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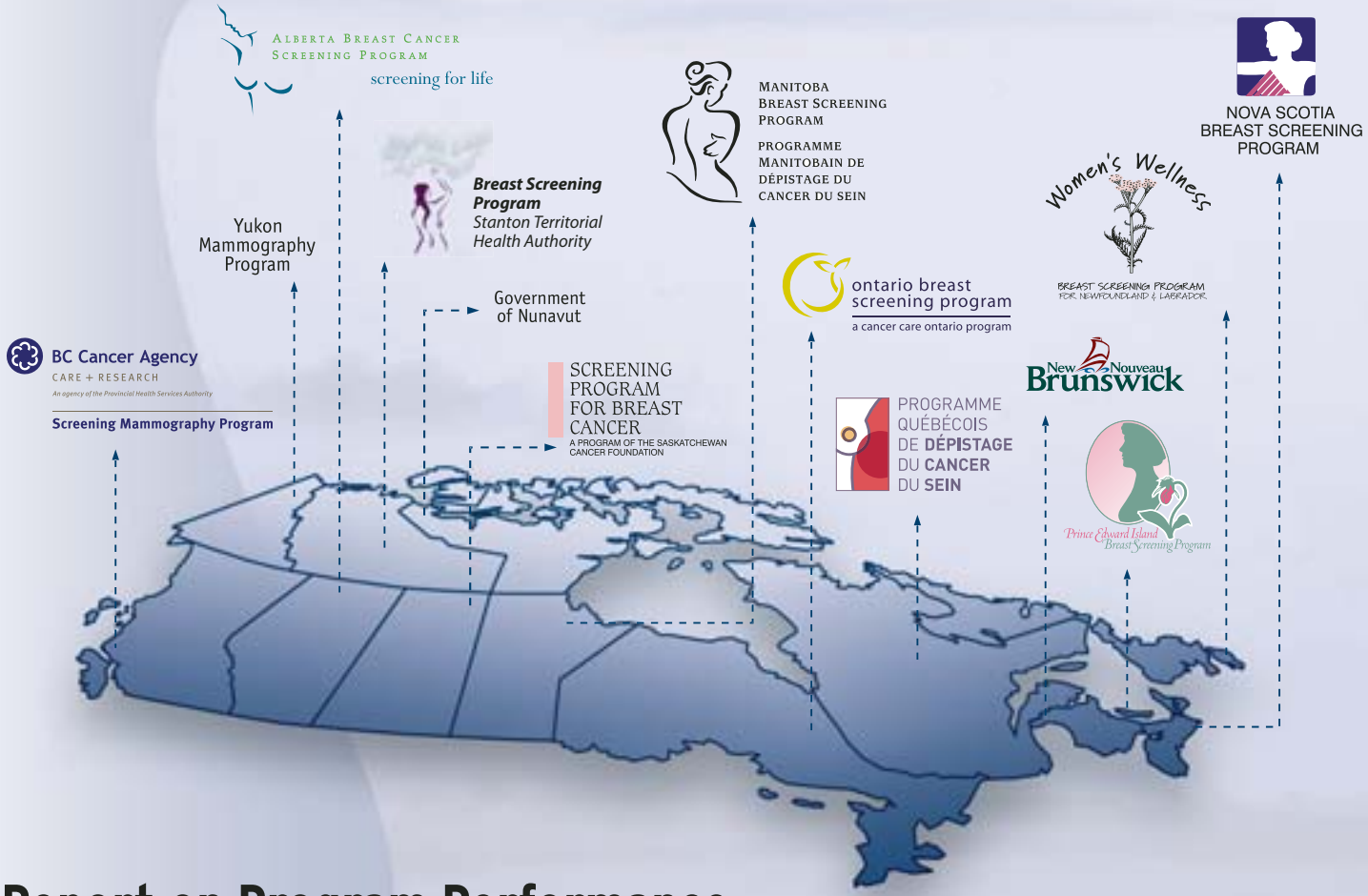
Organized Breast Cancer Screening Programs in Canada



Report on Program Performance in 2003 and 2004

Canada

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— *Public Health Agency of Canada*

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ORGANIZED BREAST CANCER SCREENING PROGRAMS IN CANADA

Report on Program Performance in 2003 and 2004

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Editorial

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EXECUTIVE SUMMARY

Breast cancer is the most common type of cancer and the second leading cancer cause of death among Canadian women with an estimated 22,400 diagnoses and 5,300 deaths in 2008 (1). Incidence rose until 1999 when it stabilized and began to show non-significant decreases. Deaths attributable to breast cancer have declined by 25% over the past twenty years (2). Although breast cancer can occur at any age, roughly half of new cases occur among women between 50 and 69 years. Early detection, through programmatic screening combined with effective treatment remains the best option available to continue reducing deaths from breast cancer in this age group; however, primary prevention through the more modifiable risk factors holds promise for the future.

The monitoring and evaluation of organized breast cancer screening programs provides an opportunity to understand their impact on breast cancer morbidity and mortality, as well as the potential harms associated with screening. Systematic evaluation of organized programs helps to ensure that Canadian women have access to high-quality breast cancer screening programs. This document presents an evaluation of the performance of organized breast cancer screening programs in Canada for the years 2003 and 2004 using data from the Canadian Breast Cancer Screening Database from ten provinces and one territory.

The societal benefits from breast cancer screening are based on the assumption that 70% of eligible women participate in biennial screening mammography; however, meeting this challenge remains elusive for organized screening programs across Canada. While many programs continue to see increases in participation rates, several mature programs have reached a plateau with participation rates just above 50%. The importance of the availability of timely diagnostic imaging was recognized in the 2004 First Ministers' *10-Year Action Plan to Strengthen Health Care* which subsequently resulted in the establishment of 'Wait Time Guarantees' for mammography in a number of jurisdictions (3).

The primary goal of organized cancer screening programs is to detect cancers as early as possible in order to minimize treatment required and reduce the likelihood of death. Indicators of program success include the proportion of cancers that are small and the proportion that have not spread outside of the breast. All programs in Canada, where information is available, meet the targets for tumour size and nodal status, an indicator that women who attend these programs can benefit from these services.

The majority of Canadian women between 50 and 69 who participate in breast cancer screening return on a biennial basis; however, this varies by a number

of characteristics. These characteristics include whether this is a woman's initial screen, whether there has been a false positive result in the past, whether a woman reports a family history of breast cancer, and which provincial program they attend. An examination of the associations between these characteristics and screening outcomes represents a worthwhile avenue for future analysis.

Organized breast cancer screening programs will continue to provide high quality screening to Canadian women in the coming years. Programs strive to achieve reductions in the morbidity and mortality associated with breast cancer through program evaluation, ongoing research, and adaptation of program policy to reflect new evidence and technologies. The Canadian Breast Cancer Screening Initiative, which supports the production of this report, provides a venue for information sharing to solve screening program challenges. The information provided in this report is available to support governments, cancer agencies, screening program managers, health professionals, and other breast cancer stakeholders to enhance organized screening across Canada.

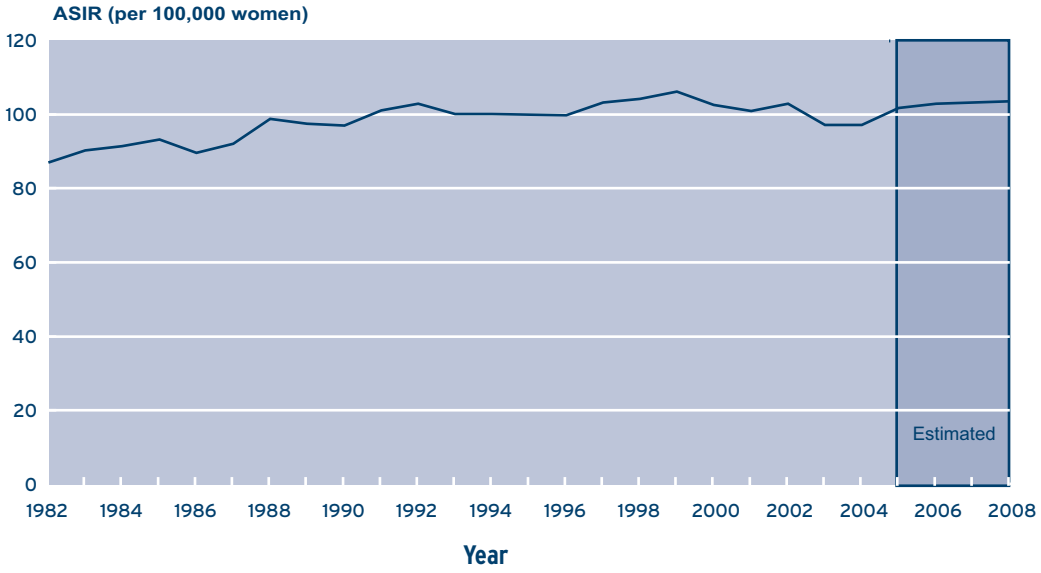
BACKGROUND

Introduction

An estimated 22,400 women will be diagnosed with breast cancer and 5,300 women will die from the disease in 2008 (1). This makes breast cancer the most common form of cancer[1] and the second leading cancer cause of death in Canadian women (1). Although breast cancer incidence has risen over the past decades, it has levelled off and is showing statistically non-significant declines since 1999. In addition, deaths attributed to breast cancer continue to decline and are approximately 25% lower than the peak in the mid-1980's (2) (Figure 1a and 1b).

An estimated 22,400 women will be diagnosed with breast cancer and 5,300 women will die from the disease in 2008.

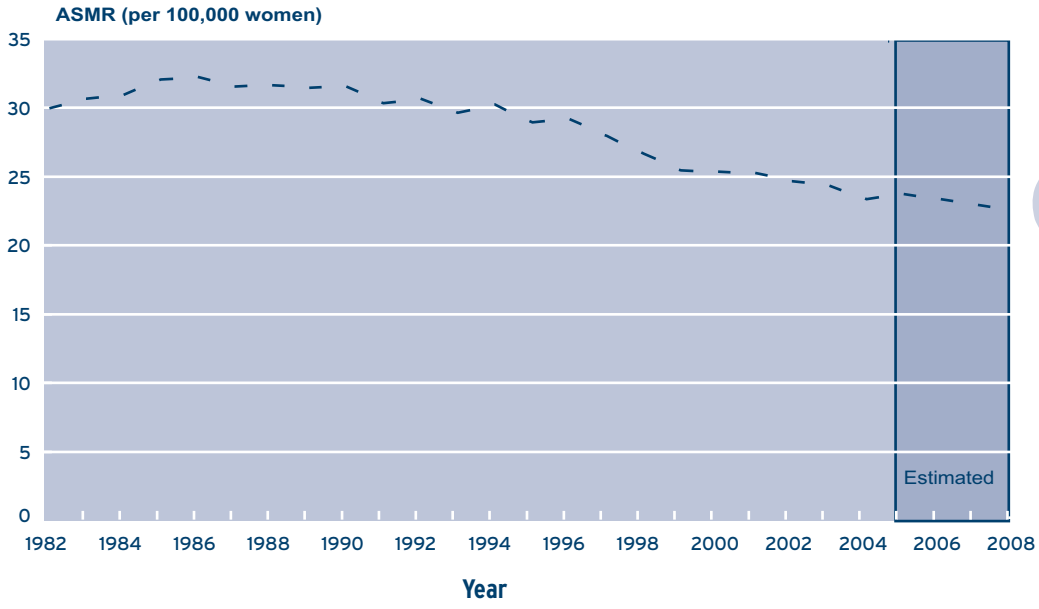
Figure 1a – Age-standardized incidence rates (ASIR) per 100,000 women for breast cancer in Canada, 1982-2008



Source: National Cancer Institute of Canada. Canadian Cancer Statistics 2008. Toronto, Canada, 2008.
Notes: Incidence rates are estimated for 2006-2008 and in 2005 for Québec, Manitoba and Alberta. Projected estimates for breast cancer beyond 2004 reflect the long-term increasing trend in breast cancer incidence and are not sensitive to recent decline.
The national rate is an estimate computed from observed case counts for all provinces and territories.
Rates are standardized to the age distribution of the 1991 population.

[1] Incidence of non-melanoma skin cancer exceeds that of breast cancer in Canada, however, rates are typically not reported due to difficulty estimating true incidence.

