently none of the three territories provide evaluation data to the CBCSD. Although most national performance targets were met or exceeded, the present evaluation suggests a number of areas on which ongoing improvement efforts should focus in order to further the aim of reducing the burden of breast cancer.

Monitoring and evaluation efforts, using the CBCSD, are used to enhance the performance of screening across Canada.

The capacity to meet the demand for breast screening is one aspect of program delivery that continues to be a challenge for organized screening programs. Although most programs saw increased participation in 2001 and 2002, only 33.9% of eligible women accessed organized screening nationally, leaving the target of at least 70% participation among women aged 50 to 69 unmet. Although program expansion and improved recruitment will bring the benefits of organized screening to more Canadian women, several mature programs are reaching the limits of their capacity at a plateau of approximately 50% participation.

For women requiring diagnostic follow-up, there must be adequate staffing and facilities for diagnosis and treatment. In recent years, abnormal call rates (i.e. the proportion of women who are recalled

for further diagnostic assessment) have increased to the point that the target for abnormal call rates in 2001 and 2002 was no longer being met. Abnormal call rates need to be optimized in order to reduce potential harms of screening for healthy women (e.g. unnecessary diagnostic procedures and the anxiety associated with them) while maintaining high cancer detection rates. Programs undergoing expansion must pay particular attention to the additional training needs of personnel new to organized screening programs. In spite of the challenge of a substantial increase in the volume of women undergoing assessment from 14,837 in 1999 to 50,133 in 2002, wait times for diagnostic tests improved slightly during this period. However, most targets for timely diagnostic follow-up, particularly for women requiring a biopsy for diagnosis, remain unmet. A more detailed discussion of actions taken to reduce wait times and the progress achieved towards meeting targets is the subject of the Special Topic of this report.

Organized screening programs aim to maximize the benefits to participants by detecting as many cancers as possible as early as possible. The number of invasive breast cancers detected among screened women (invasive cancer detection rate), the proportion of invasive cancers that are small, and the proportion of invasive cancers that have not spread to the lymph nodes reflect the extent to which programs are achieving this goal. Canadian performance targets for invasive cancer detection rates were met. Screening programs were effective in finding breast cancers at an early stage, often before they could be felt or had spread to the lymph nodes.

In the coming years, organized screening programs will continue to strive to provide high-quality breast cancer screening. Programs aim to achieve reductions in breast cancer mortality in the target population by conducting research to enhance the quality and effectiveness of screening, and by adapting and enhancing their practices as new evidence and technologies become available. The results of monitoring and evaluation efforts, such as those reported here, are used by governments, cancer agencies, screening program managers, front-line health professionals, and other breast cancer stakeholders to enhance the performance of screening across Canada.

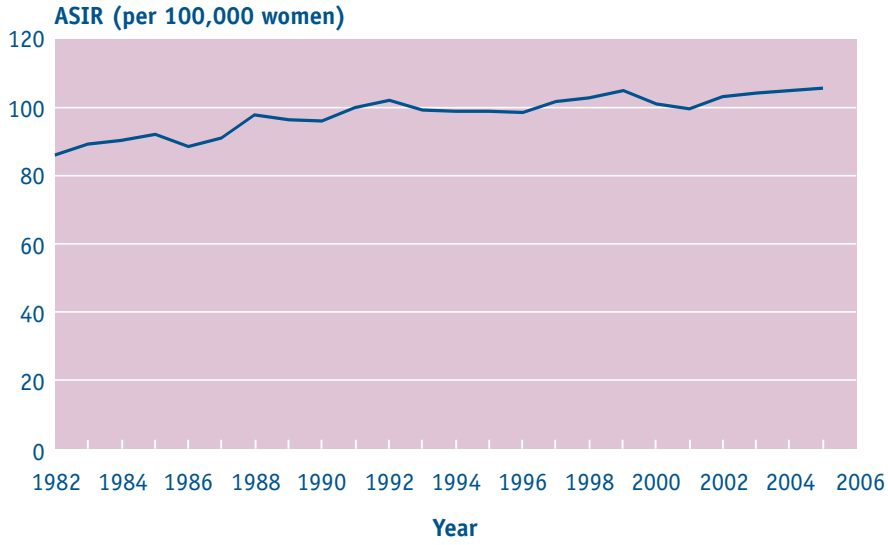
# BACKGROUND

With 21,600 new cases and 5,300 deaths estimated for 2005, breast cancer continues to be the most common cancer and the second leading cause of cancer death in Canadian women[1]. A rise in the incidence of breast cancer has been observed over several decades; this trend parallels an increase in mammographic screening. Mortality rates continue to decline, as a result of improved treatment and early detection through mammography screening (Figures 1a and 1b).

While the body of knowledge surrounding the causes of breast cancer continues to grow, public health interventions to prevent breast cancer death in the population currently emphasize secondary prevention through mammography screening. Most known risk factors are not readily modifiable; these include demographic, genetic, hormonal

Half of all new breast cancer cases are diagnosed among women aged 50 to 69. In this group, delivery of routine, high-quality breast screening can reduce breast cancer mortality rates by as much as one-third.

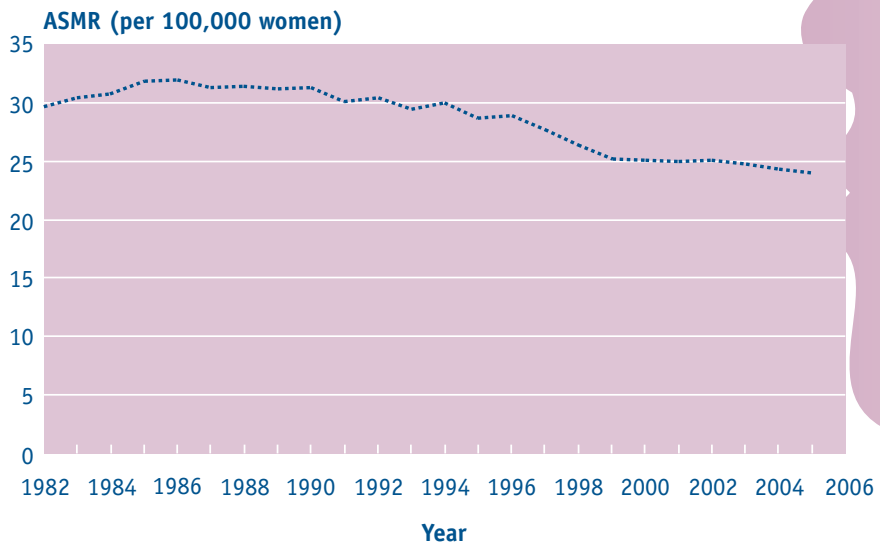
**Figure 1a**
**Age-standardized incidence rates (ASIR) per 100,000 for breast cancer in Canada, 1982-2005**




**Source:** National Cancer Institute of Canada: Canadian Cancer Statistics 2005, Toronto, Canada, 2005.
**Notes:** Incidence rates are estimated for 2002 for Quebec only. The national rate is an estimate computed from observed case counts for all provinces and territories (excluding Quebec) and the estimated number of cases for Quebec. Rates are standardized to the age distribution of the 1991 population.

**Figure 1b**

**Age-standardized mortality rates (ASMR) per 100,000 women for breast cancer in Canada, 1982-2005**




**Source:** National Cancer Institute of Canada. Canadian Cancer Statistics 2005. Toronto, Canada, 2005.
**Notes:** The national rate is an estimate computed from the death counts estimated for each province and territory. Rates are standardized to the age distribution of the 1991 population.

and biological factors. Of these, age has the strongest influence[2,3]. Both incidence and mortality rise sharply with age, with the highest rates being found among women aged 60 and over[1]. Half of all new cases occur among women aged 50 to 69[1]. Women in this age group benefit the most from breast screening, as has been demonstrated through randomized trials. For this reason, the delivery of routine, high-quality breast screening to this group has the potential to reduce breast cancer mortality rates by as much as one-third[4,5].

## Breast Cancer Screening in Canada

In December 1992, the federal government launched the first phase of the Canadian Breast Cancer Initiative (CBCI) with funding of $25 million over five years. In June 1998 the renewal of the CBCI with stable, ongoing funding of $7 million per year was announced. In September 2004 the Public Health Agency of Canada (PHAC) was created and responsibility for the CBCI became part of its mandate. Given its role in surveillance, evaluation, and best practices in public health the PHAC continues to support the activities of the National

Committee for the Canadian Breast Cancer Screening Initiative, and cancer screening remains an integral component of a broader Canadian Strategy for Cancer Control.

## Organized Breast Cancer Screening Programs

Organized breast cancer screening programs began in British Columbia in 1988 and have since expanded to include all provinces, the Yukon and the Northwest Territories (Table 1). To date, Nunavut has not developed an organized breast screening program. Breast cancer screening in all organized programs includes a bilateral,two-view screening mammogram. 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 screen some women outside the target age group (Table 1), although they are not actively recruited to the program.

## The Screening Process

The process that an organized breast cancer screening program undertakes to reach its target population for screening can be described in three stages (Figure 2):

- Identification and invitation of the target population
- Provision of the screening examination
- If an abnormality is detected, further investigation

Women of the target age are recruited to the screening program through 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, who do not have any breast symptoms, receive two-view mammography of each breast. In addition to mammographic screening, some programs offer clinical breast examination (CBE) performed by a trained health professional; the remaining programs encourage women to obtain regular CBE outside the program from their family physicians (Table 1). In the past, breast-self examination (BSE) was routinely taught to women. However, since the Canadian Task Force on Preventive Health Care recommended against the routine teaching of BSE to screen for breast cancer in 2001[6], programs in British Columbia, Alberta, Saskatchewan, Manitoba, Quebec, and New Brunswick do

Given its role in surveillance, evaluation and best practices, the Public Health Agency of Canada continues to support priorities in cancer screening through the Canadian Breast Cancer Screening Initiative and the broader Canadian Strategy for Cancer Control.

## Table 1
## Breast cancer screening programs in Canada[a] – usual practices, 2001 and 2002 screen years

| Province/territory | Program start date | Clinical breast examination on site | Program practices for women outside the 50–69 year age group | | |
|---|---|---|---|---|---|
| | | | Age group | Accept | Recall |
| Northwest Territories | 2003 | No | 40-49 | Yes | Annual |
| | | | 70+ | Yes | Biennial |
| Yukon Territory | 1990 | No | 40-49 | Yes | None |
| | | | 70+ | Yes | None |
| British Columbia | 1988 | No | <40 | Yes[b] | None |
| | | | 40-49 | Yes | Annual |
| | | | 70-79 | Yes | Biennial |
| | | | 80+ | Yes[b] | None |
| Alberta | 1990 | No | 40-49 | Yes | Annual |
| | | | 70-74 | Yes | Biennial |
| | | | 75+ | Yes | None |
| Saskatchewan | 1990 | No | 40-49 | No | N/A |
| | | | 70+ | Yes | Biennial |
| Manitoba | 1995 | Nurse or technologist | 40-49 | Yes[c] | Biennial |
| | | | 70+ | Yes[c] | None |
| Ontario | 1990 | Nurse[d] | 40-49 | No | N/A |
| | | | 70-74 | Yes | Biennial |
| | | | 75+ | Yes | None |
| Quebec | 1998 | No | 35-49 | Yes[e] | None |
| | | | 70+ | Yes[e] | None |
| New Brunswick | 1995 | No | 40-49 | Yes[b] | None |
| | | | 70+ | Yes[b] | None |
| Nova Scotia | 1991 | Technologist[f] | 40-49 | Yes | Annual |
| | | | 70+ | Yes | None |
| Prince Edward Island | 1998 | Technologist | 40-49 | Yes | Annual |
| | | | 70-74 | Yes | Biennial |
| Newfoundland and Labrador | 1996 | Nurse | 40-49 | No | N/A |
| | | | 70+ | Yes | None |

a Nunavut has not developed an organized breast cancer screening program.

b Accept with physician referral.

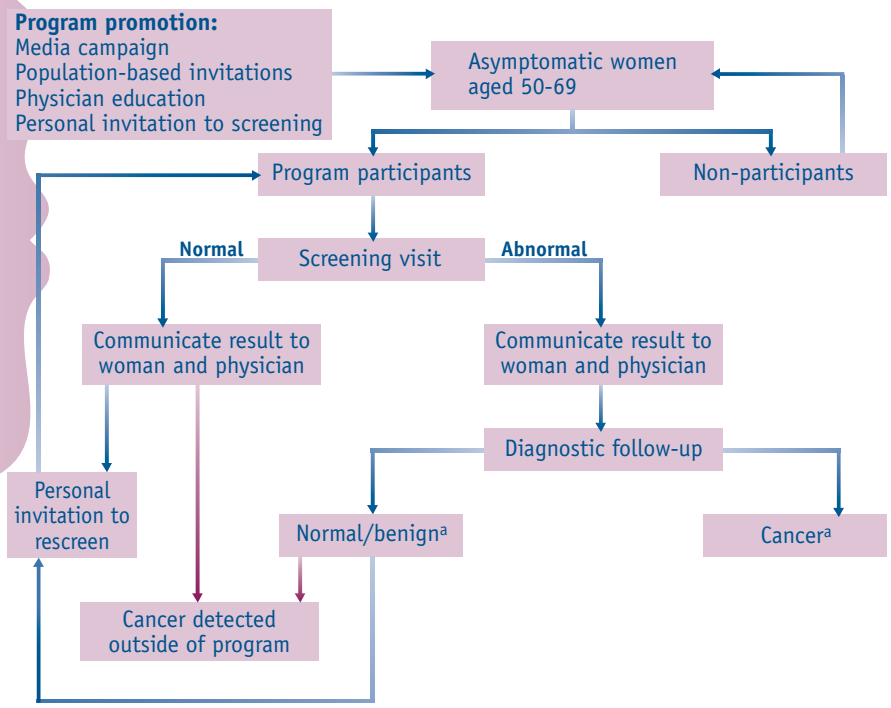
c Accept to mobile unit with a physician referral.

d Nurse provides clinical breast examination where available, but not all sites offer clinical breast examination.

e Accept with physician referral if done at a program screening centre, but is not officially considered within the program.

f Modified examination only, performed by technologist at time of mammography.

## Figure 2
## Pathway of a breast cancer screening program




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

not provide instruction in BSE, while programs in Newfoundland and Labrador, Prince Edward Island, Nova Scotia and Ontario now provide instruction in BSE only if requested by the client. Most programs continue to make educational material on BSE available to clients.

All programs provide screening results to both the woman and her physician. If the screening result is normal, women who are still eligible will be recalled by letter of invitation for another routine screen. This generally occurs after two years, although a minority of women are recalled annually on the basis of age, mammographic results, family history, or other factors that vary across programs. Women are encouraged to consult a physician if any symptoms develop in the interval before their next screening visit. Women with an abnormal screening result are informed, along with their family physician, of the need for further assessment. Depending on the program, diagnostic follow-up is coordinated either by the woman's physician or through

an integrated process coordinated by the screening program. Diagnosis is complete when a final diagnosis of either cancer or normal/benign is reached.

## Canadian Breast Cancer Screening Database (CBCSD)

The CBCSD is a national breast screening surveillance system that enables organized breast cancer screening across Canada to be monitored and evaluated. Established in 1993, it is operated and maintained by the Public Health Agency of Canada's Centre for Chronic Disease Prevention and Control, on behalf of the Canadian Breast Cancer Screening Initiative (CBCSI) and its subcommittees (Appendices 1 and 2). However, participating screening programs retain ownership of the data contained in the CBCSD.

The CBCSD currently contains screening information from program inception up to the end of 2002 for all 10 provinces (Table 2). Test data from the Northwest Territories are currently being analyzed. Because the Yukon does not have a computerized information system, its data are not available to the CBCSD. Nunavut does not have an organized program in place. Data are collected on client demographics, risk factors, screen events, referral reasons, diagnostic tests and cancers, where applicable.

Aside from its use in evaluating the performance of organized programs nationally and sub-nationally, the CBCSD is used for specialized evaluation and applied screening research. Research priorities using the CBCSD are identified on an ongoing basis. See Appendix 4 for a comprehensive list of research publications based on the CBCSD.

The CBCSD is available for use by interested researchers. For up-to-date information about the database, including the data dictionary and data access process, please visit this section in the on-line version of this report at: http://www.phac-aspc.gc.ca/publicat/obcsp-podcs01/index.html.

The Canadian Breast Cancer Screening Database (CBCSD) is a national surveillance system operated and maintained by the Public Health Agency of Canada to conduct routine and specialized evaluation of organized screening programs and applied screening research.

## Table 2
## Annual screening volume by program, all ages, 1988 to 2002 screen years

| | Program | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | BC | AB | SK | MB | ON | QC[a] | NB | NS | PE | NL | Canada |
| 1988 | 4,395 | — | — | — | — | — | — | — | — | — | 4,395 |
| 1989 | 9,188 | — | — | — | — | — | — | — | — | — | 9,188 |
| 1990 | 22,482 | 616 | 6,355 | — | 590 | — | — | — | — | — | 30,043 |
| 1991 | 54,564 | 5,873 | 14,305 | — | 15,380 | — | — | 1,877 | — | — | 91,999 |
| 1992 | 80,893 | 15,442 | 15,778 | — | 40,295 | — | — | 4,354 | — | — | 159,762 |
| 1993 | 100,276 | 16,146 | 26,057 | — | 45,541 | — | — | 4,891 | — | — | 192,911 |
| 1994 | 118,878 | 15,372 | 25,540 | — | 55,480 | — | — | 8,461 | — | — | 223,731 |
| 1995 | 143,412 | 14,170 | 29,603 | 2,671 | 58,287 | — | 5,853 | 12,491 | — | — | 266,487 |
| 1996 | 166,738 | 14,679 | 28,901 | 13,594 | 67,729 | — | 18,441 | 15,547 | — | 3,120 | 328,749 |
| 1997 | 173,908 | 23,336 | 33,915 | 19,163 | 80,132 | — | 18,247 | 19,477 | — | 4,694 | 372,872 |
| 1998 | 189,963 | 18,887 | 34,094 | 23,457 | 98,597 | 43,987 | 26,044 | 25,459 | — | 5,521 | 466,009 |
| 1999 | 217,551 | 22,408 | 35,050 | 28,204 | 114,059 | 145,107 | 30,623 | 29,285 | 5,578 | 6,087 | 633,952 |
| 2000 | 223,607 | 21,717 | 35,370 | 28,565 | 138,337 | 152,982 | 32,488 | 35,259 | 6,269 | 6,790 | 681,384 |
| 2001 | 224,565 | 23,753 | 36,287 | 28,729 | 163,932 | 172,054 | 33,569 | 35,260 | 6,700 | 8,054 | 732,903 |
| 2002 | 234,872 | 23,340 | 34,462 | 29,264 | 192,276 | 194,349 | 37,108 | 38,616 | 6,256 | 8,859 | 799,402 |
| **Total** | 1,965,292 | 215,739 | 355,717 | 173,647 | 1,070,635 | 708,479 | 202,373 | 230,977 | 24,803 | 43,125 | 4,990,787 |

a Although Quebec accepts women aged 35-49 and 70+ with physician referral if done at a program screening centre, they are not officially considered within the program.

**Notes:** Northwest Territories, Yukon Territory and Nunavut programs are still in development. Data include all screens; figures have been updated and may vary slightly from previous reports.

## Monitoring and Evaluation Using the Canadian Breast Cancer Screening Database

To achieve reductions in breast cancer mortality and morbidity and to minimize the unwanted effects of screening, delivery of organized screening must be of high quality. Monitoring and evaluation efforts, using the CBCSD, are used to enhance the performance of screening across Canada. A standardized method of evaluation for all Canadian organized breast cancer screening programs includes evidence-based performance measures and targets in the following categories (Table 3):

- Recruitment and retention
- Client experience
- Technical aspects
- Mammography interpretation

## Table 3
## Performance measures for organized breast cancer screening programs in Canada, women aged 50-69

| Indicator | Definition | Target |
|---|---|---|
| 1. Participation rate | Percentage of women who have a screening mammogram (calculated biennially) as a proportion of the eligible population. | ≥ 70% of the eligible population |
| 2. Retention rate | The estimated percentage of women who are rescreened within 30 months of their previous screen. | ≥ 75% rescreened within 30 months |
| 3. Abnormal call rate | Percentage of women screened who are referred for further testing because of abnormalities found with a program screen. | < 10% (initial screen)<br>< 5% (rescreens) |
| 4. Invasive cancer detection rate | Number of women detected with invasive cancer during a screening episode per 1,000 women screened. | > 5 per 1,000 (initial screen)<br>> 3 per 1,000 (rescreens) |
| 5. In situ cancer detection rate | Number of women detected with ductal carcinoma in situ (rather than invasive cancer) during a screening episode per 1,000 women screened. | Surveillance and monitoring purposes only |
| 6. Diagnostic interval | Percentage of women who have completed the process from abnormal screen to resolution of abnormal screen, within 5 and 7 weeks of the screen date. | ≥ 90% within 5 weeks if no open biopsy<br>≥ 90% within 7 weeks if open biopsy |
| 7. Positive predictive value | Proportion of abnormal cases with completed follow-up found to have breast cancer (invasive or in situ) after diagnostic work-up. | ≥ 5% (initial screen)<br>≥ 6% (rescreens) |
| 8. Benign to malignant open biopsy ratio | Among open biopsies, the ratio of the number of benign cases to the number of malignant cancer cases. | ≤ 2:1 open (initial and rescreens combined) |
| 9. Invasive cancer tumour size | Percentage of invasive cancers with tumour size of ≤ 10 mm in greatest diameter as determined by the best available evidence: 1) pathological, 2) radiological, 3) clinical. | > 25% ≤ 10 mm |
| 10. Positive lymph nodes in cases of invasive cancer | Proportion of invasive cancers in which the cancer has invaded the lymph nodes. | < 30% node positive |
| 11. Post-screen detected invasive cancer rate | Number of women with a diagnosis of invasive breast cancer after a negative screening episode per 10,000 person-years at risk, within 12 and 24 months of the screen date. | < 6 per 10,000 person-years (within 0-12 months)<br>< 12 per 10,000 person-years (within 0-24 months) |

**Source:** Health Canada. Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Cancer Screening Program Performance. Ottawa: Minister of Public Works and Government Services Canada, 2002.

- Diagnostic assessment and diagnosis
- Treatment
- Survival and mortality
- Data quality assurance
- Program management

For more information regarding the development of these performance measures and targets refer to the Report from the Evaluation Indicators Working Group[7]. Due to advances in diagnostic practice, some indicators are currently under review to reflect the increased use of core biopsy to obtain a tissue diagnosis.

# 2001 AND 2002 RESULTS

This report presents selected statistics for the 2001 and 2002 calendar years using data submitted to the CBCSD up to January 2005. Data submissions from the programs are staggered across several months. This may impact the completeness of cancer-related data for certain programs. Unless otherwise noted, the summary statistics for all programs include data from all 10 provinces. Tables 6, 7 and 8 summarize the performance measures by program, age group and screen year.

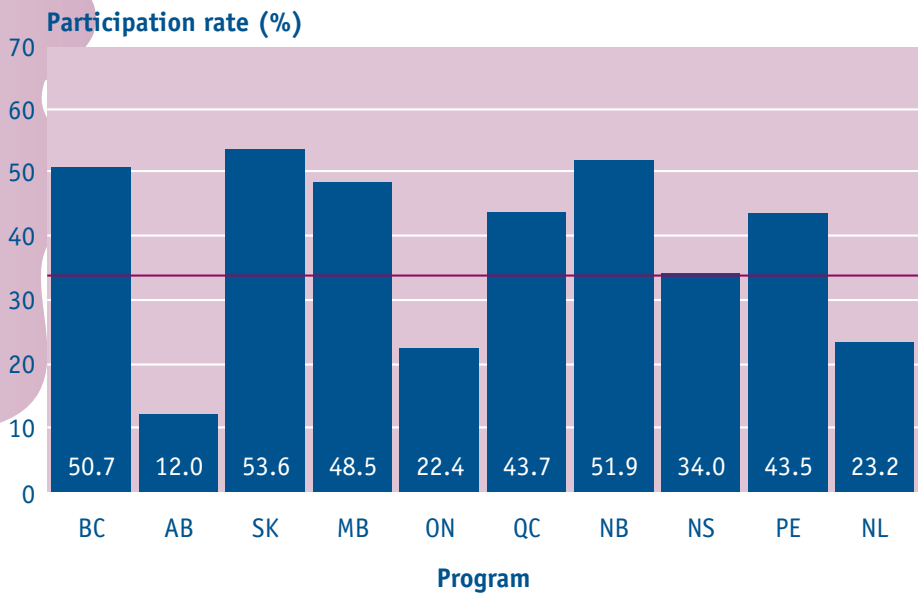
## Participation and Retention in Screening Programs

Organized breast cancer screening programs promote participation through a variety of recruitment methods. Although currently no program meets the national performance target of at least 70% participation in biennial screening, participation of women aged 50 to 69 in organized breast cancer screening programs increased slightly to reach 33.9% nationally in 2001 and 2002 (Figure 3).