Figure 1b – Age-standardized mortality rates (ASMR) per 100,000 women for breast cancer in Canada, 1982-2008



Source: National Cancer Institute of Canada. Canadian Cancer Statistics 2008. Toronto, Canada, 2008.
Notes: Mortality rates are estimated for 2005-2008.
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.

Early detection of breast cancer, through organized mammography screening programs, is an effective method to reduce death and morbidity associated with breast cancer. This is partially because primary prevention of breast cancer has been limited: most known risk factors are not easily modifiable, however, changes in some of the more modifiable risk factors at the population level such as physical activity holds future promise. Of known risk factors, age has the strongest influence on breast cancer incidence; roughly, half of all new cases are among women between 50 and 69 years of age. Modelling exercises have shown that the delivery of high quality breast screening programs to this age group has the potential to reduce breast cancer deaths by as much as one third (4). Among other considerations, this scientific information influences Canadian provinces and territories to provide breast cancer screening services to this age group. Many provinces and territories also provide screening services to other age groups but in a less targeted fashion.

Breast Cancer Screening in Canada

In December 1992, the federal government launched the first phase of the Canadian Breast Cancer Initiative (CBCI) with $25 million over five years including the Canadian Breast Cancer Screening Initiative among its priorities. In June 1998, ongoing funding for the CBCI was put in place at $7 million per year. The Public Health Agency of Canada was created in September 2004 and at that time was given responsibility for overseeing the CBCI.

Organized Breast Cancer Screening Programs

Canada's first organized breast cancer screening program began in British Columbia in 1988 and was followed quickly by most provinces (Table 1). Organized breast cancer screening programs now exist in all provinces, and the Northwest and Yukon Territories. Nunavut has not developed an organized mammography screening program.

All organized programs provide women between 50 and 69, without a prior diagnosis of breast cancer, with a bilateral, 2-view screening mammogram biennially. Some programs also include women outside of this age group and some provide screening at more frequent intervals (Table 1). In 2003 and 2004, several programs provided clinical breast examination by a nurse or technologist but most programs had phased out this service based on scientific evidence (5). Lastly, some programs include breast cancer survivors; however, survivors within five years of their diagnosis are excluded from this report.

Organized programs in Canada typically involved three steps:

- **Identification and invitation of the target population**
- **Provision of a screening examination**
- **Follow-up of any abnormalities detected at screening**

The Screening Process

Organized breast cancer screening programs offer screening to women who are asymptomatic for breast cancer. Organized programs in Canada typically involved three steps:

- Identification and invitation of the target population
- Provision of a screening examination
- Follow-up of any abnormalities detected at screening

A number of methods are used to invite women to a screening examination and include media campaigns targeting women, population-based invitations, physician education to increase referrals, and personal invitations. Women may enter into organized programs through their personal letter of invitation, physician referral or self referral.

Table 1 – Breast cancer screening programs in Canada[a] – usual practices, 2003 and 2004 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
			70-74	Yes	Biennial
			75+	Yes	None
Manitoba	1995	Yes[f]	40-49	Yes[c]	Biennial
			70+	Yes[c]	None
Ontario	1990	Yes[g]	40-49	No	N/A
			70-74	Yes	Biennial
			75+	Yes	None
Québec	1998	No	35-49	Yes[d]	None
			70+	Yes[d]	None
New Brunswick	1995	No	40-49	Yes[b]	None
			70+	Yes[b]	None
Nova Scotia	1991	Yes[h]	40-49	Yes	Annual
			70+	Yes	None
Prince Edward Island	1998	Yes[h]	40-49	Yes	Annual
			70-74	Yes	Biennial
Newfoundland and Labrador	1996	Yes[i]	40-49	No	N/A
			70+	Yes[e]	None

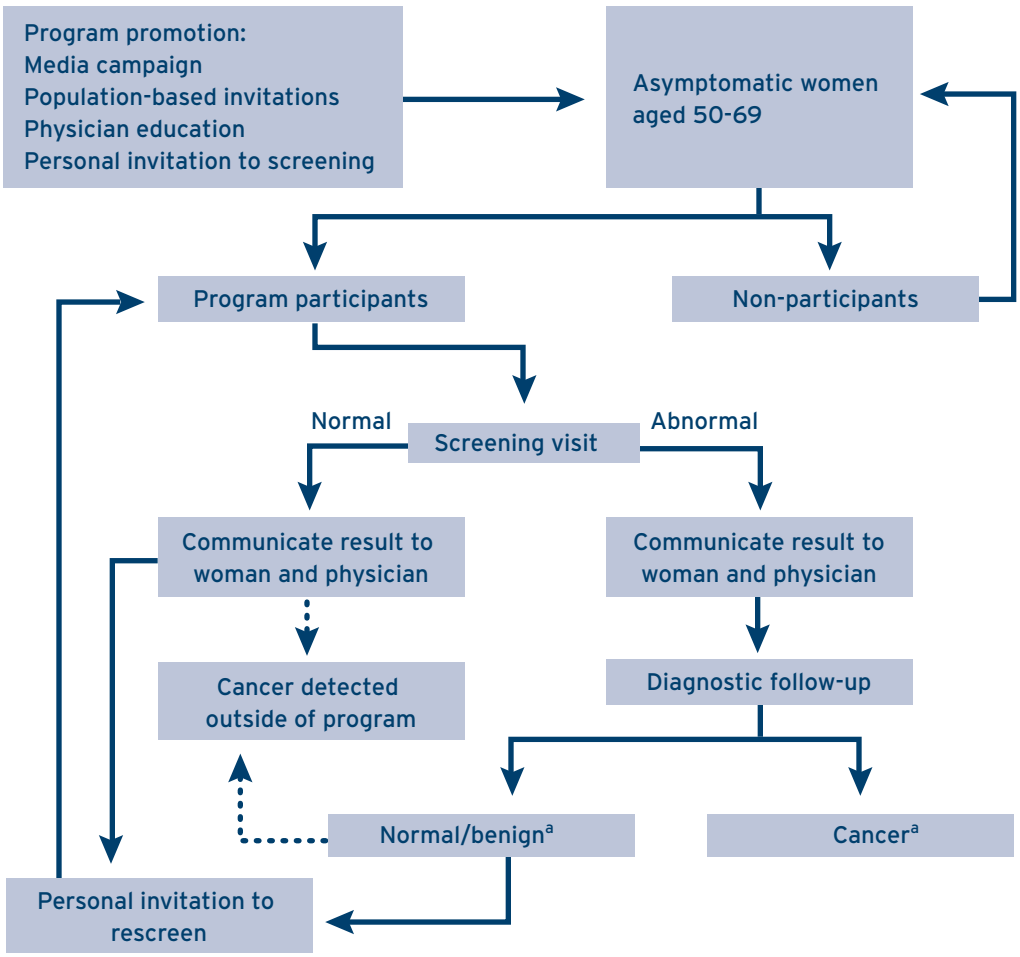
[a] Nunavut has not developed an organized breast cancer screening program.
[b] Accept with physician referral.
[c] Accept to mobile unit with a physician referral.
[d] Accept with physician referral if done at a program screening centre, but is not officially considered within the program.
[e] Accept if previously enrolled in program
[f] Nurse or Technologist.
[g] Nurse provides clinical breast examination at 69% of sites.
[h] Modified examination only, performed by technologist at time of mammography.
[i] Nurse.

Screening mammograms are provided at both fixed and mobile sites. Fixed sites are located in larger urban areas while mobile sites are used to provide service to rural and distant communities.

Results of a screening mammogram are provided to both the woman and her physician. In general, women who have normal screening results are invited back for subsequent screening through a letter of invitation. The interval is generally 24 months; however, some women are invited back after 12 months based on their age, breast density, family history, and results of their screening. After receipt of normal results, women are encouraged to follow-up with their family physicians if they become symptomatic prior to their next scheduled screening visit.

In the case of abnormal results, both the woman and her family physician are informed. The family physician or the screening program then provides coordination of follow-up. This process varies by region. The follow-up process is resolved when a final diagnosis of cancer or normal / benign is concluded (Figure 2).

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.

Canadian Breast Cancer Screening Database

Monitoring and evaluation of organized breast cancer screening programs through the systematic collection, analysis, and interpretation of health data, allows for the enhancement of programming across Canada. The Canadian Breast Cancer Screening Database (CBCSD) provides a method to examine and assess Canadian organized breast cancer screening programs. The CBCSD was established in 1993 and is operated and maintained by the Public Health Agency of Canada on behalf of the Canadian Breast Cancer Screening Initiative. Participating provincial and territorial screening programs contribute to the national database while retaining ownership over their data.

The CBCSD contains screening information from the inception of each organized screening program up to December 2004. At the present time Yukon does not keep electronic records and Nunavut does not have an organized program so they are excluded from the database. At every screening event, data including demographic characteristics, risk factors, the screen event, screening results and subsequent referral, diagnostic tests, outcomes, and cancer information is collected.

Table 2 – Annual screening volume by program, all ages, 1988 to 2004 screen years

Year	Program											
	NT	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	---	---	156,762
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	---	223,610	21,714	35,265	28,566	138,308	152,989	32,620	35,260	6,268	6,790	681,390
2001	---	224,566	23,745	36,133	28,728	163,862	172,062	33,681	35,260	6,700	8,054	732,791
2002	---	234,873	23,338	34,344	29,263	192,237	194,368	37,196	38,612	6,267	8,859	799,357
2003	---	220,933	21,806	35,477	31,637	211,926	207,816	37,433	44,998	6,094	11,038	829,158
2004	1,103	230,830	23,098	35,950	32,301	248,551	220,821	37,344	48,655	6,060	9,819	894,532
Total	1,103	2,417,060	260,630	426,767	237,584	1,530,974	1,137,150	277,482	324,627	36,967	63,982	6,714,326

[a] Although Québec 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: Yukon Territory and Nunavut programs are still in development.
Data include all screens; figures have been updated and may vary slightly from previous reports.

The database is currently used for monitoring, evaluation, and applied screening research. Research priorities are identified on an ongoing basis and the CBCSD is made available to researchers external to the Canadian Breast Cancer Screening Initiative.

Monitoring and Evaluation Using the CBCSD

Monitoring and evaluation of organized screening programs is essential to ensure Canadian women are receiving high quality services that result in the reduction of morbidity and mortality from breast cancer while minimizing the unwanted effects of screening. The results of monitoring and evaluation stemming from the CBCSD are used to enhance the performance of organized screening programs in Canada.

In order to provide fair evaluation for Canadian organized breast screening programs, standardized methods of evaluation have been developed. For detailed information please refer to the most recent Evaluation Indicators Working Group Report[2]. In general, agreed upon performance indicators for women aged 50 to 69 include those related to recruitment and retention (participation rate, retention rate), timeliness (diagnostic interval), mammography interpretation (abnormal call rate, positive predictive value), diagnosis (invasive and in situ cancer detection rate, benign:malignant open surgical biopsy ratio, benign:malignant core biopsy ratio, benign open surgical biopsy rate, benign core biopsy rate), and cancers (tumour size, node negative rate in invasive cancers, post-screen invasive cancer rate) (Table 3).

The results of monitoring and evaluation stemming from the CBCSD are used to enhance the performance of organized screening programs in Canada.