Delivery of screening services through organized programs contributes to increased effectiveness and efficiency of screening[8]. In 2001 and 2002, fewer than half of women were screened through longstanding programs in Alberta, Nova Scotia, Ontario, and Newfoundland (Figure 3, Table 6). Self-reported screening rates in the target age group were not dramatically lower in these provinces relative to others (Figure 4). This indicates that in these provinces, much screening occurs in the fee-for-service sector, where programmatic elements such as identification and recruitment of the target group, an effective referral system once an abnormality has been detected, and procedures for evaluating and monitoring the programs, are often absent. In future years, participation rates in organized screening in Alberta are expected to rise as the program expands province-wide. More recently implemented programs in Quebec and Prince Edward Island are fast approaching 50% participation. Close to or greater than half of the eligible population participated in biennial screening through organized screening programs in British Columbia, Manitoba, Saskatchewan,

Although currently no program meets the national target of ≥70% participation in biennial screening, participation of women aged 50 to 69 in organized breast screening programs increased slightly to reach 33.9% nationally.

## Figure 3
## Participation in organized breast cancer screening programs, women aged 50-69, 2001 and 2002 screen years




**Source:** Statistics Canada data for 2001 and 2002 are used for denominator values.
**Note:** Population estimates are averaged. The national participation rate of 33.9% is indicated by the horizontal bar.

and New Brunswick. Greater participation in organized screening in these programs can be attributed, in part, to lower rates of non-programmatic screening, successful recruitment campaigns, and the ability of these programs to access rural women through mobile mammography.

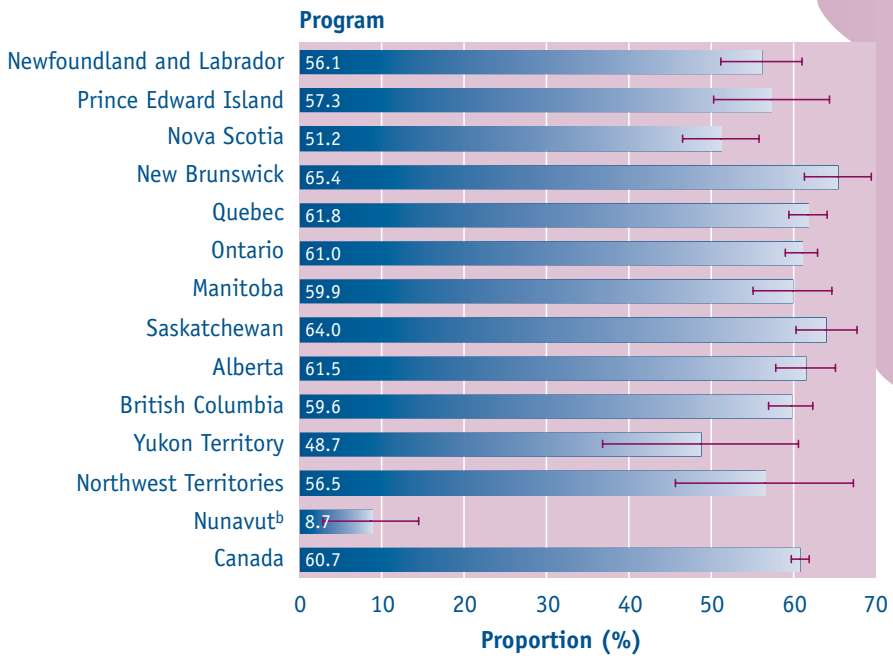
Between 1998 and 2002, the number of target aged women receiving mammography in the ten provincial organized programs nearly doubled from 328,674 to 608,967

Over half the women screened in 1998 and 1999 had been previously screened within the program, and the retention rate of 75.2% exceeded the national target of at least 75% (Table 6). For all age groups, the probability of returning for a rescreen stabilizes at 30 months following the proceeding screen (Figure 5), although women aged 40-49 are more likely to return at a 1-year interval.

Overall, participation and retention rates in most longstanding programs have stabilized or declined, reflecting, in part, limited program capacity to provide screening to a growing target population. However, some programs direct a third or more of their program capacity to screening women aged 40-49 (Figure 6), and in some programs annual recall is more common. In 2001 and 2002, the proportion of total screens that

## Figure 4

**Proportion of women with a self-reported mammogram[a] in the past two years by province, women aged 50-69, 2003 Canadian Community Health Survey (CCHS)**




a Diagnostic mammography excluded.
b The CCHS sampling frame covers 71% of the private households in Nunavut.
**Source:** Health Canada. 2003 Canadian Community Health Survey: share file.

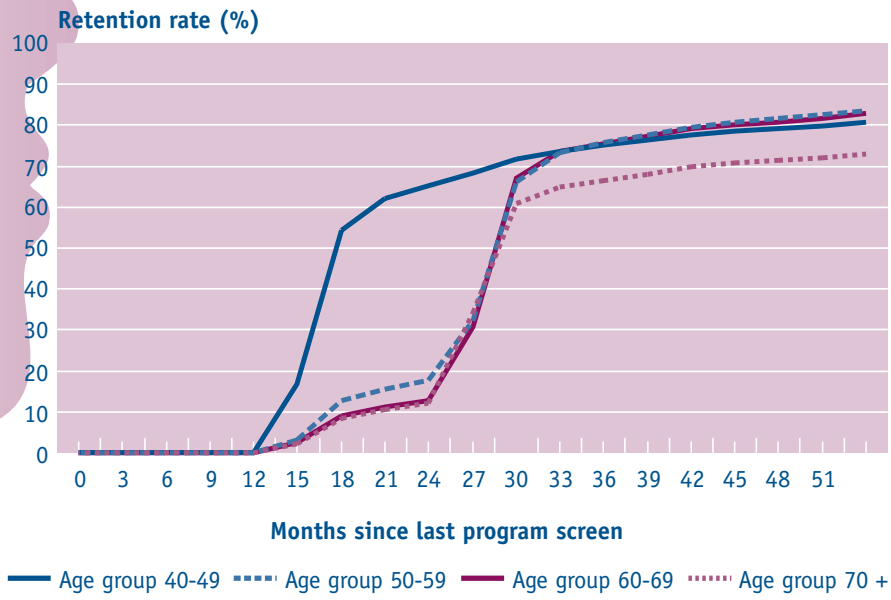
were delivered to women aged 50 to 69 ranged between programs from 51.1% to 100.0% (Figure 6). Nevertheless, even programs that apply a strict biennial screening interval and target only women aged 50 to 69 are reaching the limits of their capacity. Between 1998 and 2002 the number of target-aged women receiving mammography in the 10 provincial organized programs nearly doubled, from 328,674 to 608,967 (Table 8).

## Results of Screening

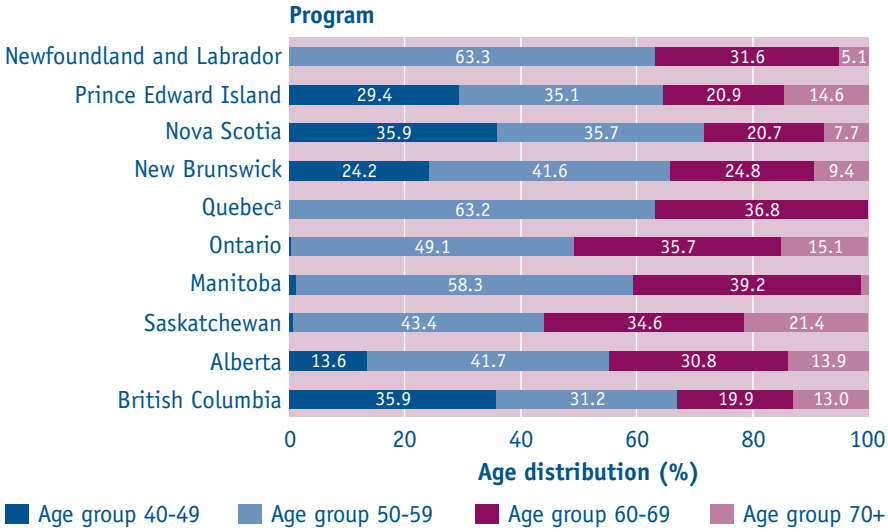
Organized programs aim to ensure that they identify breast cancers in asymptomatic women while minimizing the number of healthy women who receive an abnormal screening result and require follow-up procedures. The proportion of screened women who receive an abnormal screening result (abnormal call rate) is one measure of the

The benefits of breast screening depend on regular participation every two years. 75.2% of women returned for screening within 30 months of their previous screen, exceeding the national target of ≥ 75%.

## Figure 5
## Cumulative probability of returning for a subsequent program screen by age group, 1998 and 1999 screen years




## Figure 6
## Age distribution of program screens by province, 2001 and 2002 screen years

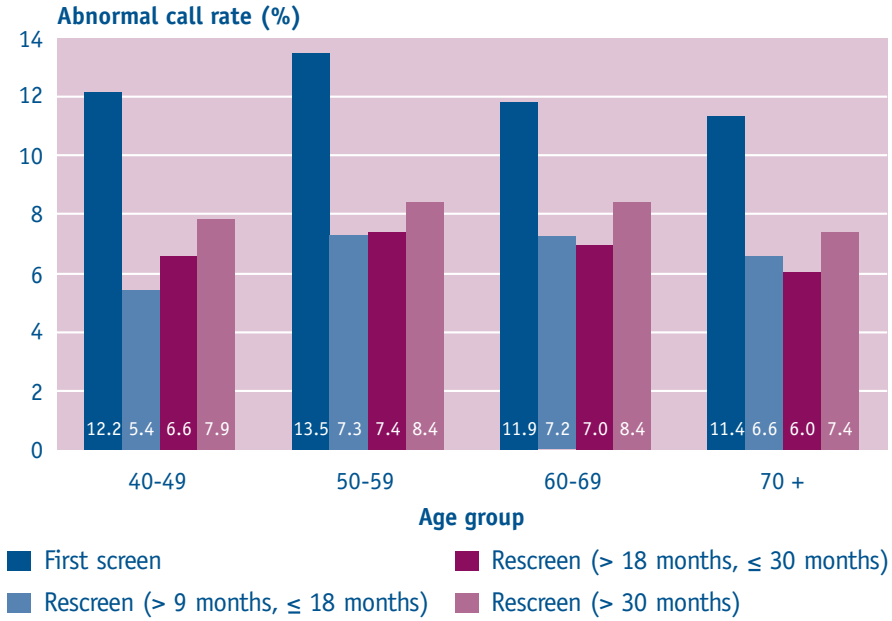



a Although Quebec accepts women aged 35-49 and 70+ with physician referral if done at a program screening centre, they are not officially considered within the program.

degree to which programs minimize the potential harms of screening among participants.

In 2001 and 2002, for women in the target age range, the observed overall abnormal call rates of 13.1 and 7.4 for first and subsequent screens, respectively, were higher than in previous years, and exceed the national targets (Table 6 and Table 8), which specify that less than 10% of first screens and less than 5% of women returning for screening should have abnormalities detected on their screening exam. The proportion of screened women who receive an abnormal screening result on first screens is normally higher, reflecting prevalent cancers among previously unscreened women (Figure 7). With delays to rescreen, abnormal call rates begin to rise, showing the benefits of returning for a subsequent screen in a timely fashion. Although the use of clinical breast exam in combination with mammography results in higher abnormal call rates, programs that provide screening using both modalities did not consistently demonstrate higher abnormal call

**Figure 7**
**Abnormal call rate[a] by age group, 2001 and 2002 screen years**




a Includes mammography and clinical breast examination as screening modalities.
**Notes:** The median time for women to return for screening is as follows: Rescreen (> 9 months, ≤ 18 months) by 12.5 months; Rescreen (> 18 months, ≤ 30 months) by 24.5 months; Rescreen (> 30 months) by 35.8 months.

The abnormal call rate, a measure of the degree to which programs minimize the potential harms of screening, was higher than in previous years and did not meet the national targets.

rates than those providing mammography only[9]. Several factors and practices have been shown to increase the proportion of screened women who receive an abnormal screening result, among them, radiologist inexperience and low reading volumes. Although formal accreditation programs in Canada require a reading volume of 480 mammograms per year, research from Canadian organized programs suggest that optimal reading volumes are much higher[10, 11]. The practice of double reading mammograms has also been shown to reduce abnormal call rates while maintaining high cancer detection rates, though few programs in Canada incorporate double reading. Incorporation of such evidence into accreditation standards and continued promotion of accreditation of screening program facilities can help optimize the delivery of mammography by programs. The setting of minimum standards of training and performance for radiologists and mammography technologists as well as guidelines for quality assurance programs are further outlined in the document of the Quality Determinants Working Group of the National Committee for the CBCSI[12]. Programs undergoing expansion must pay particular attention to the additional training needs of personnel new to organized screening programs. Continued monitoring of abnormal call rates will be critical as will ongoing efforts to reduce abnormal call rates while maintaining optimum cancer detection rates.

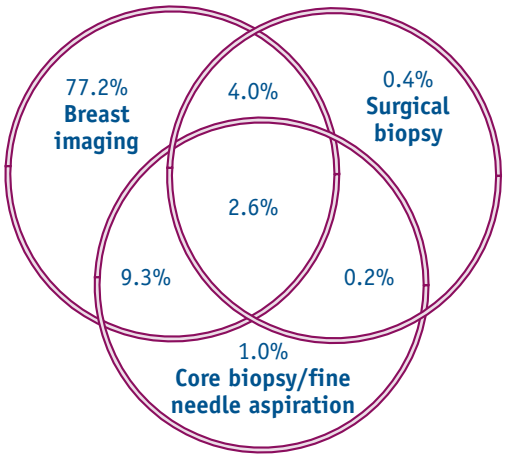
## Diagnostic Investigations

Programs have established methods to streamline scheduling, track follow-up procedures and results, and provide additional support to women during the diagnostic follow-up process.

The vast majority of women who receive an abnormal screening result do not have breast cancer. When a lump or lesion is detected through CBE or mammography screening, additional assessment is normally required to establish or exclude the presence of cancer. The fear and anxiety associated with subsequent testing should be minimized by providing timely, well-coordinated follow-up with only the appropriate number of interventions. For this reason, a number of programs have established methods to streamline scheduling, track follow-up procedures and results, and provide additional support to women during the process. Progress towards reducing waiting times in the diagnostic follow-up process is detailed in the Special Topic portion of this report.

Diagnostic investigations may include a clinical evaluation, radiologic work-up including diagnostic mammography with additional views

## Figure 8
## Combinations of diagnostic procedures after an abnormal screen, women aged 50-69, 2001 and 2002 screen years




5.3% of women had none of the above procedures[a].

a For women who had none of the above procedures, 81.4% were referred based on an abnormal clinical breast examination and may have had their final diagnosis established by their primary care provider.

(spot compression or magnification views), a comparison with previous mammograms and/or ultrasonography. Figure 8 shows the proportion of women who received each diagnostic procedure after an abnormal screen. Compared with previous years, more women in 2001 and 2002 underwent breast imaging alone (77.2%), indicating that although abnormal call rates have risen, most abnormalities are resolved without having to resort to invasive follow-up procedures.

In order that a final diagnosis can be obtained, a small number of women may undergo a surgical consultation, fine-needle aspiration, core biopsy and/or surgical biopsy where appropriate[13]. The growing trend towards using the less invasive procedures before resorting to open surgical biopsy continues. Compared with 1999 and 2000 data, the proportion of women undergoing open surgical biopsy in 2001 and 2002 declined from 8.3% to 7.2% (Table 4). Of the women aged 50 to 69 who did require a surgical biopsy, the benign to malignant open biopsy ratio was 0.9:1, which is well within the Canadian target of ≤ 2:1 and reflects a steady improvement over the past five years (Table 8). Keeping the ratio of benign to malignant biopsies appropriately low is necessary to avoid inducing unnecessary morbidity in healthy women.

Most abnormalities are resolved without having to resort to invasive follow-up procedures. Compared with previous years, more women underwent breast imaging alone and the proportion of women undergoing open surgical biopsy has declined.

## Table 4
## Diagnostic procedures after an abnormal screen, women aged 50-69, 2001 and 2002 screen years

| | Modes of referral | | | |
|---|---|---|---|---|
| | All modes of referral | Referred by mammography alone | Referred by clinical breast examination alone | Referred by both mammography and clinical breast examination |
| Diagnostic procedure | Number[a] (%[b]) Range[c] (%[b]) | Number[a] (%[b]) | Number[a] (%[b]) | Number[a] (%[b]) |
| Diagnostic mammogram | 68,183 (71.2) (44.8 - 89.7) | 65,819 (78.6) | 438 (4.9) | 1,926 (61.4) |
| Ultrasound | 53,238 (55.6) (32.0 - 71.0) | 46,795 (55.9) | 4,128 (46.4) | 2,315 (73.8) |
| Fine-needle aspiration | 3,807 (4.0) (0.4 - 9.7) | 3,040 (3.6) | 488 (5.5) | 279 (8.9) |
| Core biopsy | 9,187 (9.6) (3.6 - 24.6) | 8,440 (10.1) | 152 (1.7) | 595 (19.0) |
| Open biopsy with or without fine wire localization | 6,874 (7.2) (0.0 - 14.9) | 5,886 (7.0) | 422 (4.8) | 566 (18.0) |

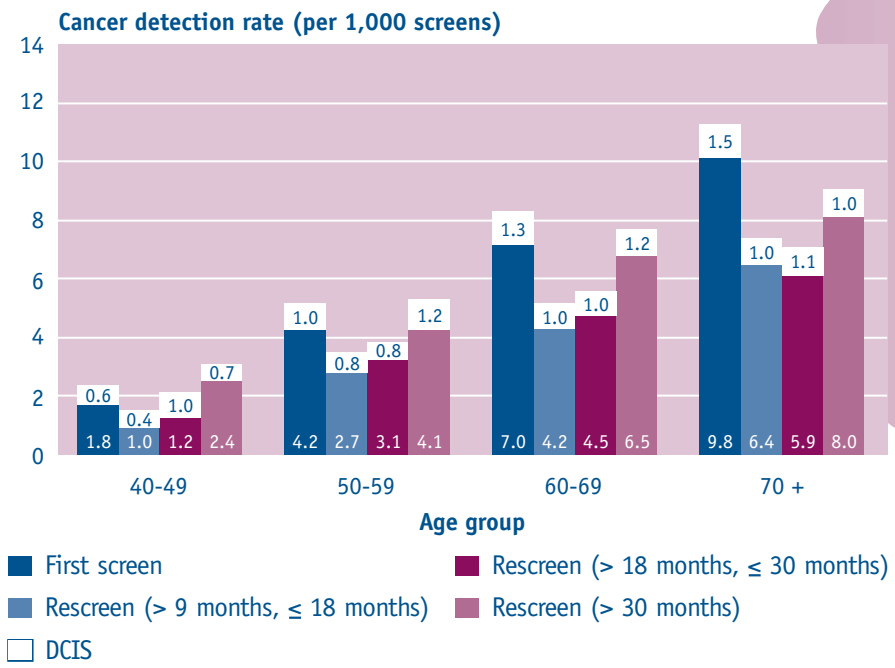
a All provinces combined.
b Proportion of all abnormal screens that had this diagnostic procedure performed.
c Range among provinces.

**Note:** Proportions will not add up to 100% since a woman is likely to have a combination of procedures performed during her work-up.

## Cancer Detection

The cancer detection rate is a meaningful indicator for program evaluation when it is observed in relation to the abnormal call rate, post-screen detected cancer rate and the underlying breast cancer incidence rate. The cancer detection rate in an organized screening program should generally exceed the cancer incidence rate that existed in the population before screening implementation, because screening detects asymptomatic cancers. Consequently, cancer detection rates will generally be higher for first screens (when prevalent cancers would be detected) than for rescreens (Figure 9). These rates also tend to be higher among women who do not return for screening within the recommended interval. Target-aged women who are rescreened within the recommended interval have similar cancer detection rates at 9-18 months and 18-30 months.

## Figure 9
## Cancer detection rate per 1,000 screens by age group, 2001 and 2002 screen years




**Notes:** The non-shaded area indicates the rate of invasive cancers detected, while the shaded area indicates the rate of DCIS cancers detected.
The median time for women to return for screening is as follows: Rescreen (> 9 months, ≤ 18 months) by 12.5 months; Rescreen (> 18 months, ≤ 30 months) by 24.3 months; Rescreen (> 30 months) by 36.2 months. Quebec data are not included in this analysis.

The positive predictive value (PPV) is determined by the proportion of women who had an abnormal screen and who subsequently received a diagnosis of cancer. A high PPV reflects the effectiveness of the screening program at minimizing unnecessary follow-up. The national picture indicates that the PPV of an abnormal mammogram meets targets of ≥ 5% for initial screens and ≥ 6% for rescreens. However, provision of CBE lowers the PPV by raising the abnormal call rates but only increasing cancer detection rates slightly. The factors that influence cancer detection rate and abnormal call rate must be taken into consideration when evaluating a program's PPV. The PPV tends to improve with rescreening because the initial screen establishes a normal baseline for comparison. A greater prevalence of cancers also tends to increase PPV. Even though abnormal call rates did not differ substantially with age (Figure 7), the PPV increased with age (Table 7), reflecting the increased number of cancers with advancing age and

the improved discriminating power of mammograms for less dense breasts.

The prevention of breast cancer death through mammography screening depends on detecting cancers at an early stage where treatment is most effective. In 2001 and 2002, screening programs detected a total of 6125 cancers (Table 6), of which 81% were invasive and 19% were ductal carcinoma in situ (DCIS) (Table 5). Nationally, the cancer detection rates of 5.0 invasive cancers detected per 1000 screens and 3.9 invasive cancers detected per 1000 screens on first and rescreen, respectively, were within the targets set. The proportion of screen-detected cancers that were invasive increased with age, and the lowest proportion of DCIS detected was among women aged 70-79. A performance measure has not been established for in situ cancer detection rates, given the lack of scientific consensus surrounding the interpretation of these rates. They are included in this report for monitoring purposes only. In situ cancer detection rates remained stable in the 5-year period from 1998 to 2002.

Preventing breast cancer deaths through screening depends on detecting cancers early, before they are large enough to be felt or to have spread. In 2001 and 2002, 36.4% of invasive cancers detected were ≤ 10 mm in diameter and 75.3% were node negative, both well within Canadian performance targets.

Patients with cancer detected at an early stage have more treatment options, reduced cancer recurrence and improved survival. Nearly 97.9% of women with stage I breast cancers survive for at least five years[14]. This stage accounted for 52.9% of screen-detected cancers (with complete staging information) in women aged 50 to 69 (Table 5). Among women aged 50 to 69 in 2001 and 2002, 36.4% of invasive cancers detected by program screens were ≤ 10 mm in diameter (Table 6), and 24.7% of cases were node positive, both well within the Canadian performance targets of ≥ 25% and ≥ 30% respectively.

## Post-Screen Cancers

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 may develop in the interval between screens (sometimes called “interval cancers”). Others may occur in women who do not return for subsequent screening (sometimes called “non-compliant cancers”). The rate at which post-screen cancers are diagnosed in the interval between biennial screens needs to be closely monitored because

this is an indicator of the sensitivity of screening and the appropriateness of the screening interval[15].