2 The Evaluation Indicators Working Group Report: Guidelines for Monitoring Breast Screening Program Performance: 2nd Edition is available online at www. phac-aspc.gc.ca

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 re-screened within 30 months of their previous screen.	≥75% initial re-screen within 30 months; ≥90% subsequent re-screens 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); <5% (subsequent screens).
4. Invasive cancer detection rate	Number of invasive cancers detected per 1,000 screens.	>5 per 1,000 (initial screen) >3 per 1,000 (subsequent screens).
5. In situ cancer detection rate	Number of ductal carcinoma in situ cancers (rather than invasive cancer) during a screening episode per 1,000 screens.	Surveillance and monitoring purposes only.
6. Diagnostic interval	Total duration from abnormal screen to resolution of abnormal screen.	≥90% within 5 weeks if no tissue biopsy[a] performed; ≥90% within 7 weeks if tissue biopsy[a] performed.
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); ≥6% (subsequent screens).
8. Benign open surgical biopsy[b] rate	The number of benign open surgical biopsies per 1,000 screens.	Surveillance and monitoring purposes only.
9. Benign to malignant open surgical biopsy[b] ratio	Among open surgical biopsies, the ratio of the number of benign cases to the number of malignant cancer cases.	≤1:1 (initial screen); ≤1:1 (subsequent screens).
10. Benign core biopsy rate	The number of benign core biopsies per 1,000 screens.	Surveillance and monitoring purposes only.
11. Benign to malignant core biopsy ratio	Among core biopsies, the ratio of number of benign cases to the number of malignant cancer cases.	Surveillance and monitoring purposes only.
12. Invasive cancer tumour size	Percentage of invasive cancers with tumour size of ≤10mm and ≤15mm in greatest diameter as determined by the best available evidence: 1) pathological, 2) radiological, and 3) clinical.	>25% ≤10mm; >50% ≤15mm.
13. Node negative rate in cases of invasive cancer	Proportion of invasive cancers in which the cancer has not invaded the lymph nodes.	>70% (initial and subsequent screens).
14. Post-screen invasive cancer rate[c]	Number of women with a diagnosis of invasive breast cancer after a normal screening within 12 AND 24 months of the screen date.	<6 per 10,000 person-years (within 12 months); <12 per 10,000 person-years (within 24 months).

Source: Public Health Agency of Canada. Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Cancer Screening Program Performance: Second edition. Ottawa: Minister of Health, 2007.
Note: Table adapted from the Program Performance Measures.

[a] Tissue biopsy does not include fine needle aspiration (FNA).
[b] Open surgical biopsy includes cases that went directly to an open surgical biopsy as their primary diagnostic assessment and those who underwent an inconclusive or incorrect core biopsy prior to a definitive diagnosis by open surgical biopsy.
[c] Calculated based on all women screened from 2000-2001 who developed a post-screen cancer during 2000-2003. Non-compliant cancers were not included in this calculation. Post-screen cancers include all invasive cancers diagnosed after a normal program screen (not referred) or screen detected (referred) cancers that took >6 months to diagnosis (beyond the 'normal screening episode'). Post-screen cancers do not include cases referred for diagnostic follow-up with a benign result (calculation includes those missed at screening and excludes those missed at diagnosis).

2003 AND 2004 RESULTS

This report presents statistics for the 2003 and 2004 calendar years using data submitted up to August 2007. Further, the outcomes presented in this report are based on the 2007 report by the Evaluation Indicators Working Group (6). Some outcomes are based on a relatively small number of events but are included to accurately reflect the work of the Evaluation Indicators Working Group (for example: benign to malignant open surgical biopsy ratio). In these cases, sample size is presented. Data submission is staggered and may impact the completeness of cancer-related data for some programs. Unless otherwise noted, the summary statistics include data from all 10 provinces and apply to women aged 50 to 69. Importantly, the data from the Northwest Territories is only available for the 2004 reporting year and therefore tables requiring at least two years of data exclude this region.

Overall, 1,345,382 Canadian women between 50 and 69, and 1,723,690 women of all ages, received a screening mammogram through a Canadian organized screening program in 2003 and 2004.

Participation and Retention in Organized Screening Programs

Participation

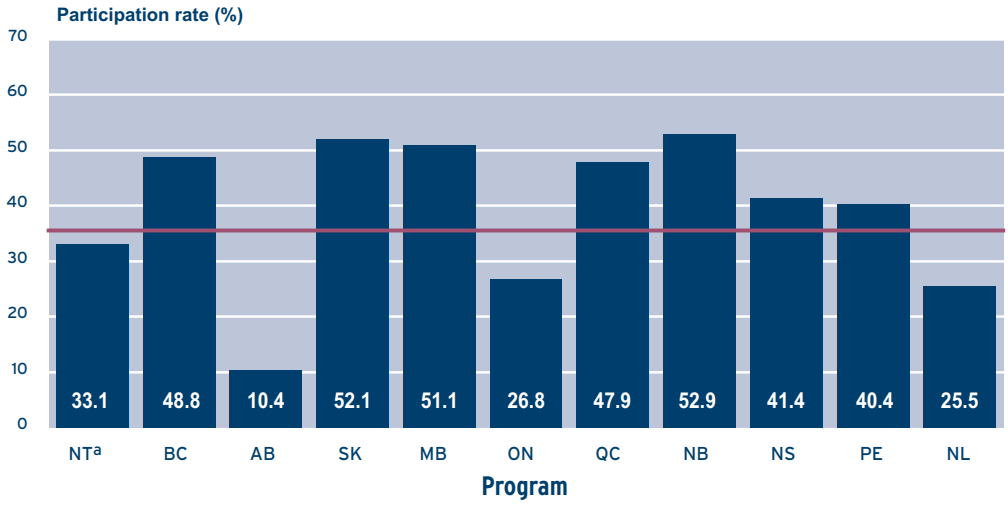
Adequate participation in breast cancer screening is essential for reductions in mortality to occur in the target population. Based on extrapolation from randomized controlled trials, Canadian programs have established 70% as the target participation rate.

Participation rates include all 10 provinces and data from the Northwest Territories for screening exams in the year 2004 only. Overall, 1,345,382 Canadian women between 50 and 69, and 1,723,690 women of all ages, received a screening mammogram through a Canadian organized screening program in 2003 and 2004 (Table 2). Since the inception of the first Canadian organized screening program in British Columbia, over 6.5 million screening mammograms have been performed. Although these numbers appear high, the targeted program participation rate of 70% among women 50 to 69 years for biennial screening is far from being reached through organized programs. In 2003 and 2004, only 36.5% of the target population received a screening mammogram through an organized program. This represents a small improvement from 2001 and 2002 when only 33.9% of eligible women attended. The participation rate varies between programs from 10.4% in Alberta to 52.9% in New Brunswick (Figure 3).

Overall, many well-established programs have seen participation rates stabilize since 1997 and 1998; British Columbia (46-51%), Alberta (10-15%), and Saskatchewan (52-55%). While programs in Nova Scotia (27-41%) and Ontario (13-27%) have continued to see participation rates increase. Newer programs in Québec (12-48%), New Brunswick (36-53%), and Newfoundland and Labrador (18-26%) have also seen increases in participation rates.

Importantly, these rates do not include women who receive their breast cancer screening outside of an organized program. Results from population health surveys suggest that close to 62% of women between 50 and 69 years received a screening mammogram within the past two years (Figure 4). This figure is self-reported and may be slightly inflated as survey respondents tend to overestimate desirable behaviours, however, it is more closely aligned with the target of 70% set by the Evaluation Indicators Working Group Report.

Figure 3 – Participation in organized breast cancer screening programs, women aged 50-69, 2003 and 2004 screen years



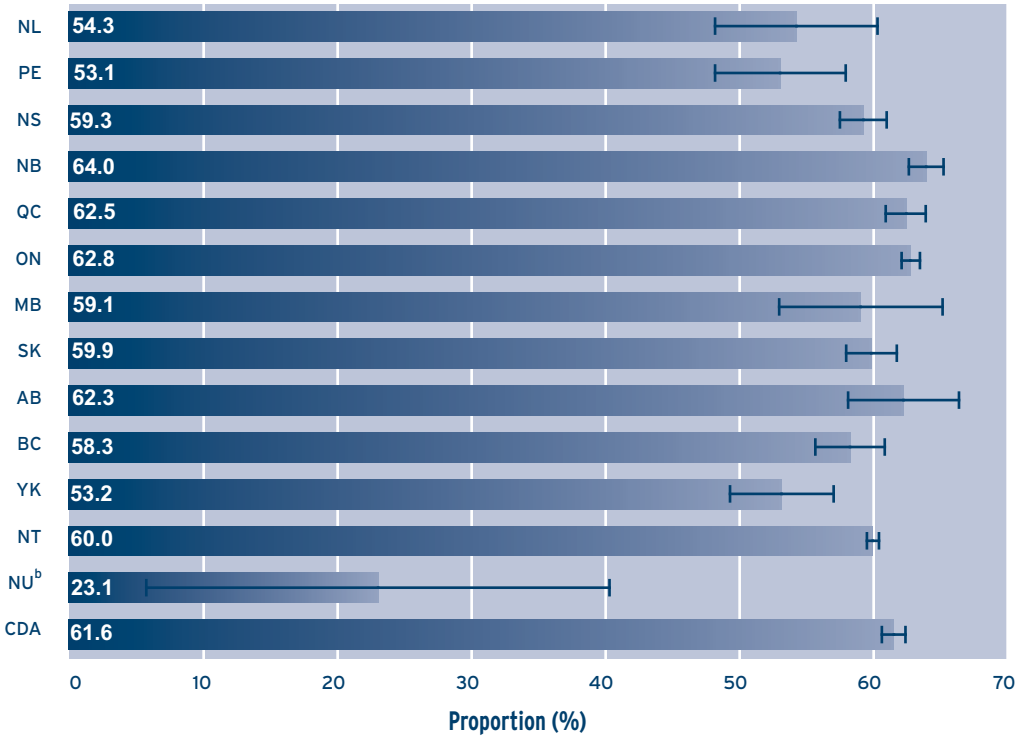
Source: Statistics Canada data for 2003 and 2004 are used for denominator values.
Notes: Population estimates are averaged.
The national participation rate of 36.5% is indicated by the horizontal bar.
[a]Northwest Territories (NT) rate is based on 2004 data only.

Retention

Optimal benefits from screening programs are achieved when regular participation in screening occurs. Two targets were set based on participation rates, sojourn time, screening interval studies and randomized controlled trials (7-9). The first, for women undergoing their initial screening mammogram, states that ≥75% of women should return within 30 months. The second states that ≥90% of women undergoing a subsequent screen should return within 30 months. Retention rate for women aged 50 to 69 excludes women who returned at age 70 years or older.

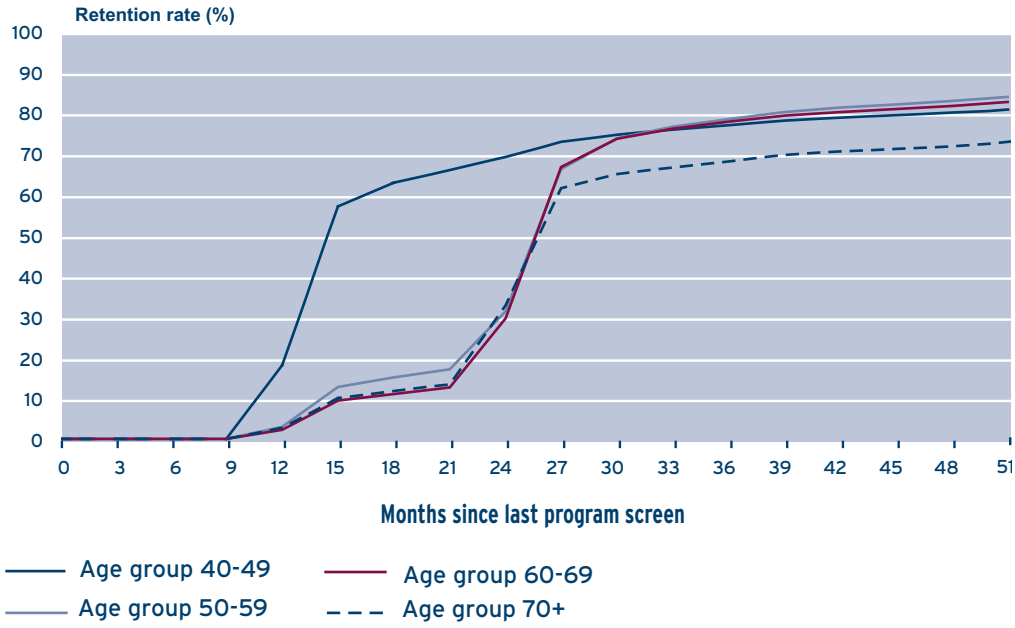
Overall, 74.3% of women aged 50 to 68 who received a screening mammogram between 2001 and 2002 were rescreened within 30 months during 2003 to 2004. Among women who received their first screening mammogram in the 2001 and 2002 calendar years, 64.9% returned for a subsequent mammogram within 30 months. Among women aged 50 to 68 who received a subsequent screening mammogram in the 2001 and 2002 calendar years, 76.8% returned for a subsequent mammogram within 30 months. (Table 6)

Figure 4 – Proportion of women aged 50-69 with a self-reported mammogram[a] in the past two years by province, 2005 Canadian Community Health Survey



[a] Diagnostic mammography excluded.
[b] The CCHS sampling frame covers 71% of the private households in Nunavut.
Source: Health Canada. 2005 Canadian Community Health Survey: share file.