As an element of the quality control process, when post-screen cancers are detected, program radiologists (and, in some cases, technologists) review the previous screening film to arrive at a final decision regarding whether the cancers were newly developed in the interval between

**Table 5**
**Characteristics of screen-detected cancers by age group, 2001 and 2002 screen years**

| | Age group | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 40-49 | | 50-59 | | 60-69 | | 70+ | | All ages | |
| | n | % | n | % | n | % | n | % | n | % |
| Number of cancers[a] | | | | | | | | | | |
| Invasive | 301 | 71.7 | 1,602 | 79.4 | 1,600 | 82.1 | 1,036 | 85.2 | 4,539 | 81.0 |
| DCIS | 119 | 28.3 | 415 | 20.6 | 349 | 17.9 | 180 | 14.8 | 1,063 | 19.0 |
| TNM staging | | | | | | | | | | |
| 0 *(in situ)* | 119 | 28.9 | 415 | 22.0 | 349 | 19.4 | 180 | 16.5 | 1,063 | 20.5 |
| I | 179 | 43.4 | 904 | 48.0 | 1,008 | 56.1 | 651 | 59.5 | 2,742 | 52.9 |
| II | 107 | 26.0 | 510 | 27.1 | 410 | 22.8 | 239 | 21.8 | 1,266 | 24.4 |
| III / IV | 7 | 1.7 | 54 | 2.9 | 30 | 1.7 | 24 | 2.2 | 115 | 2.2 |
| Invasive (TNM stage missing)[b] | 8 | | 138 | | 153 | | 124 | | 423 | |
| Tumour size[c] | | | | | | | | | | |
| ≤ 5 mm | 30 | 10.1 | 168 | 11.2 | 136 | 9.2 | 65 | 6.8 | 399 | 9.4 |
| > 5, ≤ 10 mm | 64 | 21.5 | 326 | 21.7 | 429 | 29.1 | 277 | 28.9 | 1,096 | 25.9 |
| > 10, ≤ 15 mm | 84 | 28.2 | 404 | 26.9 | 436 | 29.6 | 273 | 28.5 | 1,197 | 28.3 |
| > 15, ≤ 20 mm | 43 | 14.4 | 263 | 17.5 | 216 | 14.7 | 167 | 17.5 | 689 | 16.3 |
| ≥ 21 mm | 77 | 25.8 | 339 | 22.6 | 257 | 17.4 | 175 | 18.3 | 848 | 20.1 |
| Size unknown | 3 | | 102 | | 126 | | 79 | | 310 | |
| Median tumour size (mm) | 15 | | 15 | | 13 | | 13 | | 14 | |
| Positive nodes[c] | | | | | | | | | | |
| 0 | 187 | 73.6 | 991 | 72.2 | 1,057 | 78.9 | 648 | 81.2 | 2,883 | 76.6 |
| 1-3 | 50 | 19.7 | 259 | 18.9 | 208 | 15.5 | 106 | 13.3 | 623 | 16.6 |
| 4+ | 17 | 6.7 | 122 | 8.9 | 75 | 5.6 | 44 | 5.5 | 258 | 6.9 |
| Number unknown[d,e] | 47 | | 230 | | 260 | | 238 | | 775 | |

a Unclassified cancers are not included in this analysis.

b Prince Edward Island does not provide TNM staging and accounts for 8.0% of all cases in this category.

c This analysis includes invasive cancers only.

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

e New Brunswick has 23.5% pathologically positive nodes but nodal distribution is not provided. New Brunswick accounts for 28.4% of all cases in this category.

**Notes:** Quebec data are not included in this analysis.

screens, were missed at screening or were missed at diagnosis. In cases of disagreement, resolutions are made either through consensus or by a majority decision by readers.

According to the Canadian performance targets, fewer than six post-screen detected invasive cancers per 10,000 person-years should be detected within 12 months from screening, and fewer than 12 per 10,000 person-years should be detected within 24 months from screening. While these targets were met or nearly met (Table 6), with overall rates per 10,000 person-years of 6.5 and 9.4 at 12 and 24-months, respectively, the figures must be interpreted cautiously for a number of reasons. Comparisons of post-screen cancer rates among programs require complete and up-to-date breast cancer registration and the assurance that post-screen cancers are counted in the same way. Good linkages with cancer registries will result in higher post-screen cancer rates because of higher levels of case ascertainment. In Canada, post-screen cancer rates may also be affected by the amount of screening delivered outside of screening programs, the performance of CBE and BSE between screening episodes, and differences in the classification of the end of a screening episode in the event of a screening abnormality.

## Table 6
## Performance measures by program, women aged 50-69, 2001 and 2002 screen years

| Indicator | Target | Program | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BC | AB | SK | MB[a] | ON[a] | QC | NB | NS[b] | PE[a] | NL[a] | Canada |
| Number of screens | N/A[c] | 234,324 | 34,127 | 55,115 | 56,531 | 301,967 | 366,378 | 46,094 | 41,635 | 7,246 | 16,042 | 1,159,459 |
| Number of first screens | N/A[c] | 22,834 | 8,435 | 8,181 | 12,794 | 110,516 | 157,685 | 9,135 | 7,454 | 1,735 | 4,078 | 342,847 |
| Number of cancers[d] | N/A[c] | 1,166 | 132 | 277 | 330 | 1,562 | 2,154 | 190 | 211 | 22 | 81 | 6,125 |
| Participation rate (%) | ≥ 70 | 50.7 | 12.0 | 53.6 | 48.5 | 22.4 | 43.7 | 51.9 | 34.0 | 43.5 | 23.2 | 33.9 |
| Retention rate (% rescreened within 30 months)[e] | ≥ 75 | 77.4 | 68.4 | 78.6 | 74.6 | 81.3 | 67.6 | 71.8 | 81.6 | 84.2 | 76.4 | 75.2 |
| Abnormal call rate (%) | | | | | | | | | | | | |
| Abnormal by mammography[f] | | | | | | | | | | | | |
| Initial screen | < 10 | 14.0 | 5.7 | 14.7 | 9.7 | 10.7 | 13.2 | 12.2 | 8.6 | 8.1 | 12.5 | 12.0 |
| Rescreen | < 5 | 5.8 | 3.2 | 6.6 | 5.9 | 6.4 | 8.3 | 7.5 | 4.5 | 6.9 | 7.3 | 6.6 |
| Abnormal by any mode of detection | | | | | | | | | | | | |
| Initial screen | < 10 | 14.0 | 5.7 | 14.7 | 11.2 | 13.5 | 13.2 | 12.2 | 8.9 | 8.1 | 19.7 | 13.1 |
| Rescreen | < 5 | 5.8 | 3.2 | 6.6 | 7.0 | 8.9 | 8.3 | 7.5 | 4.7 | 6.9 | 13.9 | 7.4 |
| Invasive cancer detection rate (per 1,000 screens) | | | | | | | | | | | | |
| Detected by mammography[f] | | | | | | | | | | | | |
| Initial screen | > 5 | 5.8 | 2.4 | 4.9 | 5.7 | 4.5 | 5.0 | 5.3 | 6.0 | 4.6 | 5.4 | 4.9 |
| Rescreen | > 3 | 3.6 | 3.2 | 4.0 | 4.2 | 3.9 | 4.3 | 3.1 | 3.3 | 2.2 | 3.5 | 3.8 |
| Detected by any mode of detection | | | | | | | | | | | | |
| Initial screen | > 5 | 5.8 | 2.4 | 4.9 | 6.2 | 4.7 | 5.0 | 5.3 | 6.2 | 4.6 | 5.6 | 5.0 |
| Rescreen | > 3 | 3.6 | 3.2 | 4.0 | 4.3 | 4.1 | 4.3 | 3.1 | 3.4 | 2.2 | 3.8 | 3.9 |

## Table 6 *con't*
## Performance measures by program, women aged 50-69, 2001 and 2002 screen years

| Indicator | Target | Program | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BC | AB | SK | MB[a] | ON[a] | QC | NB | NS[b] | PE[a] | NL[a] | Canada |
| In situ cancer detection rate (per 1,000 screens) | | | | | | | | | | | | |
| Initial screen | N/A[c] | 1.8 | 0.6 | 0.9 | 1.4 | 0.9 | 1.4 | 0.7 | 1.3 | 0.0 | 1.0 | 1.2 |
| Rescreen | N/A[c] | 1.1 | 0.9 | 0.9 | 1.0 | 0.8 | 1.1 | 0.6 | 1.2 | 0.4 | 0.7 | 1.0 |
| Diagnostic interval (%)[g] | | | | | | | | | | | | |
| Completed with no biopsy, within 5 weeks | ≥ 90 | 65.3 | 53.6 | N/A | 69.7 | 77.4 | 64.5 | 71.2 | 70.3 | 75.5 | 58.1 | 72.1 |
| Completed with biopsy, within 7 weeks | ≥ 90 | 45.5 | 46.2 | N/A | 39.2 | 54.2 | 27.8 | 44.4 | 55.1 | 73.3 | 33.2 | 49.4 |
| Positive predictive value (%)[d] | | | | | | | | | | | | |
| Detected by mammography[f] | | | | | | | | | | | | |
| Initial screen | ≥ 5 | 5.4 | 5.5 | 3.9 | 7.4 | 5.1 | 4.9 | 4.8 | 8.6 | 6.2 | 5.1 | 5.1 |
| Rescreen | ≥ 6 | 8.1 | 12.8 | 7.4 | 8.8 | 7.2 | 6.6 | 4.9 | 9.9 | 3.7 | 5.7 | 7.3 |
| Detected by any mode of detection | | | | | | | | | | | | |
| Initial screen | ≥ 5 | 5.4 | 5.5 | 3.9 | 6.9 | 4.2 | 4.9 | 4.8 | 8.5 | 6.2 | 3.4 | 4.8 |
| Rescreen | ≥ 6 | 8.1 | 12.8 | 7.4 | 7.6 | 5.5 | 6.6 | 4.9 | 9.6 | 3.7 | 3.2 | 6.6 |
| Benign open biopsy rate (per 1,000 screens) | N/A[c] | 4.3 | 0.9 | 5.8 | 2.4 | 3.1 | 2.5 | 3.6 | 0.6 | 0.0 | 7.8 | 2.4 |
| Benign to malignant direct to open biopsy ratio | ≤ 2:1 | (1.2 : 1) | (1.0 : 1) | (1.8 : 1) | (1.8 : 1) | (1.7 : 1) | (0.4 : 1) | (1.3 : 1) | (2.2 : 1) | N/A | (3.0 : 1) | (0.9 : 1) |
| Benign core biopsy rate (per 1,000 screens) | N/A[c] | 1.4 | 5.4 | 2.2 | 5.1 | 5.5 | 11.1 | 2.9 | 8.6 | 5.2 | 3.6 | 4.8 |

## Table 6 *con't*
## Performance measures by program, women aged 50-69, 2001 and 2002 screen years

| Indicator | Target | Program | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BC | AB | SK | MB[a] | ON[a] | QC | NB | NS[b] | PE[a] | NL[a] | Canada |
| Benign to malignant direct to core biopsy ratio | N/A[c] | (1.0 : 1) | (1.9 : 1) | (1.9 : 1) | (1.1 : 1) | (1.7 : 1) | (2.7 : 1) | (2.3 : 1) | (1.8 : 1) | (5.4 : 1) | (1.9 : 1) | (2.0 : 1) |
| Invasive cancer tumour size (% ≤ 10 mm)[h] | > 25 | 33.2 | 39.4 | 42.2 | 33.7 | 35.8 | 39.7 | 36.3 | 40.1 | 33.3 | 43.1 | 36.4 |
| Positive lymph nodes in cases of invasive cancer (%)[h,i] | < 30 | 22.8 | 37.6 | 27.5 | 26.9 | 23.9 | 25.5 | 23.1 | 24.7 | 25.0 | 22.1 | 24.7 |
| Post-screen detected invasive cancer rate (per 10,000 person-years)[e] | | | | | | | | | | | | |
| Within 12 months | < 6 | 8.6 | 6.0 | 7.1 | 4.7 | 4.8 | N/A[j] | N/A[j] | N/A[j] | N/A[j] | 3.0 | 6.5 |
| Within 24 months | < 12 | 11.6 | 8.6 | 9.6 | 9.1 | 7.4 | N/A[j] | N/A[j] | N/A[j] | N/A[j] | 5.6 | 9.4 |

a Screening visit includes mammography and complete clinical breast examination.

b Screening visit includes mammography and modified clinical breast examination by technician.

c Surveillance and monitoring purposes only.

d Includes invasive, in situ, and unclassified cancers.

e Data for 1998 and 1999 screen years are used.

f Independent of clinical breast examination or its findings.

g Canada total excludes Saskatchewan and Quebec data. However, Quebec provided numbers separately for their program.

h Missing values are exluded from calculations. Expressed as a proportion of screen-detected invasive cancers with complete data on tumour size or number of positive nodes. Quebec data are available for the 2001 screen year only.

i New Brunswick does not provide the number of pathologically positive nodes; rate is calculated based on N stage of disease data.

j Data on out of program cancers are not available for analysis in the national database.