Figure 5 – Cumulative probability of returning for a subsequent program screen by age group, 2000 and 2001 screen years



Note: Northwest Territories data are not included in this analysis.

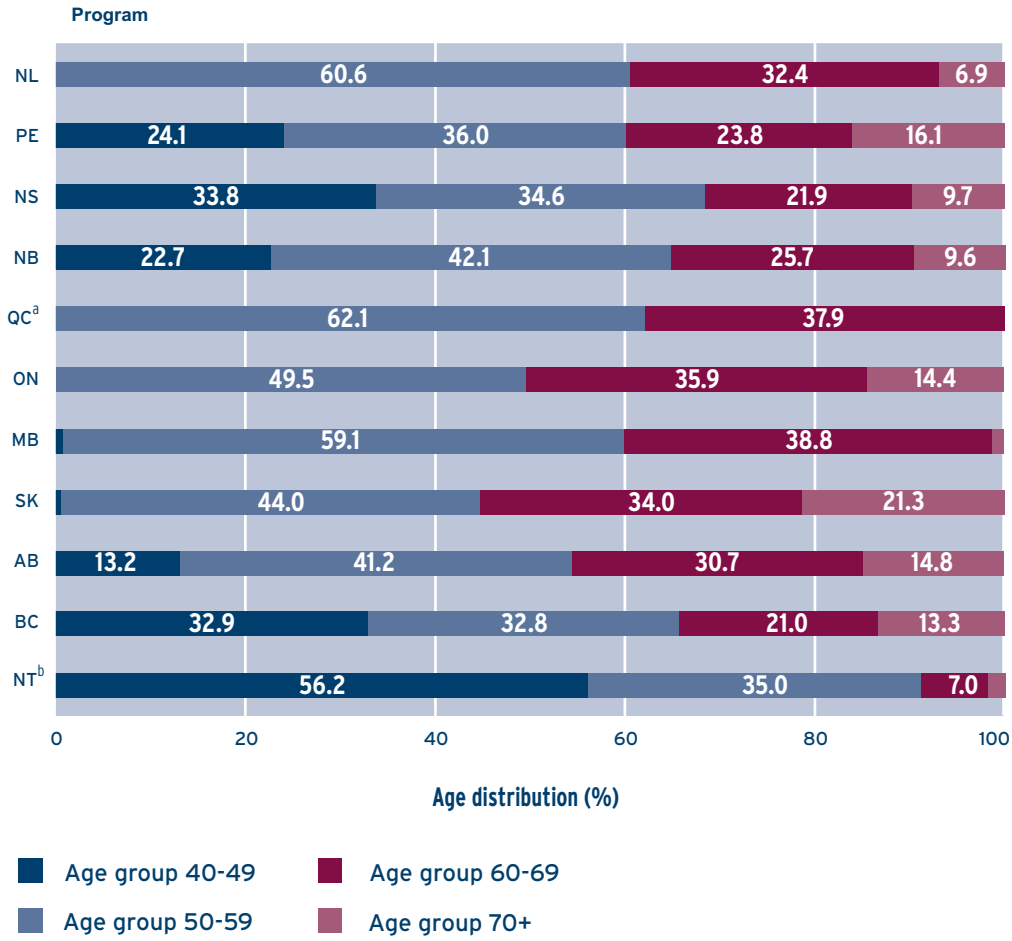
In general, younger women (40 to 49 years) were more likely to return for subsequent screening within 30 months compared to older women (70+ years) regardless of whether it was an initial (63.9% and 53.5% respectively) or subsequent screen (86.7% and 68.4% respectively) (Table 7). Most women returned for subsequent screening between 21 and 27 months after their 2001 to 2002 screen, however, women between age 40 and 49 were more likely than older women to return between 12 and 15 months (Figure 5).

Overall, 74.3% of women aged 50 to 68 who received a screening mammogram between 2001 and 2002 were rescreened within 30 months during 2003 to 2004.

Results of Screening

The goal of organized screening programs is to identify disease in asymptomatic women and at the same time minimize the number of healthy women who receive abnormal screening results. Both the abnormal call rate and the positive predictive value offer insight into the process of accurately identifying asymptomatic women with breast cancer.

Figure 6 – Age distribution of program screens by province, 2003 and 2004 screen years



[a] Although Québec 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.
[b] Data for Northwest Territories available only for year 2004.

Abnormal Call Rates

The abnormal call rate refers to the percentage of all women screened who are referred for further testing because of abnormalities found during the screening mammogram and is one way to measure of the quality of a screening program. The Canadian target is <10% for women undergoing their first screen and <5% of women undergoing their subsequent timely screens.

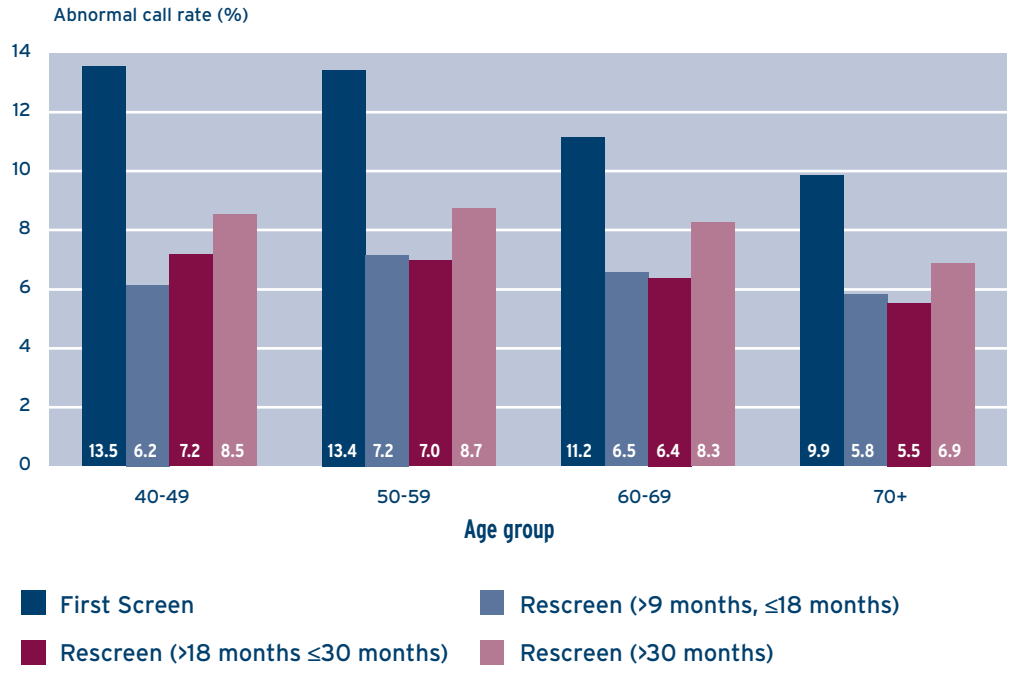
Among women 50 to 69 years, the abnormal call rate for women receiving their first screening mammogram is 12.1% and for a subsequent screening mammogram is 6.5% (Table 6). These rates have been relatively stable since 2001 and 2002. Radiologist inexperience and/or low reading volumes can contribute to unnecessarily high abnormal call rates, as can delays in rescreening. For all age groups, the abnormal call rate rises after a screening interval of 30 months indicating the importance of regular screening intervals (Figure 7).

Positive Predictive Value

The positive predictive value (PPV) is determined by the proportion of women with an abnormal call who go on to be diagnosed with invasive or in situ cancer. A high PPV reflects the minimization of unnecessary follow-up procedures. The Canadian target is ≥5% for first screens and ≥6% for subsequent timely screens.

Among women aged 50 to 69 years, and based on detection by mammography alone, the PPV meets these targets (5.0% and 7.3% for initial and subsequent screening mammograms respectively) and has been relatively stable since 2001. It is worth noting that PPV is sensitive to the age distribution of the screened population, which is among the reasons why the Canadian targets are only intended for women age 50 to 69. The PPV improves dramatically with age for it is as low as 2.3% for women between 40 and 49 years undergoing their initial screening mammogram and as high as 13.8% in the 70+ age group (Table 6-8).

Figure 7 – Abnormal call rate[a] by age group, 2003 and 2004 screen years



[a] Includes mammography and clinical breast examination as screening modalities. Northwest Territories data are not included in this analysis.

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 24.4 months;
Rescreen (>30 months) by 35.7 months.

Diagnostic Interventions

As suggested by the PPV, most women who receive abnormal screening results do not actually have breast cancer, however, additional assessment is required to determine the definitive diagnosis. The provision of timely, well coordinated, and minimized follow-up assessment has been shown to reduce fear and anxiety associated with abnormal results (10). Women who receive abnormal results require additional radiological or surgical assessment including diagnostic mammography, ultrasonography, core or open biopsy, and/or fine needle aspiration.

Analysis of diagnostic test type (Figure 8) includes all 10 provinces and data from the Northwest Territories for screening exams in the year 2004 only. In 2003 and 2004, approximately three quarters of women who received an abnormal screen were followed-up with additional breast imaging only. A further 13% received breast imaging combined with core biopsy or fine needle aspiration; an increase from 9.3% in 2001 and 2002 (Figure 8). Lastly, there was a shift from the use of the more invasive open biopsy to the less invasive core biopsy from 2001 and 2002 to 2003 and 2004. Core biopsy increased from 9.6% (9,187 women) to 12.3% (13,648 women) and open biopsy decreased from 7.2% (6,874 women) to 5.6% (6,188 women) (Table 4).

Diagnostic Interval

The diagnostic interval is the duration of time from the abnormal screen to its resolution. Excessively long diagnostic intervals can have negative psychological impact and potentially worsen prognosis (10). The Canadian target is ≥90% of abnormal screens will be resolved with 5 weeks if no tissue biopsy is required and ≥90% within 7 weeks if tissue biopsy is required.

Nationally, 74.3% of women not requiring a tissue biopsy received resolution within five weeks and 46.3% of women requiring tissue biopsy received resolution within seven weeks. The proportion of women who did not require tissue biopsy and received resolution within five weeks has been showing gradual annual improvement, however, the proportion of women requiring tissue biopsy who received resolution within seven weeks has been relatively stable over time (Table 6-8).

Table 4 – Diagnostic procedures after an abnormal screen, women aged 50-69, 2003 and 2004 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])		Number[a] (%[b])		Number[a] (%[b])		Number[a] (%[b])	
Diagnostic mammogram	82,019 (50.8 - 90.7)	(74.1)	79,639	(79.3)	401	(5.5)	1,979	(65.0)
Ultrasound	59,651 (32.4 - 71.4)	(53.9)	53,207	(53.0)	4,235	(58.3)	2,209	(72.6)
Fine-needle aspiration	4,232 (0.4 - 6.7)	(3.8)	3,633	(3.6)	356	(4.9)	243	(8.0)
Core biopsy	13,648 (4.8 - 29.0)	(12.3)	12,759	(12.7)	184	(2.5)	705	(23.2)
Open biopsy with or without fine wire localization	6,188 (0.0 - 13.1)	(5.6)	5,659	(5.6)	294	(4.1)	235	(7.7)

[a] All provinces combined. Northwest Territories data not included due to small numbers.
[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.

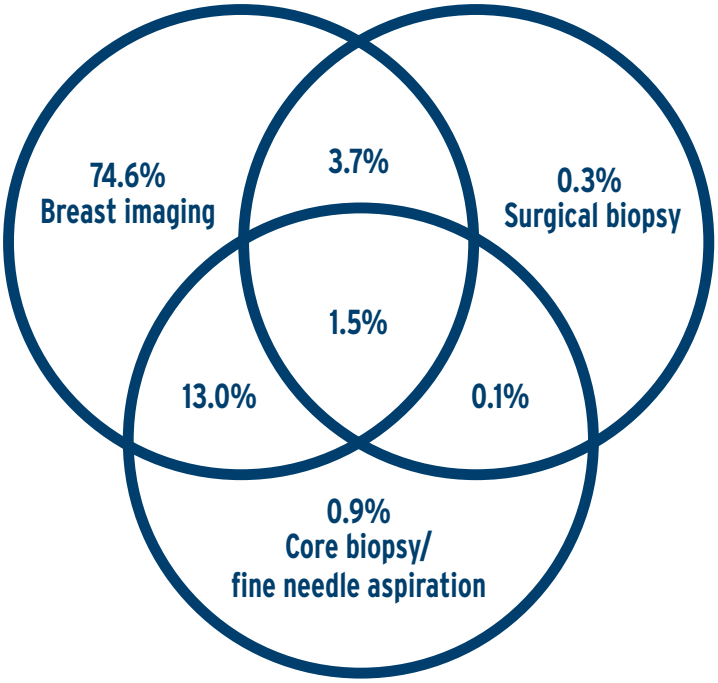
Benign to Malignant Open Surgical Biopsy Ratio[3]

High quality pre-surgical assessment reduces the number of women requiring invasive follow-up who ultimately have a normal or benign result. The ratio of benign results compared to malignant results after an open surgical biopsy is one way to assess the quality of the pre-surgical assessment. This includes women who went directly to an open surgical biopsy as their primary assessment and those who underwent an inconclusive core biopsy prior to a definitive diagnosis by open surgical biopsy. The target for this indicator is ≤1:1; for every malignant cancer detected there should be one or fewer benign results.

In 2003 and 2004, the ratio was 1.8:1, meaning that close to two benign results for every malignant cancer case were detected by open surgical biopsy. The ratio among women undergoing their initial mammogram was 2.6:1 while women undergoing a subsequent mammogram had a ratio of 1.6:1 (Table 6). This result varies by the age of the women. Women 70 years and older undergoing a subsequent mammogram had the best ratio (0.9:1) while women between 40 and 49 years undergoing their first mammogram had the poorest ratio (5.6:1) (Table 7).

3 Québec calculates the benign to malignant open biopsy ratio using a different method. Canada total excludes Québec data.

Figure 8 – Combinations of diagnostic procedures after an abnormal screen, women aged 50-69, 2003 and 2004 screen years



5.9% of women had none of the above procedures[a].

[a] For women who had none of the above procedures, 93.8% were referred based on an abnormal clinical breast examination (CBE) and may have had their final diagnosis established by their primary care provider. Québec data included for all procedures but not calculated for CBE referral status.

Northwest Territories data are for 2004 only.

The benign to malignant open surgical biopsy ratio reflects the experience of very few women because there has been a substantial shift to core biopsy, and away from open surgical biopsy, as a means to achieve definitive diagnosis. As a result, the indicator is nearing the end of its usefulness as the declining numbers of procedures result in ratios that are difficult to interpret. The number of women undergoing this procedure is included in Table 6 to illustrate this point.

Benign Open Surgical Biopsy Rate

The rate of open surgical biopsy can provide an indication of the quality of pre-surgical assessment, however, no target as yet has been set for this indicator.

In 2003 and 2004, the benign open surgical biopsy rate was 4.5 and 2.6 per 1,000 screens (initial and subsequent screens respectively). The biopsy rate is lower among older women (70+ years) undergoing their first screening mammogram compared to younger women, however, rates among women undergoing

subsequent screening mammograms shows little variation by age group. Since 2000, the rate has decreased for both initial and subsequent screening mammograms suggesting a shift away from the use of open surgical biopsy (Table 6-8).

Benign to Malignant Core Biopsy Ratio

The ratio of benign to malignant core biopsies, can provide an indication of the quality of pre-surgical assessment, however, no target as yet has been set for this indicator.

In 2003 and 2004, the benign to malignant core biopsy ratio was 2.8:1 for initial screens and 1.5:1 for subsequent screens, and is lowest in older women (70+ years). For women undergoing their first screen the ratio has decreased to 2.8:1 from 3.3:1 since 2000, however, for women undergoing subsequent screens the value has been relatively stable between 1.4 and 1.6:1 (Table 6-8).

Benign Core Biopsy Rate

The rate of benign core biopsy can provide an indication of the quality of pre-surgical assessment, however, no target has been set for this indicator.

In 2003 and 2004, the benign core biopsy rate was 11.6 and 4.7 per 1,000 screens (initial and subsequent screens respectively). The biopsy rate is lowest among older women (70+ years) undergoing subsequent screens. Since 2000, the rate has increased for both initial and subsequent screening mammograms suggesting a shift toward the use of core biopsy (Table 6-8).

Cancer Detection

In total, 6,900 cancers (invasive, in situ and unclassified types combined) were detected among women aged 50 to 69 during 2003 and 2004 by organized screening programs (Table 6). Other breast cancers among Canadian women were detected by opportunistic screening (outside of an organized program) or when a woman became symptomatic of disease.

Among women ≥40 years, 79.7% (6,851 women) were diagnosed with invasive and 20.3% (1,747 women) with in situ cancers. This includes data from women diagnosed in the Northwest Territories during 2004. The proportion of cancers considered invasive increased with age; 70.8% of women aged 40 to 49 were diagnosed with invasive cancers compared to 85.3% of women 70 or more years (Table 5).

Invasive Cancer Detection Rate

6,900 cancers (invasive, in situ and unclassified types combined) were detected among women aged 50 to 69 during 2003 and 2004 by organized screening programs.

The targets for invasive cancer detection rates established in Canada are >5 per 1,000 first screens and >3 per 1,000 subsequent timely screens.

In Canada, women undergoing their first screen had an invasive cancer detection rate of 4.7 cases per 1,000 screens. Women undergoing subsequent screens had an invasive cancer detection rate of 3.7 cases per 1,000 screens[4] (Table 6). As anticipated, the invasive cancer detection rate increased in older women and when subsequent screening was not timely (Figure 9).

In Situ Cancer Detection Rate

Ductal carcinoma in situ (DCIS) is a form of cancer detected through mammography screening, however, there is limited evidence supporting the transition of all forms of DCIS to invasive cancer. Because of this, no target has been set for in situ cancer detection rates in Canada. Despite this, it is important to monitor rates of detection until appropriate targets can be set.

In Canada, women undergoing their first screen had a DCIS detection rate of 1.3 cases per 1,000 screens. Women undergoing subsequent screens had a DCIS detection rate of 1.0 case per 1,000 screens[4] (Table 6).

[4] Refers to all women, including those who may have returned late (≥ 30 months) from their previous mammogram.

Table 5 – Characteristics of screen-detected cancers by age group, 2003 and 2004 screen years

	Age group									
	40-49		50-59		60-69		70+		All ages	
	n	%	n	%	n	%	n	%	n	%
Number of cancers[a]										
Invasive	312	70.8	2,758	77.7	2,673	80.8	1,108	85.3	6,851	79.7
DCIS	129	29.3	790	22.3	637	19.2	191	14.7	1,747	20.3
TNM staging										
0 (in situ)	129	29.9	790	33.5	637	28.7	191	16.4	1,747	28.3
I	172	39.9	970	41.2	1,034	46.6	713	61.4	2,889	46.8
II	119	27.6	544	23.1	502	22.6	218	18.8	1,383	22.4
III / IV	11	2.6	52	2.2	45	2.0	40	3.4	148	2.4
Invasive (TNM stage missing)[b]	11		1,215		1,105		134		2,465	
Tumour size[c]										
> 0 to < 2 mm	9	3.0	69	2.7	61	2.5	24	2.4	163	2.6
2 to 5 mm	21	7.0	215	8.6	191	7.8	74	7.5	501	8.0
6 to 10 mm	60	19.9	619	24.7	647	26.5	303	30.8	1,629	26.1
11 to 15 mm	87	28.9	684	27.3	724	29.6	260	26.4	1,755	28.1
16 to 20 mm	45	15.0	388	15.5	398	16.3	157	16.0	988	15.8
≥ 21 mm	79	26.2	535	21.3	422	17.3	166	16.9	1,202	19.3
Size unknown[d]	11		248		230		124		613	
Median tumour size (mm)	14.0		14.0		13.0		12.0		13.0	
Positive nodes[c]										
0	194	70.5	1,819	74.6	1,751	75.3	750	83.6	4,514	76.1
1 to 3	61	22.2	441	18.1	451	19.4	110	12.3	1,063	17.9
4+	20	7.3	177	7.3	122	5.2	37	4.1	356	6.0
Number unknown[efg]	37		321		349		211		918	

[a] Unclassified cancers are not included in this analysis.
[b] Quebec and Prince Edward Island do not provide TNM staging and account for 80.1% and 2.6% of all cases in this category respectively.
[c] Saskatchewan and Prince Edward Island do not provide tumour size and account for 51.3% and 10.3% of all cases in this category respectively.
[d] This analysis includes invasive cancers only.
[e] Includes missing values (5.9%) and cases in which dissection was not done (1.6%) .
[f] New Brunswick has 27.5% pathologically positive nodes but nodal distribution is not provided. New Brunswick accounts for 28.1% of all cases in this category.
[g] Prince Edward Island does not provide number of positive nodes and accounts for 6.9% of all cases in this category.

Note: Northwest Territories data are for 2004 only.

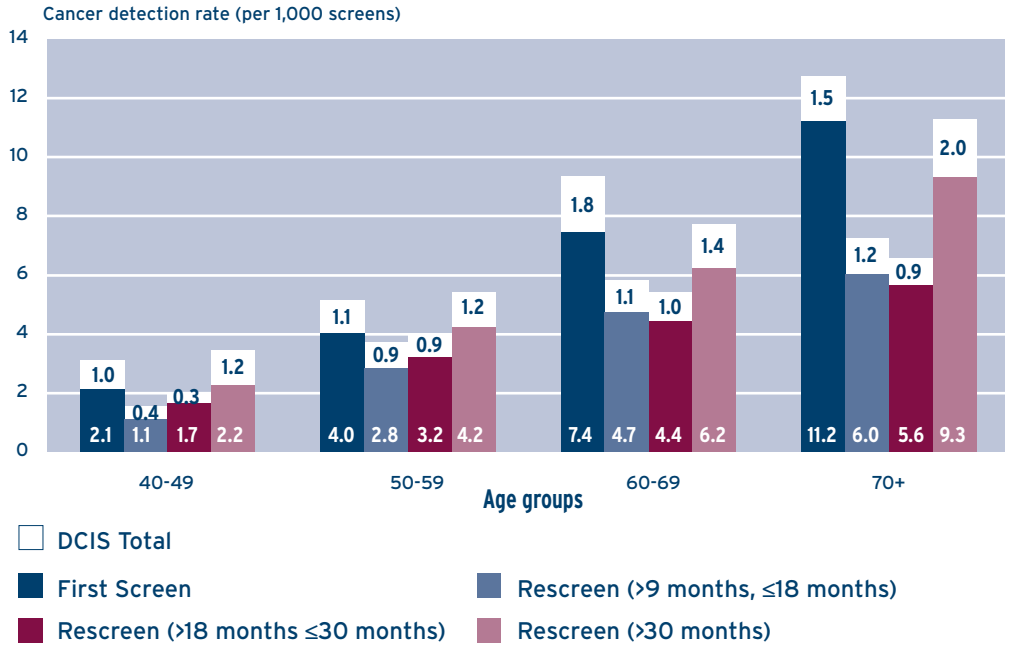
Invasive Tumour Size and Node Negative Rate

Cancer detected at earlier stages has more treatment options, less recurrence, and improved survival. Research in Canada has shown that 97.9% of women with stage I breast cancer survive at least five years while only 27.9% of women diagnosed in stage IV survive for five years (11). Early stage cancer has smaller tumours and no lymph node involvement. Based on size of tumour, the Canadian target is for greater than 25% of invasive tumours to be ≤10mm and greater than 50% of invasive tumours to be ≤15mm. The second target is for >70% of women with invasive cancer to have no lymph node involvement.

Analysis of cancer stage (Table 5) includes all 10 provinces and data from 2004 screening exams in the Northwest Territories. Among women aged ≥40 years, diagnosed with breast cancer in 2003 and 2004, 46.8% of tumours were classified as stage I and fewer than three percent were classified as stage III/IV (Table 5). The proportion of women with DCIS (stage 0) detected decreased with age while the proportion with stage I invasive cancer increased with age. Stage II – IV invasive cancer stayed relatively stable across age groups.