## Table 7
## Performance measures by age group, 2001 and 2002 screen years

| Indicator | Target[a] | Age group | | | | |
|---|---|---|---|---|---|---|
| | | 40-49 | 50-59 | 60-69 | 70+ | All ages |
| Number of screens | N/A[b] | 219,966 | 703,996 | 455,463 | 150,908 | 1,530,333 |
| Number of first screens | N/A[b] | 64,442 | 250,670 | 92,177 | 21,024 | 428,313 |
| Number of cancers[c] | N/A[b] | 420 | 3,247 | 2,878 | 1,218 | 7,763 |
| Participation rate (%) | ≥ 70 | 6.3 | 33.8 | 33.3 | 8.2 | 18.5 |
| Retention rate (% rescreened within 30 months)[d] | ≥ 75 | 55.6 | 73.2 | 73.7 | 78.6 | 75.2 |
| Abnormal call rate (%) | | | | | | |
| Abnormal by mammography[e] | | | | | | |
| Initial screen | < 10 | 12.1 | 12.4 | 10.8 | 9.5 | 11.9 |
| Rescreen | < 5 | 5.7 | 6.8 | 6.4 | 5.6 | 6.4 |
| Abnormal by any mode of detection | | | | | | |
| Initial screen | < 10 | 12.2 | 13.5 | 11.9 | 11.4 | 12.9 |
| Rescreen | < 5 | 5.8 | 7.5 | 7.2 | 6.4 | 7.0 |
| Invasive cancer detection rate (per 1,000 screens) | | | | | | |
| Detected by mammography[e] | | | | | | |
| Initial screen | > 5 | 1.8 | 4.2 | 6.6 | 9.7 | 4.6 |
| Rescreen | > 3 | 1.2 | 3.2 | 4.6 | 6.3 | 3.7 |
| Detected by any mode of detection | | | | | | |
| Initial screen | > 5 | 1.8 | 4.3 | 6.7 | 9.8 | 4.7 |
| Rescreen | > 3 | 1.2 | 3.2 | 4.7 | 6.4 | 3.8 |
| In situ cancer detection rate (per 1,000 screens) | | | | | | |
| Initial screen | N/A[a] | 0.6 | 1.1 | 1.5 | 1.5 | 1.1 |
| Rescreen | N/A[a] | 0.5 | 0.9 | 1.1 | 1.1 | 0.9 |
| Diagnostic interval (%)[f] | | | | | | |
| Completed with no biopsy, within 5 weeks | ≥ 90 | 67.7 | 71.7 | 72.7 | 72.5 | 71.3 |
| Completed with biopsy, within 7 weeks | ≥ 90 | 41.6 | 47.9 | 51.6 | 50.3 | 48.3 |

## Table 7 *con't*
## Performance measures by age group, 2001 and 2002 screen years

| Indicator | Target[a] | Age group | | | | |
|---|---|---|---|---|---|---|
| | | 40-49 | 50-59 | 60-69 | 70+ | All ages |
| Positive predictive value (%)[c] | | | | | | |
| Detected by mammography[e] | | | | | | |
| Initial screen | ≥ 5 | 1.9 | 4.3 | 7.6 | 11.8 | 4.6 |
| Rescreen | ≥ 6 | 3.0 | 6.0 | 8.9 | 13.4 | 6.8 |
| Detected by any mode of detection | | | | | | |
| Initial screen | ≥ 5 | 1.9 | 4.1 | 7.0 | 9.9 | 4.9 |
| Rescreen | ≥ 6 | 3.0 | 5.5 | 8.1 | 11.8 | 7.4 |
| Benign open biopsy rate (per 1,000 screens) | N/A[a] | 3.6 | 2.6 | 2.2 | 3.3 | 2.6 |
| Benign to malignant direct to open biopsy ratio | ≤ 2:1 | (3.2 : 1) | (1.1 : 1) | (0.7 : 1) | (0.8 : 1) | (1.0 : 1) |
| Benign core biopsy rate (per 1,000 screens) | N/A[a] | 3.3 | 5.3 | 3.9 | 2.8 | 4.4 |
| Benign to malignant direct to core biopsy ratio | N/A[a] | (4.5 : 1) | (2.6 : 1) | (1.4 : 1) | (0.7 : 1) | (2.0 : 1) |
| Invasive cancer tumour size (% ≤ 10 mm)[g] | > 25 | 31.5 | 34.5 | 38.4 | 35.7 | 36.0 |
| Positive lymph nodes in cases of invasive cancer (%)[g] | < 30 | 26.4 | 27.1 | 22.1 | 18.8 | 23.7 |
| Post-screen detected invasive cancer rate (per 10,000 person-years)[h] | | | | | | |
| Within 12 months | < 6 | 5.8 | 6.8 | 6.1 | 7.4 | 6.5 |
| Within 24 months | < 12 | 7.2 | 9.7 | 9.1 | 10.2 | 9.3 |

a Targets apply only to women aged 50-69.

b Surveillance and monitoring purposes only.

c Includes invasive, in situ, and unclassified cancers.

d Data for 1998 and 1999 screen years are used.

e Independent of clinical breast examination or its findings.

f Saskatchewan and Quebec data are not included in this analysis.

g Missing values are excluded from calculations. Expressed as a proportion of screen-detected invasive cancers with complete data on tumour size or number of positive nodes. Quebec data only available for the 2001 screen year only.

h Post-screen detected cancer rates are calculated with 1998 and 1999 data and include the following provinces: British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Newfoundland.

## Table 8
## Performance measures[a] by year, women aged 50-69

| Indicator | Target | Screen year | | | | |
|---|---|---|---|---|---|---|
| | | 1998[b] | 1999 | 2000 | 2001 | 2002 |
| Number of screens | N/A[c] | 328,674 | 467,165 | 503,905 | 550,492 | 608,967 |
| Number of first screens | N/A[c] | 155,177 | 247,929 | 229,125 | 173,297 | 169,550 |
| Number of cancers[d] | N/A[c] | 1,448 | 2,575 | 2,683 | 2,873 | 3,252 |
| Retention rate (% rescreened within 30 months) | ≥ 75 | 76.8 | 73.9 | N/A[e] | N/A[e] | N/A[e] |
| Abnormal call rate (%) | | | | | | |
| Abnormal by mammography[f] | | | | | | |
| Initial screen | < 10 | 10.2 | 11.2 | 11.4 | 12.3 | 11.7 |
| Rescreen | < 5 | 5.4 | 5.8 | 5.9 | 6.6 | 6.6 |
| Abnormal by any mode of detection | | | | | | |
| Initial screen | < 10 | 11.3 | 11.9 | 12.1 | 13.4 | 12.7 |
| Rescreen | < 5 | 6.5 | 7.0 | 7.0 | 7.4 | 7.3 |
| Invasive cancer detection rate (per 1,000 screens) | | | | | | |
| Detected by mammography[f] | | | | | | |
| Initial screen | > 5 | 5.1 | 5.0 | 4.9 | 4.8 | 4.9 |
| Rescreen | > 3 | 3.2 | 3.5 | 3.5 | 3.7 | 3.9 |
| Detected by any mode of detection | | | | | | |
| Initial screen | > 5 | 5.2 | 5.0 | 4.9 | 4.9 | 5.0 |
| Rescreen | > 3 | 3.3 | 3.6 | 3.7 | 3.8 | 4.0 |
| In situ cancer detection rate (per 1,000 screens) | | | | | | |
| Initial screen | N/A[c] | 1.4 | 1.2 | 1.2 | 1.3 | 1.1 |
| Rescreen | N/A[c] | 0.8 | 0.9 | 1.0 | 0.9 | 1.0 |
| Diagnostic interval (%)[g] | | | | | | |
| Completed with no biopsy, within 5 weeks | ≥ 90 | 71.5 | 70.7 | 71.3 | 70.3 | 73.8 |
| Completed with biopsy, within 7 weeks | ≥ 90 | 46.2 | 48.3 | 47.8 | 47.6 | 50.9 |

## Table 8 *con't*
## Performance measures[a] by year, women aged 50-69

| Indicator | Target | Screen year 1998[b] | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|
| Positive predictive value (%)[e] | | | | | | |
| Detected by mammography[f] | | | | | | |
| Initial screen | ≥ 5 | 6.2 | 5.7 | 5.4 | 5.0 | 5.2 |
| Rescreen | ≥ 6 | 7.4 | 7.6 | 7.6 | 7.1 | 7.4 |
| Detected by any mode of detection | | | | | | |
| Initial screen | ≥ 5 | 5.6 | 5.3 | 5.1 | 4.7 | 4.9 |
| Rescreen | ≥ 6 | 6.3 | 6.5 | 6.6 | 6.4 | 6.9 |
| Benign open biopsy rate (per 1,000 screens) | N/A[c] | 5.9 | 4.0 | 3.1 | 2.5 | 2.2 |
| Benign to malignant direct to open biopsy ratio | ≤ 2:1 | (1.8 : 1) | (1.2 : 1) | (1.1 : 1) | (0.9 : 1) | (0.9 : 1) |
| Benign core biopsy rate (per 1,000 screens | N/A[c] | 2.3 | 4.8 | 4.9 | 4.9 | 4.5 |
| Benign to malignant direct to core biopsy ratio | N/A[c] | (2.1 : 1) | (2.9 : 1) | (2.5 : 1) | (2.3 : 1) | (1.9 : 1) |
| Invasive cancer tumour size (% ≤ 10 mm)[h] | > 25 | 39.0 | 40.5 | 39.4 | 36.6 | 36.2 |
| Positive lymph nodes in cases of invasive cancer (%)[h] | < 30 | 21.3 | 26.8 | 25.0 | 25.3 | 23.8 |
| Post-screen detected invasive cancer rate (per 10,000 person-years)[i] | | | | | | |
| Within 12 months | < 6 | 6.6 | 6.4 | 6.2 | N/A[e] | N/A[e] |
| Within 24 months | < 12 | 10.0 | 8.9 | 8.6 | N/A[e] | N/A[e] |

a Participation rate is not calculated by year due to biennial recall.

b Québec and Prince Edward Island data for 1998 are incomplete and are excluded from this analysis.

c Surveillance and monitoring purposes only.

d Includes invasive, in situ, and unclassified cancers.

e Insufficient time for follow-up to ensure data completeness.

f Independent of clinical breast examination or its findings.

g Saskatchewan and Quebec data are not included in this analysis.

h Missing values are excluded from calculations. Expressed as a proportion of invasive cancers with complete data on tumour size or number of positive nodes. Quebec data are available up to the 2001 screen year only.

i Post-screen detected cancer rates include the following provinces: British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Newfoundland.

# SPECIAL TOPIC

## Waiting for a Diagnosis Following an Abnormal Breast Screening Examination in Canada-Progress to Date

Efforts to achieve timely access to high-quality health care for all Canadians is a priority for governments, health providers and Canadians. Related concerns regarding delays during the assessment process and poor integration of screening and diagnosis were raised in April 1997 at a workshop on organized breast cancer screening. In response, the National Committee for the CBCSI established a Working Group on the Integration of Screening and Diagnosis. The mandate of the working group was to identify and assess the existing diagnostic processes after an abnormal breast screening examination for Canadian women and propose steps to achieve timely and seamless integration of screening and assessment for women with abnormal screening mammograms in Canada. On the basis of a review of the evidence regarding psychosocial and health implications and an analysis of the situation in Canada for 1996, the Working Group proposed timeliness targets that were subsequently adopted by the National Committee in 1999 (Table 9)[16].

In spite of the challenge of a substantial increase in the volume of women undergoing diagnostic assessment, the overall national picture for diagnostic wait times improved slightly between 1999 and 2002.