Accordingly, the proportion of invasive tumours less than 10 mm was 36.4% and almost three quarters of women had negative lymph nodes at diagnosis (Table 6). A larger proportion of older women had smaller tumours at diagnosis and negative lymph nodes at diagnosis compared to younger women (Table 7).

Figure 9 – Cancer detection (Invasive and In situ) rate per 1,000 screens by age group, 2003 and 2004 screen years



Notes: The shaded area indicates the rate of invasive cancers detected, while the non-shaded area indicates the rate of DCIS cancers detected.
Northwest Territories data are not included in this analysis.

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 24.4 months;
Rescreen (>30 months) by 35.7 months.

Post-screen Cancers

Post-screen cancers are those cancers that develop after a normal screening mammogram but before the next screen and serve as an indicator of the sensitivity of the screening program. Post-screen cancers can include cancers that occur after the recommended 12 or 24 months in women who do not return for their regular annual or biennial screen respectively (non-compliant cancers) or women who become symptomatic before their next regular screen (interval cancers). These cancers do not include cases referred for diagnostic follow-up with a benign result. Post-screen cancers were calculated based on all women screened from 2000 to 2001 who developed an interval cancer during 2000 to 2003. Non-compliant cancers were not included in this calculation. In order to ensure consistency between provinces this report also considers interval cancers to include those detected by a screening mammogram that have taken longer than six months to diagnosis. The target is for less than 6 women per 10,000 person years be diagnosed with a post screen cancer within 12 months of screening and less than 12 women per 10,000 person years within 24 months.

Nationally, the post-screen cancer detection rate was 5.4 per 10,000 person years within 12 months and 7.9 per 10,000 person years within 24 months (Table 6).

Table 6 – Performance measures by program, women aged 50-69, 2003 and 2004 screen years

Indicator	Target[a]	Program										
		BC	AB	SK	MB[b]	ON[b]	QC	NB	NS[c]	PE[d]	NL[b]	Canada
Number of screens	N/A[e]	242,835	32,319	55,722	62,648	393,415	428,637	50,169	52,966	7,266	19,405	1,345,382
Number of first screens	N/A[e]	18,648	7,323	8,725	13,484	122,309	127,756	6,165	11,950	622	4,324	321,306
Number of cancers[f]	N/A[e]	1,094	168	280	328	1,914	2,510	231	233	37	105	6,900
Participation rate (%)	≥70	48.8	10.4	52.1	51.1	26.8	47.9	52.9	41.4	40.4	25.5	36.5
Retention rate (% initial rescreen within 30 months)[gh]	≥75	55.9	51.9	68.0	63.3	74.3	62.7	56.5	62.4	71.2	71.9	64.9
Retention rate (% subsequent rescreen within 30 months)[gh]	≥90	76.4	69.5	77.2	75.6	80.6	74.3	73.2	77.6	83.7	82.3	76.8
Abnormal call rate (%)												
Abnormal by mammography[i]												
Initial screen	<10	15.4	6.3	16.5	9.4	10.2	14.2	13.3	7.5	16.7	11.6	12.1
Rescreen	<5	5.8	3.3	6.5	4.8	6.0	8.1	7.2	4.2	11.0	6.2	6.5
Abnormal by any mode of detection												
Initial screen	<10	15.4	6.3	16.5	10.5	11.9	14.2	13.3	7.7	16.7	16.8	12.9
Rescreen	<5	5.8	3.3	6.5	5.6	7.6	8.1	7.2	4.3	11.0	10.6	7.0
Invasive cancer detection rate (per 1,000 screens)												
Detected by mammography[i]												
Initial screen	>5	5.4	4.2	2.3	5.3	4.5	5.0	4.7	4.7	9.6	4.9	4.7
Rescreen	>3	3.2	4.6	4.2	3.7	3.5	4.3	3.5	3.0	4.4	3.6	3.7
Detected by any mode of detection												
Initial screen	>5	5.4	4.2	2.3	5.5	4.7	5.0	4.7	4.7	9.6	5.1	4.8
Rescreen	>3	3.2	4.6	4.2	3.8	3.7	4.3	3.5	3.0	4.4	3.6	3.8

Table 6 – Performance measures by program, women aged 50-69, 2003 and 2004 screen years (con't)

Indicator	Target[a]	Program										
		BC	AB	SK	MB[b]	ON[b]	QC	NB	NS[c]	PE[d]	NL[b]	Canada
In situ cancer detection rate (per 1,000 screens)												
Initial screen	N/A[e]	1.8	0.4	2.2	0.7	1.1	1.4	0.6	1.3	1.6	1.9	1.3
Rescreen	N/A[e]	1.1	0.8	0.9	1.1	0.7	1.2	1.0	1.0	0.2	1.3	1.0
Diagnostic interval (%)[j]												
Completed with no tissue biopsy, within 5 weeks	≥ 90	71.1	60.8	62.4	76.8	81.0	71.5	78.0	78.4	56.2	58.2	74.3
Completed with tissue biopsy, within 7 weeks	≥ 90	43.6	59.1	24.9	39.6	52.2	45.7	39.9	63.4	46.3	24.8	46.3
Positive predictive value (%)[f]												
Detected by mammography[i]												
Initial screen	≥5	5.0	7.3	2.8	6.4	5.5	4.7	4.0	7.9	7.1	5.6	5.0
Rescreen	≥6	7.5	16.1	7.9	10.0	7.1	6.9	6.3	9.3	4.4	8.0	7.3
Detected by any mode of detection												
Initial screen	≥5	5.0	7.3	2.8	5.9	4.8	4.7	4.0	7.7	7.1	4.1	4.8
Rescreen	≥6	7.5	16.1	7.9	8.8	5.9	6.9	6.3	9.2	4.4	4.7	6.9
Benign open surgical biopsy (per 1,000 screens)[k]												
Initial screen	N/A[e]	9.0	1.8	13.2	4.7	3.8	4.2	7.3	1.8	0.0	9.3	4.5
Rescreen	N/A[e]	3.7	0.6	4.8	1.7	2.3	2.0	3.1	0.7	0.0	6.2	2.6
Benign to malignant open surgical biopsy ratio[kl]												
Initial screen	≤ 1:1	2.3 : 1	13.0 : 1	3.5 : 1	4.5 : 1	2.6 : 1	N/A[l]	2.0 : 1	1.4 : 1	N/A[m]	2.0 : 1	2.6 : 1
Total open biopsies (benign + malignant)		n = 240	n = 14	n = 148	n = 77	n = 641	N/A[l]	n = 67	n = 36	n = 0	n = 60	n = 1,283
Rescreen	≤ 1:1	1.6 : 1	0.9 : 1	1.5 : 1	1.8 : 1	1.7 : 1	N/A[l]	1.1 : 1	2.0 : 1	N/A[m]	2.2 : 1	1.6 : 1
Total open biopsies (benign + malignant)		n = 1,360	n = 29	n = 372	n = 127	n = 989	N/A[l]	n = 253	n = 45	n = 0	n = 136	n = 3,311
Benign core biopsy rate (per 1,000 screens)												
Initial screen	N/A[e]	7.8	9.6	4.6	10.6	7.7	16.6	7.1	16.1	14.5	4.9	11.6
Rescreen	N/A[e]	2.0	3.0	0.8	4.0	4.1	8.0	3.2	7.6	8.7	3.1	4.7

Table 6 – Performance measures by program, women aged 50-69, 2003 and 2004 screen years (con't)

Indicator	Target[a]	Program										
		BC	AB	SK	MB[b]	ON[b]	QC	NB	NS[c]	PE[d]	NL[b]	Canada
Benign to malignant core biopsy ratio												
Initial screen	N/A[e]	2.5 : 1	2.1 : 1	2.7 : 1	2.1 : 1	1.9 : 1	3.5 : 1	4.9 : 1	3.5 : 1	1.5 : 1	2.3 : 1	2.8 : 1
Rescreen	N/A[e]	1.0 : 1	0.6 : 1	0.4 : 1	1.0 : 1	1.4 : 1	1.8 : 1	1.8 : 1	2.1 : 1	4.8 : 1	1.6 : 1	1.5 : 1
Invasive cancer tumour size (%)[mno]												
≤10 mm	>25	37.3	28.5	N/A[o]	28.4	35.0	39.0	28.4	35.0	N/A[o]	34.2	36.4
≤15 mm	>50	64.9	59.7	N/A[o]	63.2	61.4	68.8	56.3	65.5	N/A[o]	63.2	64.8
Node negative rate in cases of invasive cancer (%)[mnpq]	>70	75.6	73.3	80.2	75.7	75.1	74.0	69.4	77.1	N/A[q]	77.9	74.8
Post-screen detected invasive cancer rate (per 10,000 person-years)[grs]												
Within 12 months	<6	6.2	6.6	N/A[r]	3.3	4.8	N/A[r]	7.4	N/A[r]	N/A[r]	3.0	5.4
Within 24 months	<12	8.6	8.9	N/A[r]	6.9	7.1	N/A[r]	10.3	N/A[r]	N/A[r]	5.3	7.9

[a] Targets apply to women aged 50-69 years.
[b] Screening visit includes mammography and complete clinical breast examination (CBE).
[c] Screening visit includes mammography and modified CBE by technician.
[d] Screening visit includes modified CBE by technician, with all referrals based on mammography.
[e] Surveillance and monitoring purposes only.
[f] Includes invasive, in situ, and unclassified cancers.
[g] Data for 2000 and 2001 screen years are used.
[h] Retention rate for women aged 50-69 excludes women who returned at age 70 years or older.
[i] Independent of CBE or its findings.
[j] Tissue biopsy does not include fine needle aspiration (FNA). Time to diagnosis is based on the date of the first pathological biopsy result of breast cancer (excludes FNA and all inconclusive or incorrect procedures) or the date of the last benign test or pathological biopsy.
[k] Includes direct to open surgical biopsy diagnosis and cases who underwent an inconclusive or incorrect core biopsy prior to a definitive diagnosis by open surgical biopsy.
[l] Québec calculates the benign to malignant open biopsy ratio using a different method. Canada total excludes Québec data.
[m] Ratio not applicable due to null values.
[n] 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.
[o] Saskatchewan and Prince Edward Island do not provide tumour size. Canada total excludes Saskatchewan and Prince Edward Island data.
[p] New Brunswick does not provide the number of pathologically positive nodes; rate is calculated based on N stage of disease data.
[q] Prince Edward Island does not provide number of pathologically positive nodes. Canada total excludes Prince Edward Island data.
[r] Data on out of program cancers are not available for analysis in the national database.
[s] Calculated based on all women screened from 2000-2001 who developed a post-screen cancer during 2000-2003. Non-compliant cancers were not included in this calculation. Post-screen cancers include all invasive cancers diagnosed after a normal program screen (not referred) or screen detected cancers (referred) that took >6 months to diagnosis (beyond the 'normal screening episode'). Post-screen cancers do not include cases referred for diagnostic follow-up with a benign result (calculation includes those missed at screening and excludes those missed at diagnosis). This calculation method has been updated from previous reports.
Note: Northwest Territories data not included due to small numbers (463 first screens among women aged 50-69 in 2004).

Table 7 – Performance measures by age group, 2003 and 2004 screen years

Indicator	Target[a]	Age group				
		40-49	50-59	60-69	70+	All ages
Number of screens	N/A[b]	207,262	810,367	535,015	168,701	1,721,345
Number of first screens	N/A[b]	62,239	245,424	75,882	18,351	401,896
Number of cancers[c]	N/A[b]	439	3,572	3,328	1,299	8,638
Participation rate (%)	≥70	6.2	36.1	36.7	8.7	19.9
Retention rate (% initial rescreen within 30 months)[de]	≥75	63.9	67.7	60.8	53.5	65.1
Retention rate (% subsequent rescreen within 30 months)[de]	≥90	86.7	81.4	72.7	68.4	79.2
Abnormal call rate (%)						
Abnormal by mammography[f]						
Initial screen	<10	13.4	12.6	10.5	9.0	12.2
Rescreen	<5	6.6	6.7	6.2	5.3	6.4
Abnormal by any mode of detection						
Initial screen	<10	13.5	13.4	11.2	9.9	12.9
Rescreen	<5	6.6	7.3	6.7	5.8	6.8
Invasive cancer detection rate (per 1,000 screens)						
Detected by mammography[f]						
Initial screen	>5	2.1	3.9	7.4	10.8	4.6
Rescreen	>3	1.2	3.1	4.5	5.9	3.7
Detected by any mode of detection						
Initial screen	>5	2.1	4.0	7.4	11.2	4.7
Rescreen	>3	1.2	3.1	4.6	6.0	3.8
In situ cancer detection rate (per 1,000 screens)						
Initial screen	N/A[b]	1.0	1.1	1.8	1.5	1.2
Rescreen	N/A[b]	0.5	0.9	1.1	1.1	0.9
Diagnostic interval (%)[g]						
Completed with no tissue biopsy, within 5 weeks	≥90	73.0	74.1	74.7	75.1	74.2
Completed with tissue biopsy, within 7 weeks	≥90	41.0	45.4	47.8	49.9	46.1
Positive predictive value (%)[c]						
Detected by mammography[f]						
Initial screen	≥5	2.3	4.0	8.9	13.8	4.9
Rescreen	≥6	2.6	6.0	9.1	13.4	7.4
Detected by any mode of detection						
Initial screen	≥5	2.3	3.9	8.4	13.0	4.7
Rescreen	≥6	2.6	5.6	8.5	12.3	6.9
Benign open surgical biopsy (per 1,000 screens)[h]						
Initial screen	N/A[b]	7.3	4.9	3.4	3.3	4.9
Rescreen	N/A[b]	2.7	2.6	2.6	2.6	2.6
Benign to malignant open biopsy ratio[hi]						
Initial screen	≤ 1:1	5.6 : 1	3.2 : 1	1.5 : 1	1.3 : 1	3.0 : 1
Rescreen	≤ 1:1	3.5 : 1	1.9 : 1	1.3 : 1	0.9 : 1	1.6 : 1
Benign core biopsy rate (per 1,000 screens)						
Initial screen	N/A[b]	10.1	12.3	9.3	5.9	11.1
Rescreen	N/A[b]	3.0	4.7	4.7	2.6	4.3

Table 7 – Performance measures by age group, 2003 and 2004 screen years (con't)

Indicator	Target[a]	Age group				
		40-49	50-59	60-69	70+	All ages
Benign to malignant core biopsy ratio						
Initial screen	N/A[b]	6.2 : 1	3.6 : 1	1.4 : 1	0.7 : 1	2.8 : 1
Rescreen	N/A[b]	3.4 : 1	1.7 : 1	1.3 : 1	0.7 : 1	1.4 : 1
Invasive cancer tumour size (%)[jk]						
≥10 mm	>25	30.0	35.9	36.8	40.6	36.7
≥15 mm	>50	59.0	63.2	66.4	67.1	64.9
Node negative rate in cases of invasive cancer (%)[jlm]	>70	69.9	74.5	75.0	83.8	75.9
Post-screen detected invasive cancer rate						
(per 10,000 person-years)[dno]						
Within 12 months	<6	4.7	5.9	4.7	5.0	5.2
Within 24 months	<12	6.6	8.1	7.7	8.6	7.9

[a] Targets apply to women aged 50-69 years.
[b] Surveillance and monitoring purposes only.
[c] Includes invasive, in situ, and unclassified cancers.
[d] Data for 2000 and 2001 screen years are used.
[e] Retention rate for women aged 50-69 excludes women who returned at age 70 years or older.
[f] Independent of clinical breast examination or its findings.
[g] Tissue biopsy does not include fine needle aspiration (FNA). Time to diagnosis is based on the date of the first pathological biopsy result of breast cancer (excludes FNA and all inconclusive or incorrect procedures) or the date of the last benign test or pathological biopsy.
[h] Includes direct to open surgical biopsy diagnosis and cases who underwent an inconclusive or incorrect core biopsy prior to a definitive diagnosis by open surgical biopsy.
[i] Québec calculates the benign to malignant open biopsy ratio using a different method. Canada total excludes Québec data.
[j] 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.
[k] Saskatchewan and Prince Edward Island do not provide tumour size. Canada total excludes Saskatchewan and Prince Edward Island data.
[l] New Brunswick does not provide the number of pathologically positive nodes; rate is calculated based on N stage of disease data.
[m] Prince Edward Island does not provide number of pathologically positive nodes. Canada total excludes Prince Edward Island data.
[n] Post-screen detected cancer rates are calculated with 2000 and 2001 data and include the following provinces: British Columbia, Alberta, Manitoba, Ontario, New Brunswick and Newfoundland.
[o] Calculated based on all women screened from 2000-2001 who developed a post-screen cancer during 2000-2003. Non-compliant cancers were not included in this calculation. Post-screen cancers include all invasive cancers diagnosed after a normal program screen (not referred) or screen detected cancers (referred) that took >6 months to diagnosis (beyond the 'normal screening episode'). Post-screen cancers do not include cases referred for diagnostic follow-up with a benign result (calculation includes those missed at screening and excludes those missed at diagnosis). This calculation method has been updated from previous reports.
Note: Northwest Territories data not included due to small numbers (1,103 first screens among women ≥40 years in 2004).

Table 8 – Performance measures by year, women aged 50-69

Indicator	Target[a]	Screen year				
		2000	2001	2002	2003	2004
Number of screens	N/A[b]	503,946	550,463	608,979	646,386	698,996
Number of first screens	N/A[b]	229,120	173,251	169,523	159,062	162,244
Number of cancers[cd]	N/A[b]	2,648	2,853	3,268	3,373	3,527
Participation rate[e]	≥70	30.3	31.9	33.9	35.4	36.5
Retention rate (% initial rescreen within 30 months)[f]	≥75	64.5	65.5	N/A[g]	N/A[g]	N/A[g]
Retention rate (% subsequent rescreen within 30 months)[f]	≥90	77.7	75.9	N/A[g]	N/A[g]	N/A[g]
Abnormal call rate (%)						
Abnormal by mammography[h]						
Initial screen	<10	11.4	12.3	11.8	12.0	12.3
Rescreen	<5	5.9	6.6	6.7	6.6	6.4
Abnormal by any mode of detection						
Initial screen	<10	12.1	13.4	12.7	12.8	13.0
Rescreen	<5	7.0	7.5	7.3	7.1	6.9
Invasive cancer detection rate (per 1,000 screens)[d]						
Detected by mammography[h]						
Initial screen	>5	4.8	4.7	5.0	5.0	4.5
Rescreen	>3	3.5	3.7	3.9	3.8	3.7
Detected by any mode of detection						
Initial screen	>5	4.9	4.8	5.1	5.0	4.6
Rescreen	>3	3.6	3.7	4.0	3.9	3.7
In situ cancer detection rate (per 1,000 screens)						
Initial screen	N/A[b]	1.2	1.3	1.1	1.2	1.3
Rescreen	N/A[b]	1.0	0.9	1.0	1.0	1.0
Diagnostic interval (%)[i]						
Completed with no tissue biopsy, within 5 weeks	≥90	70.3	69.7	73.0	74.7	74.0
Completed with tissue biopsy, within 7 weeks	≥90	47.0	45.8	47.1	46.1	46.5
Positive predictive value (%)[cd]						
Detected by mammography[h]						
Initial screen	≥5	5.3	5.0	5.2	5.2	4.8
Rescreen	≥6	7.5	7.1	7.5	7.3	7.4
Detected by any mode of detection						
Initial screen	≥5	5.1	4.6	4.9	5.0	4.6
Rescreen	≥6	6.5	6.3	6.9	6.8	6.9
Benign open surgical biopsy rate (per 1,000 screens)[dj]						
Initial screen	N/A[b]	4.9	4.7	4.6	4.6	4.5
Rescreen	N/A[b]	3.7	3.1	2.8	2.7	2.5

Table 8 – Performance measures by year, women aged 50-69 (con't)

Indicator	Target[a]	Screen year				
		2000	2001	2002	2003	2004
Benign to malignant open biopsy ratio[djk]						
Initial screen	≤ 1:1	2.2 : 1	2.3 : 1	2.3 : 1	2.6 : 1	2.7 : 1
Rescreen	≤ 1:1	1.5 : 1	1.5 : 1	1.4 : 1	1.6 : 1	1.6 : 1
Benign core biopsy rate (per 1,000 screens)[d]						
Initial screen	N/A[b]	10.3	11.3	10.4	11.3	11.9
Rescreen	N/A[b]	2.5	3.8	4.0	4.6	4.8
Benign to malignant core biopsy ratio[d]						
Initial screen	N/A[b]	3.3 : 1	3.2 : 1	2.8 : 1	2.8 : 1	2.8 : 1
Rescreen	N/A[b]	1.4 : 1	1.6 : 1	1.4 : 1	1.5 : 1	1.5 : 1
Invasive cancer tumour size (%)[dlm]						
≥10 mm	>25	38.8	35.9	37.4	37.7	35.0
≥15 mm	>50	67.5	63.2	66.0	65.5	64.0
Node negative rate in cases of invasive cancer (%)[dlno]	>70	75.1	75.1	75.7	75.7	73.8
Post-screen detected invasive cancer rate (per 10,000 person-years)[dpq]						
Within 12 months	<6	5.7	5.1	N/A[g]	N/A[g]	N/A[g]
Within 24 months	<12	7.9	8.0	N/A[g]	N/A[g]	N/A[g]

[a] Targets apply to women aged 50-69 years
[b] Surveillance and monitoring purposes only.
[c] Includes invasive, in situ, and unclassified cancers.
[d] Screen detected invasive cancers have been updated for women screened in 2000 and 2001, to reflect the total exclusive of post-screen detected cancers.
[e] Participation rate was calculated in 2 year intervals due to biennial recall (Screen Years: 1999-2000, 2000-2001, 2001-2002, 2002-2003, 2003-2004).
[f] Retention rate for women aged 50-69 excludes women who returned at age 70 years or older.
[g] Insufficient time for follow-up to ensure data completeness.
[h] Independent of clinical breast examination or its findings.
[i] Tissue biopsy does not include fine needle aspiration (FNA). Time to diagnosis is based on the date of the first pathological biopsy result of breast cancer (excludes FNA and all inconclusive or incorrect procedures) or the date of the last benign test or pathological biopsy.
[j] Includes direct to open surgical biopsy diagnosis and cases who underwent an inconclusive or incorrect core biopsy prior to a definitive diagnosis by open surgical biopsy.
[k] Québec calculates the benign to malignant open biopsy ratio using a different method. Canada total excludes Québec data.
[l] Missing values are excluded from calculations. Expressed as a proportion of invasive cancers with complete data on tumour size or number of positive nodes.
[m] Saskatchewan and Prince Edward Island do not provide tumour size. Canada total excludes Saskatchewan and Prince Edward Island data.
[n] New Brunswick does not provide the number of pathologically positive nodes; rate is calculated based on N stage of disease data.
[o] Prince Edward Island does not provide number of pathologically positive nodes. Canada total excludes Prince Edward Island data.
[p] Post-screen detected cancer rates are calculated with 2000 and 2001 data and include the following provinces: British Columbia, Alberta, Manitoba, Ontario, New Brunswick and Newfoundland.
[q] Calculated based on all women screened from 2000-2001 who developed a post-screen cancer during 2000-2003. Non-compliant cancers were not included in this calculation. Post-screen cancers include all invasive cancers diagnosed after a normal program screen (not referred) or screen detected (referred) cancers that took >6 months to diagnosis (beyond the 'normal screening episode'). Post-screen cancers do not include cases referred for diagnostic follow-up with a benign result (calculation includes those missed at screening and excludes those missed at diagnosis). This calculation method has been updated from previous reports.