Programs sought to improve timeliness in the context of program expansion and growth. Since 1999 nearly all programs, most markedly in the new and expanding programs of Quebec and Ontario, experienced dramatic increases in the volume of women undergoing assessment. In spite of the challenge of a substantial increase in the volume of women undergoing assessment, from 14,837 in 1999 to 50,133 in 2002, the overall national picture for diagnostic wait times improved slightly during this period (Table 9). For each component of the diagnostic follow-up, the proportion of women who were assessed within target increased during the 4-year period between 1999 and 2002. However, only targets for the interval from abnormal screen to notification of the client and for the interval from first assessment to diagnosis (if no tissue biopsy was required) were met by any of the programs (Table 9). Nationally 90% of women were notified of results by 2.0 weeks following their screening examination in 2002 and all programs notified 90% of

women close to, or well within the 2.0 week target. Similarly, in 7 of 8 programs that provided complete data to the CBCSD, at least 70% of women who did not require a biopsy were given a diagnosis within 1 week of their first assessment and in 3 of 8, at least 90% received a diagnosis within 2 weeks. In contrast, no program met targets for screen to first assessment (Figure 10), or screen to diagnosis (Figures 11 and

**Table 9**
**Timeliness targets and attainment status for the investigation of abnormal screening results in organized breast cancer screening programs in Canada, women aged 50-69**

| | | Proportion of women completing interval within target (%) (range[a]) | | |
|---|---|---|---|---|
| Assessment interval | Target | 1996 Baseline status | 1999 Adoption of targets | 2002 Current status |
| Abnormal screen to notification of client | 100% to be notified | | | |
| | ≥ 90% to be notified within 2 weeks | Not collected | 89.1[b] (84.0 – 99.0) | 91.8[b] (89.8 – 96.9) |
| Notification of client to first assessment | ≥ 90% within 2 weeks | Not collected | 58.9[b] (31.1 – 67.9) | 62.8[b] (43.2 – 65.9) |
| Total duration from abnormal screen to first assessment | ≥ 90% within 3 weeks | 67.6 (32.0 – 85.6) | 62.0 (35.4 – 79.0) | 64.8 (45.1 – 71.6) |
| First assessment to diagnosis (if no tissue biopsy) | ≥ 70% within 1 week | 78.7 (61.4 – 98.5) | 78.6 (49.2 – 95.9) | 82.9 (54.8 – 97.3) |
| | ≥ 90% within 2 weeks | 84.5 (66.3 – 98.8) | 82.7 (66.3 – 96.7) | 86.3 (70.2 – 97.8) |
| First assessment to diagnosis (if tissue biopsy) | ≥ 70% within 3 weeks | 34.2 (10.2 – 75.0) | 33.8 (19.6 – 82.0) | 37.8 (16.7 – 69.5) |
| | ≥ 90% within 4 weeks | 48.4 (18.8 – 80.2) | 46.2 (31.6 – 86.0) | 49.4 (34.4 – 76.1) |
| Diagnosis to notification of the client | ≥ 90% within 1 week | Not collected | Not collected | Not collected |
| Abnormal screen to diagnosis (if no tissue biopsy) | ≥ 90% within 5 weeks | 73.2 (54.8 – 81.9) | 70.7 (54.9 – 86.5) | 73.8 (54.2 – 85.7) |
| Abnormal screen to diagnosis (if tissue biopsy) | ≥ 90% within 7 weeks | 51.0 (30.0 – 64.8) | 48.3 (33.3 – 85.5) | 50.9 (38.3 – 67.2) |

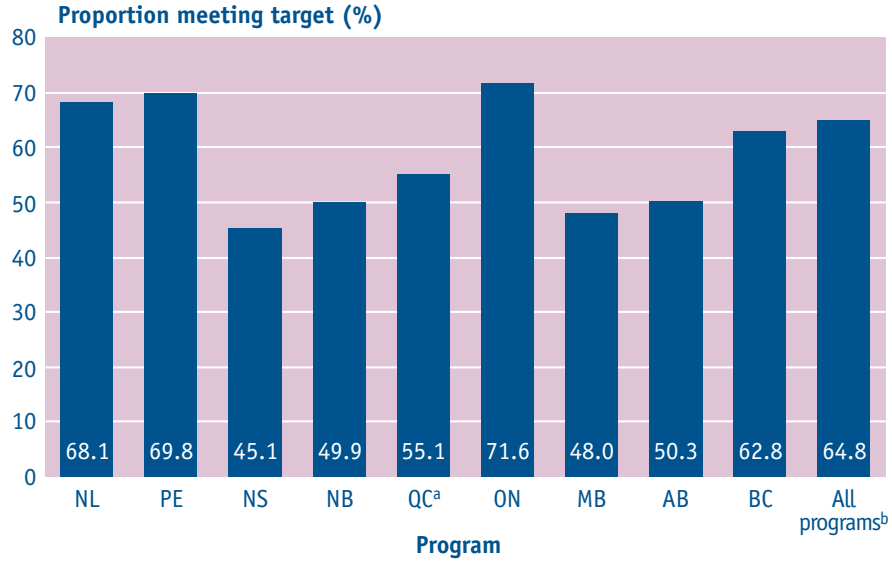
a Range among provinces.
b Programs in Prince Edward Island, Nova Scotia, and New Brunswick do not provide data to the CBCSD regarding the date a letter was generated or sent informing the client of her abnormal screening result. These programs are not included in the calculation of this interval.

**Note:** Saskatchewan and Quebec data are not included in this analysis.

12). Achieving timely diagnosis is a particular challenge among women who require a tissue biopsy as part of their assessment process, leaving overall timeliness targets unmet (Figure 11).

Concrete guidance on what types of system changes would have an impact on waiting times has become available only more recently through the results of evaluated interventions initiated by organized Canadian screening programs. A number of pilots have implemented a redesign of the process. Some interventions have effectively reduced diagnostic waiting times, whereas others have not. For instance, a simple change involved a screening centre directly communicating abnormal findings to the diagnostic centre rather than advising the family physician to do so. This substantially reduced median time to diagnosis[17]. A similar process was implemented successfully in the Manitoba Breast Screening Program and resulted in significant reductions in the time to diagnosis after an abnormal screening result[18]. Since then, several other programs have instituted direct referral mechanisms.

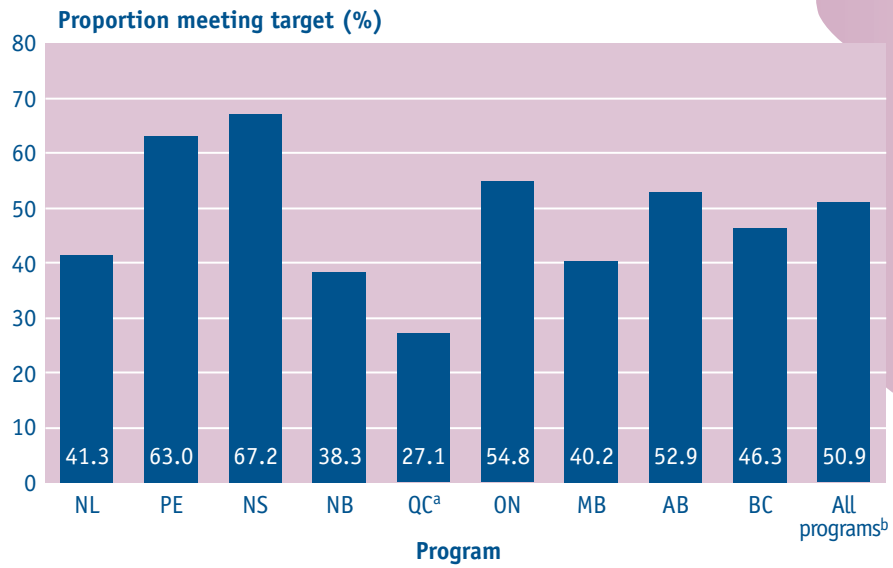
**Figure 10**
**Proportion of women meeting 3.0 week target from screen to first assessment by program, women aged 50-69, 2002 screen year**




a Quebec diagnostic test data are incomplete in the CBCSD. Therefore, diagnostic test data derived by the Quebec screening program through linkages with the Régie de l'assurance maladie du Québec (RAMQ) are provided separately for inclusion.
b Saskatchewan and Quebec data are not included in this proportion.

## Figure 11

## Proportion of women meeting 7.0 week target from screen to diagnosis if a biopsy was required by program, women aged 50-69, 2002 screen year



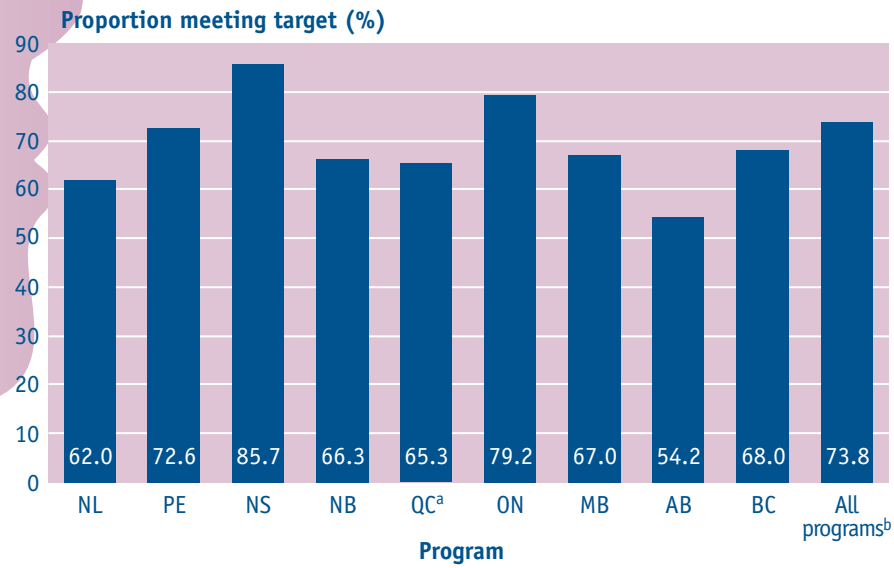

a Quebec diagnostic test data are incomplete in the CBCSD. Therefore, diagnostic test data derived by the Quebec screening program through linkages with the Régie de l'assurance maladie du Québec (RAMQ) are provided separately for inclusion.

b Saskatchewan and Quebec data are not included in this proportion.

In Nova Scotia, the screening program regularly navigates women through the diagnostic process on behalf of the family physician, a practice that has both provided supportive care to women undergoing assessment and has reduced waiting times[19]. With more evidence regarding which interventions have been most effective, jurisdictions will be better positioned to implement changes that are most likely to reduce diagnostic waiting times.

Overall, while there has been slight improvement toward meeting timeliness targets at the national level, more significant improvements are apparent in some provincial jurisdictions. Without broader dissemination, actions to improve waiting times taken at the regional level, are unlikely to impact on the overall national picture. In order to understand which interventions to improve waiting times are most effective, it will be important to continue to examine data at the regional level. This will be particularly important in identifying methods to improve timeliness for women undergoing tissue biopsy. Although dedicated assessment facilities associated with screening programs have been

## Figure 12
## Proportion of women meeting 5.0 week target from screen to diagnosis if no biopsy was required by program, women aged 50-69, 2002 screen year




a Quebec diagnostic test data are incomplete in the CBCSD. Therefore, diagnostic test data derived by the Quebec screening program through linkages with the Régie de l'assurance maladie du Québec (RAMQ) are provided separately for inclusion.
b Saskatchewan and Quebec data are not included in this proportion.

shown to effectively keep surgical waiting times lower, such facilities are often not a feasible option in settings other than larger urban centres. It appears that notification and other aspects of assessment within control of the program have, on the whole, improved. Better coordination of surgical assessment or increased capacity for the provision of core biopsy will be needed to improve waiting times for women who require a tissue biopsy to complete their diagnosis.

In September 2004, the Government of Canada and the First Ministers signed a historic, $41.3 billion, 10 year plan to strengthen health care. This includes $5.5 billion over 10 years to reduce wait times in five priority areas, including cancer. As a first step towards improving timely access to quality care, the First Ministers agreed in 2004 to establish evidence-based benchmarks for medically acceptable wait times in the five priority areas by December 31, 2005[20]. The Government will also invest a further $500 million in medical equipment to enhance a prior $1.5 billion investment in 2003, for the Diagnostic/Medical Equipment Fund (D/MEF). The provinces and territories decide

how to use the fund, which can be applied to the cost of purchasing, replacing/updating and installing mammography equipment. This investment will help to improve access to diagnostic care and treatment services and support training for specialized staff, key factors in reducing waiting times and sustaining a quality health care system.

# SUMMARY AND FUTURE DIRECTIONS

The availability of performance measures and targets allows for the continuous improvement of the quality of organized screening programs. Although most performance targets for organized programs were met, the current evaluation indicates three areas on which to concentrate future efforts for improvement: capacity, referral practices, and timeliness of diagnostic follow-up.

Although organized screening programs have expanded and grown significantly, no program currently meets the performance target of screening at least 70% of the target population. Organized programs can offer benefits that include: a population-based outcome goal, special emphasis on hard-to-reach communities, organized quality assurance including equipment and interpretation, high quality diagnosis and follow-up and outcome data and performance measurement, as presented in this report. Greater participation in organized screening programs by women aged 50 to 69 will bring the benefits of breast cancer screening to more Canadian women. Continued progress toward a 70% participation target will require that issues of program capacity and the growing target population be addressed.

Although a number of new technologies are on the horizon, these are unlikely to replace mammography in the near future for population screening. Mammography remains the only modality proven to reduce mortality from breast cancer in the population.

For the period covered in this report, performance targets for the proportion of screened women who receive an abnormal screening result (abnormal call rate) were not met. Increased support for expanding programs will be critical to ensure optimum implementation of guidelines recommended by the Quality Determinants Working Group of the National Committee for the CBCSI[12]. Continued monitoring of abnormal call rates will be critical, as will ongoing efforts to reduce these rates while maintaining optimum cancer detection rates.

Although timeliness of diagnostic follow-up has improved only slightly in the four years since national targets were adopted, several individual programs have made remarkable strides in expediting the diagnostic work-up after an abnormal screening examination. In order to achieve performance targets set for diagnostic follow-up, further evaluation

and exchange of various effective strategies may allow other programs to enhance their own processes. Evaluation of new strategies to improve the timeliness of surgical assessment will be critical in order to achieve targets for the interval from screen to diagnosis for women requiring biopsy to confirm their diagnosis.

The goal of monitoring and evaluating organized breast cancer screening programs in Canada is to promote high-quality screening, ultimately leading to reductions in breast cancer mortality and morbidity and the minimization of the unwanted effects of screening. Although a number of new technologies are on the horizon, new screening modalities are unlikely to replace mammography in the near future for screening the general population[21]. Mammography remains the only breast screening modality proven to reduce mortality from breast cancer in the population. Monitoring efforts, such as those reported here, continue to be critical in order to provide women with an accurate picture of the benefits and harms of participation in screening programs. Ongoing monitoring and evaluation is a necessary mechanism to provide direction for programs in their continuous efforts to provide high-quality screening and to reduce the burden of breast cancer mortality on Canadian women and their families.

Organized breast cancer screening programs have grown and evolved substantially since the inception of the first program in 1988. With many programs surpassing their 10-year anniversary, it is becoming timely for a formal evaluation of the impact of screening on mortality in the population. Critical areas for national, evidence- based, guideline development include the screening of women aged 40 to 49 and 70 to 79, a practice that is being increasingly adopted both within and external to screening programs.

Breast screening programs are also encountering challenges that cross disease boundaries. For example, recruitment and recall strategies for breast, cervical and in the future, colorectal cancer screening will need to be examined in an integrative fashion. Health systems issues including health human resources, training and capacity in the cancer care sector cross disease boundaries. Issues pertaining to breast cancer screening remain critical components both within the disease-specific Canadian Breast Cancer Screening Initiative and as a component of a broader Canadian Strategy for Cancer Control.

Ongoing monitoring and evaluation is a necessary mechanism to provide direction for programs in their continuous efforts to provide high-quality screening and to reduce the burden of breast cancer mortality on Canadian women and their families.

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# APPENDIX 1

## 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 Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada.

**Dr. Carolyn Pim (Chair)**
Director of Screening Programs
Alberta Cancer Board
2202 -2 St. S.W.
Calgary, AB T2S 3C1

**Dr. Andy Coldman**
Leader, Population and Preventive Oncology
BC Cancer Agency
8th Floor, 686 West Broadway
Vancouver, BC V5Z 1G1

**Chuck Paltiel**
Statistician
BC Cancer Agency
8th Floor, 686 West Broadway, Rm 801
Vancouver, BC V5Z 1G1

**Marion Harrison**
Director, Screening Programs
CancerCare Manitoba
5-25 Sherbrook Street
Winnipeg, MB R3C 2B1

**Christine LeBlanc Bennett**
Provincial Cancer Consultant
New Brunswick Health and Wellness
P.O. Box 5100
Fredericton, NB E3B 5G8

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

**Marcia Campbell**
Project Coordinator, Breast Screening Pilot Project
Stanton Territorial Health Authority
550 Byrne Road PO BOX 10
Yellowknife, NT X1A 2N1

**Dr. Judy Caines**
Medical Director
Nova Scotia Breast Screening Program
QE2 Health Science Centre
Room 3036A, Dickson Building
1278 Tower Road
Halifax, NS B3H 1B3

**Bill Campbell**
Provincial Program Director
Ontario Breast Screening Program
620 University Avenue, 11th Floor
Toronto, ON M5G 2L7

**Norah Smith**
PEI Breast Screening Clinic
Queen Elizabeth Hospital
Department of Diagnostic Imaging
Riverside Drive, PO Box 6600
Charlottetown, PE C1A 8T5

**Dr. Guy Roy**
Médecin responsable du dépistage
Direction générale de la santé publique
Ministère de la santé et des services sociaux du Québec
1075 ch. Sainte-Foy, 3ème étage
Ste-Foy, QC G1S 2M1

**Lois Harrison**
Director, Screening Programs
Prevention and Early Detection Division
Saskatchewan Cancer Agency
952 Albert Street
Regina, SK S4R 2P7

**Christina Bancej**
Manager, Screening and Early Detection
Chronic Disease Prevention Division
Centre for Chronic Disease Prevention and Control
Public Health Agency of Canada
120 Colonnade Road AL 6702B
Ottawa, ON K1A 0K9

**Jay Onysko**
Screening and Early Detection
Chronic Disease Prevention Division
Centre for Chronic Disease Prevention and Control
Public Health Agency of Canada
120 Colonnade Road AL 6702B
Ottawa, ON K1A 0K9

**Asako Bienek**
Surveillance and Risk Assessment Division
Centre for Chronic Disease Prevention and Control
Public Health Agency of Canada
120 Colonnade Road AL 6702B
Ottawa, ON K1A 0K9

**Barb Kasprowicz**
Program Manager, Population Health & Community Programs
Chronic Disease Prevention Division
Centre for Chronic Disease Prevention and Control
Public Health Agency of Canada
120 Colonnade Road AL 6702B
Ottawa, ON K1A 0K9

# APPENDIX 2

## 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 Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada.

**Asako Bienek (Chair)**
Surveillance and Risk Assessment Division
Centre for Chronic Disease Prevention and Control
Public Health Agency of Canada
120 Colonnade Road AL 6702B
Ottawa, ON K1A 0K9

**Zeva Mah**
*Manager, Information Management and Evaluation Screening Programs*
Alberta Cancer Board
2202 - 2 Street S.W.
Calgary, AB T2S 3C1

**Chuck Paltiel**
*Statistician*
BC Cancer Agency
801-686 West Broadway
Vancouver, BC V5Z 1G1

**Kathleen Decker**
*Research and Evaluation*
Manitoba Breast Screening Program
CancerCare Manitoba
5-25 Sherbrooke Street
Winnipeg, MB R3C 2B1

**Suzanne Leonfellner**
*Epidemiology Program Officer*
Provincial Epidemiology Service
PO Box 5100
520 King St. Carleton Place
Fredericton, NB E3B 5G8

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

**Marcia Campbell**
*Project Coordinator, Breast Screening Pilot Project*
Stanton Territorial Health Authority
550 Byrne Road PO BOX 10
Yellowknife, NT X1A 2N1

**Theresa Foley**
*Program Manager*
Nova Scotia Breast Screening Program
7001 Mumford Rd., Tower 1, Suite 105
Halifax, NS B3L 4N9

**Vicky Majpruz**
*Research Associate*
Screening Unit
Cancer Care Ontario
620 University Avenue
Toronto, ON M5G 2L7

**Norah Smith**
*Program Coordinator*
PEI Breast Screening Program
Queen Elizabeth Hospital
Dept. of Diagnostic Imaging
P.O. Box 6600
60 Riverside Drive
Charlottetown, PE C1A 8T5

**André Langlois**
*Scientifique de recherche*
Institut national de santé publique du Québec
Direction systèmes de soins et services
945 Wolfe, 5ième étage
Ste-Foy, QC G1V 5B3

**Felicia Watson**
Research Officer
Saskatchewan Cancer Agency
4101 Dewdney Avenue
Regina, SK  S4T 7T1

# APPENDIX 3

## Glossary

**Asymptomatic**
A woman who does not report symptoms and appears without signs of disease at screening.

**Breast self-examination (BSE)**
An examination of the breasts performed by the woman herself in order to learn what is normal for her own breasts and to recognize when something may be wrong.

**Cancer**
Includes malignant and ductal carcinoma in situ (DCIS) of the breast.

**Clinical breast examination (CBE)**
A physical examination of the breasts performed by a trained health professional.

**Diagnosis**
The first pathologic or cytologic diagnosis of cancer, last known biopsy for benign cases, or last intervention before a recommendation to return to screening or return for early recall[1].

**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.

**Incident cancer**
Cancer detected by a program screen after the initial screen.

**In situ**

Refers specifically to 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.

**Initial screen**

The first Canadian screening program screen provided to a woman.

**Interval cancer**

Any invasive breast cancer diagnosed in the interval after 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. A ductal carcinoma in situ component may also be present in cases of invasive cancer.

**Negative screening episode**

A screening episode that concludes with normal findings, including program-initiated work-up that did not reveal any cancer.

**Open biopsy**

Surgical removal of a breast mass under local anesthesia for subsequent microscopic examination by a pathologist.

**Post-screen cancer**

A cancer detected outside the program within 24 months of a negative screening episode.

**Prevalent cancer**

The proportion of the population with cancer at a given point in time.

**Rescreening**

Subsequent screening, according to policy, after initial screening under the program. This includes women who miss a scheduled round of screening.

**Screen**

Can comprise mammography, or both clinical breast examination and mammography, delivered by a program.

**Screening episode (completed)**

Defined for normal screens as the date of the last screen; for abnormal screens, the date of tissue diagnosis if biopsy is performed, the date of the last test before a return to screening or before the recommendation for repeat diagnostic imaging. A "negative screening episode" can include all follow-up, provided that the end result is negative.

**Screen-detected cancer**

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

**Total person-years at risk**

Within a 12 or 24-month period after a negative screening episode, women are considered at risk for post-screen detected cancer. Women contribute a count in the denominator for each year or fraction of a year within the period of interest before a post-screen detected cancer or the next regular program screen.

# APPENDIX 4

## Publications Using the CBCSD


Yankaskas, B.C., C.N. Klabunde, R. Ancelle-Park, G. Renner, H. Wang, J. Fracheboud, G. Pou, and J.L. Bulliard. 2004. "International comparison of performance measures for screening mammography: can it be done?" *J Med Screen*. 11:187-93.

Bancej, C., K. Decker, A. Chiarelli, M. Harrison, D. Turner, and J. Brisson. 2003. "Contribution of clinical breast examination to mammography screening in the early detection of breast cancer." *J Med Screen*. 10:16-21.

Health Canada. Quality Determinants of Organized Breast Cancer Screening Programs in Canada. Ottawa: Minister of Public Works and Government Services Canada, 2003; Cat. No. H39-407/2003E-IN .

Health Canada. Organized Breast Cancer Screening Programs in Canada, 1999 and 2000 Report. Ottawa: Minister of Public Works and Government Services Canada, 2003; Cat. No. H1-9/13-2000.

Olivotto, I.A., A. Gomi, C. Bancej, J. Brisson, J. Tonita, L. Kan, Z. Mah, M. Harrison, and R. Shumak. 2002. "Influence of delay to diagnosis on prognostic indicators of screen-detected breast carcinoma." *Cancer*. 94:2143-50.

Health Canada. Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Cancer Screening Program Performance. Ottawa: Minister of Public Works and Government Services Canada, 2002.

Olivotto, I.A., C. Bancej, V. Goel, J. Snider, R.G. McAuley, B. Irvine, L. Kan, D. Mirsky, M.J. Sabine, R. McGilly, and J.S. Caines. 2001. "Waiting times from abnormal breast screen to diagnosis in 7 Canadian provinces." *CMAJ*. 165:277-83.

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Paquette, D., J. Snider, F. Bouchard, I. Olivotto, H. Bryant, K. Decker, and G. Doyle. 2000. "Performance of screening mammography in organized programs in Canada in 1996. The Database Management Subcommittee to the National Committee for the Canadian Breast Cancer Screening Initiative." *CMAJ*. 163:1133-8.

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Health Canada. Organized Breast Cancer Screening Programs in Canada, 1996 Report. Ottawa: Minister of Public Works and Government Services Canada, 1999; Cat. No. H39-526/2000E.