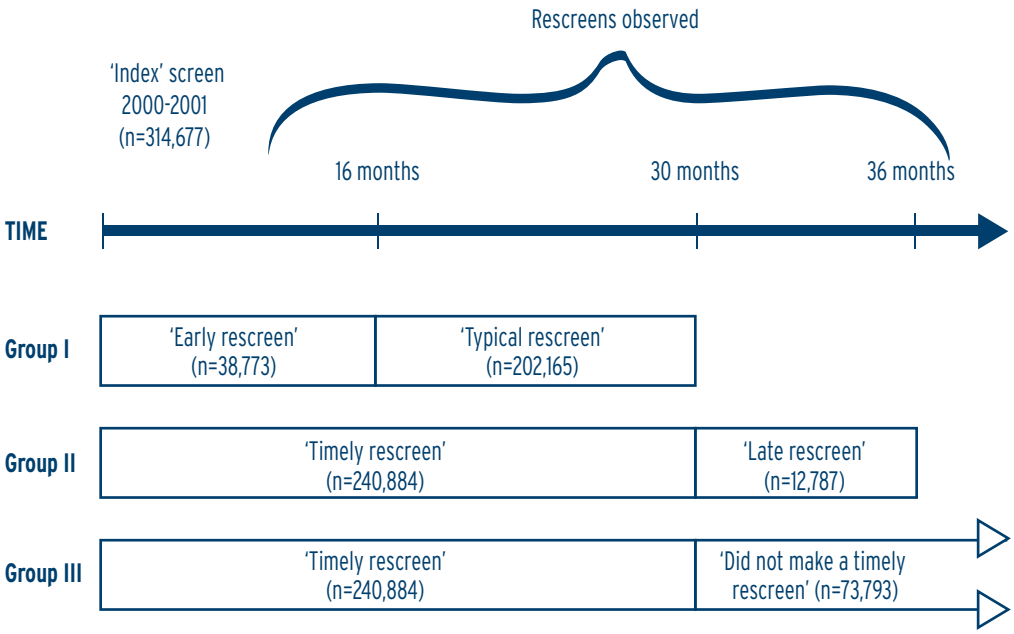
Notes: Data include all screens; figures have been updated and may vary slightly from previous reports.
Northwest Territories data not included due to small numbers (463 first screens among women aged 50-69 in 2004)

SPECIAL TOPIC: TIME INTERVALS BETWEEN SCREENING EVENTS

It is necessary for mammography to be repeated at regular intervals in order to maximize the benefits of participation in an organized breast cancer screening program (12). Yet the likelihood of returning to screening at a regular interval has been found to vary considerably across provincial programs (13). There are many factors that might influence the likelihood that a woman will make a timely return to screening, including demographic characteristics, the presence/absence of breast cancer risk factors, previous screening experiences such as false-positive screening test results, and provincial/territorial program factors such as re-invitation and appointment reminder systems. There may be complex relationships among these factors, with one factor influencing another possibly negating or amplifying its influence on rescreening behaviour. In order to simultaneously examine these influences, a series of three longitudinal multivariate analyses were developed.

A total of 314,677 women aged 50 to 68 years who underwent a screening mammogram in British Columbia, Alberta, Manitoba, New Brunswick, and Newfoundland and Labrador in the years 2000 or 2001 were followed for at least 36 months, and then categorized into a series of groups for analysis (Figure 10). Women who were diagnosed with breast cancer at the initial screen were not included in these analyses. With each rescreening grouping (i.e. Group I – women who were early to rescreen; Group II - women who were late to rescreen; and, Group III – women who did not make a timely rescreen) designated as a dependant variable, and the potentially confounding factors, including demographic characteristics, breast cancer risk factor profiles, previous screening experiences, and the provincial programs, treated as independent variables, a series of multivariate logistic regression analyses were conducted. This statistical technique estimates the unique influence of each independent variable while controlling for the competing influence of the other potentially confounding independent variables. The results of these analyses are expressed as 'odds ratios', with value 1.0 representing equal odds and larger or smaller numbers representing greater or lesser likelihood. The percentages of program participants with a given dependant variable characteristic in each rescreening grouping were also calculated (see Table 9).

Figure 10 – Sampling framework for screening interval categories



Demographics

Demographic characteristics including age, country of birth, urban/rural residence, and educational attainment did not contribute very substantially to the likelihood of when or whether women returned for screening (see Table 9). The contribution of these characteristics—whether they were associated with greater or lesser likelihood—was generally consistent, however, with some of the underlying risks often associated with demographic factors. For example, the increased risk of breast cancer associated with increasing age and Western lifestyles which may be more common among women born in Canada was associated with a modest increase in the odds of returning early (Odds $\text{Ratio}_{\text{adjusted}}$ (OR_{adj}) 1.2 (95% Confidence Interval (CI): 1.17 – 1.23), $p \leq 0.0001$). Being aware of one's risk of developing breast cancer, and the potential benefits of health protective behaviours such as screening tend to be associated with increasing levels of education. Increasing levels of education were associated with a lower likelihood of not making a timely return to screening (OR_{adj} 0.9 (CI: 0.87 – 0.92), $p \leq 0.0001$). Residing in a rural area is often associated with less convenient access to screening clinics. This can make timely rescreening more challenging, and this appears to be reflected by a slightly greater likelihood of not making a timely return to screening (OR_{adj} 1.1 (CI: 1.07 – 1.12), $p \leq 0.0001$)).

Previous Screening Experiences

Of women who attended breast cancer screening for their first time in 2000 or 2001, 39% did not make a timely return compared to 19% of women who had screening mammography on at least one prior occasion at the time of the 2000 or 2001 index screen (OR_{adj} 2.6 (CI: 2.57 - 2.68), $p \leq 0.0001$). This is consistent with previous reports (12) and underscores the importance of focusing attention on the retention of women undergoing first time screening (see Figure 11).

Table 9 – Factors associated with retention and screening intervals, including the odds (95% CI) of annual return, late return and failure to return (within 30 months)

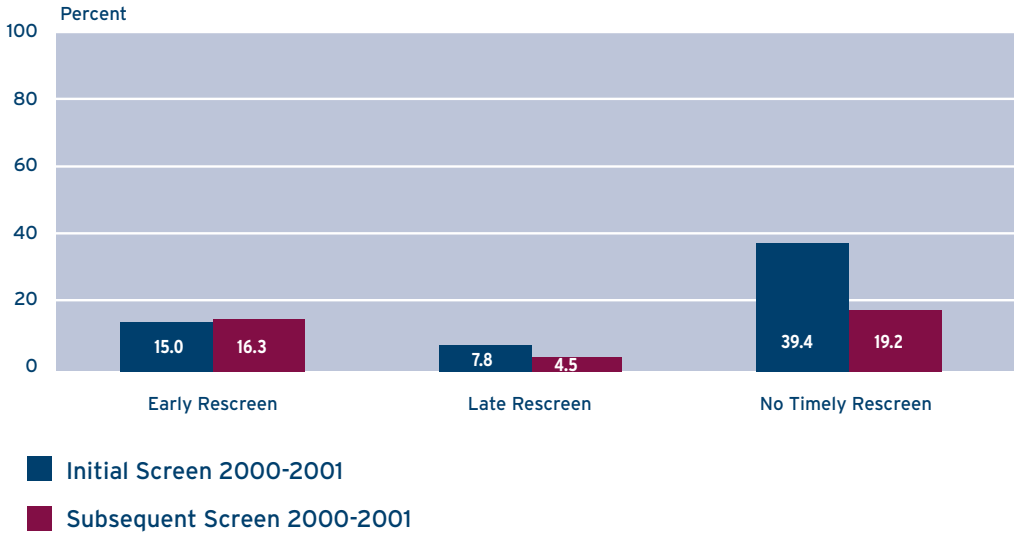
	Annual Return (<16 months) (n = 38,265)		Late Return (30 to 36 months) (n = 11,958)		Did not make a timely rescreen (within 30 months) (n = 75,522)	
	Percent	OR_{adj} (95% CI)[a]	Percent	OR_{adj} (95% CI)[a]	Percent	OR_{adj} (95% CI)[a]
Demographic Characteristics						
Age (Index Screen)						
50 to 54 years	17.2	1.0	5.7	1.0	25.9	1.0
55 to 59 years	15.8	0.9 (0.87 - 0.93)***	5.1	1.0 (0.91 - 1.00)*	22.8	‡
60 to 64 years	15.4	0.9 (0.89 - 0.94)***	4.5	0.8 (0.80 - 0.88)***	21.1	0.9 (0.86 - 0.90)***
65 to 68 years	14.8	0.9 (0.88 - 0.95)***	3.9	0.7 (0.69 - 0.79)***	21.6	0.9 (0.88 - 0.93)***
Born In Canada						
no	13.8	1.0	5.1	1.0	24.2	1.0
yes	17.4	1.2 (1.17 - 1.23)***	5.0	1.0 (1.00 - 1.09)*	23.0	‡
Residence						
urban	16.0	1.0	5.0	1.0	23.2	1.0
rural	16.4	1.1 (1.08 - 1.15)***	5.0	1.2 (1.10 - 1.22)***	24.9	1.1 (1.07 - 1.12)***
Education						
< high school	15.2	1.0	5.7	1.0	24.9	1.0
high school & some post	16.7	1.2 (1.15 - 1.21)***	4.6	‡	22.6	0.9 (0.91 - 0.94)***
university degree	16.3	1.2 (1.16 - 1.25)***	4.8	‡	22.4	0.9 (0.87 - 0.92)***
Breast Cancer Risk Factors						
Breast Density[b]						
low density	15.1	1.0	5.1	1.0	23.7	1.0
high density	20.4	1.3 (1.23 - 1.30)***	5.0	0.9 (0.86 - 0.95)***	22.5	0.9 (0.90 - 0.94)***
Family History of Breast Cancer						
no	14.2	1.0	5.1	1.0	23.9	1.0
yes	30.1	2.5 (2.46 - 2.60)***	4.3	0.8 (0.75 - 0.84)***	20.3	0.8 (0.77 - 0.81)***
Age at First Birth						
< 30 years	16.1	1.0	5.0	1.0	23.6	1.0
≥ 30 years	15.7	‡	5.0	‡	22.0	0.9 (0.87 - 0.93)***
Parity						
≥ one live birth	15.4	1.0	5.1	1.0	23.9	1.0
nulliparity	18.5	1.2 (1.16 - 1.23)***	4.9	0.9 (0.83 - 0.91)***	21.9	0.9 (0.87 - 0.91)***
Hormone Replacement Therapy (Index Screen)						
no current use	14.3	1.0	5.1	1.0	24.3	1.0
current use	19.4	1.4 (1.32 - 1.39)***	5.0	0.9 (0.90 - 0.97)**	21.9	0.9 (0.84 - 0.87)***
Menopausal Status (Index Screen)						
post-menopausal	16.0	1.0	5.0	1.0	22.9	1.0
pre-menopausal	16.8	1.1 (1.03 - 1.10)**	5.3	0.9 (0.90 - 0.99)*	26.0	‡

Table 9 – Factors associated with retention and screening intervals, including the odds (95% CI) of annual return, late return and failure to return (within 30 months) (con't)

	Annual Return (<16 months) (n = 38,265)		Late Return (30 to 36 months) (n = 11,958)		Did not make a timely rescreen (within 30 months) (n = 75,522)	
	Percent	OR_{adj} (95% CI)[a]	Percent	OR_{adj} (95% CI)[a]	Percent	OR_{adj} (95% CI)[a]
Past Screening Experiences						
Initial Screen (Index Screen)						
no	16.3	1.0	4.5	1.0	19.2	1.0
yes	15.0	0.8 (0.81 - 0.86)***	7.8	1.8 (1.69 - 1.85)***	39.4	2.6 (2.57 - 2.68)***
Previous False-Positive Screen						
no	15.5	1.0	4.9	1.0	22.5	1.0
yes	26.7	1.8 (1.77 - 1.92)***	6.9	1.3 (1.21 - 1.39)***	36.0	1.8 (1.75 - 1.86)***
Program-specific Factors						
Province						
British Columbia	15.8	1.0	5.0	1.0	22.1	1.0
Alberta	13.8	0.9 (0.84 - 0.92)***	2.4	0.4 (0.37 - 0.45)***	31.4	1.4 (1.32 - 1.40)***
Manitoba	11.1	0.8 (0.82 - 0.88)***	4.9	0.8 (0.75 - 0.84)***	22.5	0.8 (0.74 - 0.78)***
New Brunswick	19.3	1.2 (1.17 - 1.27)***	7.7	1.6 (1.51 - 1.67)***	27.3	1.2 (1.13 - 1.21)***
Newfoundland and Labrador	36.7	2.8 (2.64 - 2.90)***	4.7	0.8 (0.68 - 0.83)***	18.1	0.6 (0.54 - 0.60)***

[a] Obtained from multivariate logistic regression model.
[b] As measured by each provincial program. Excludes Manitoba.
‡ failed to remain statistically significant, not included in the final model.
* p<.05, ** p<.001, *** p≤.0001

Figure 11 – Effect of Initial versus Subsequent Screen on Retention and Screening Interval

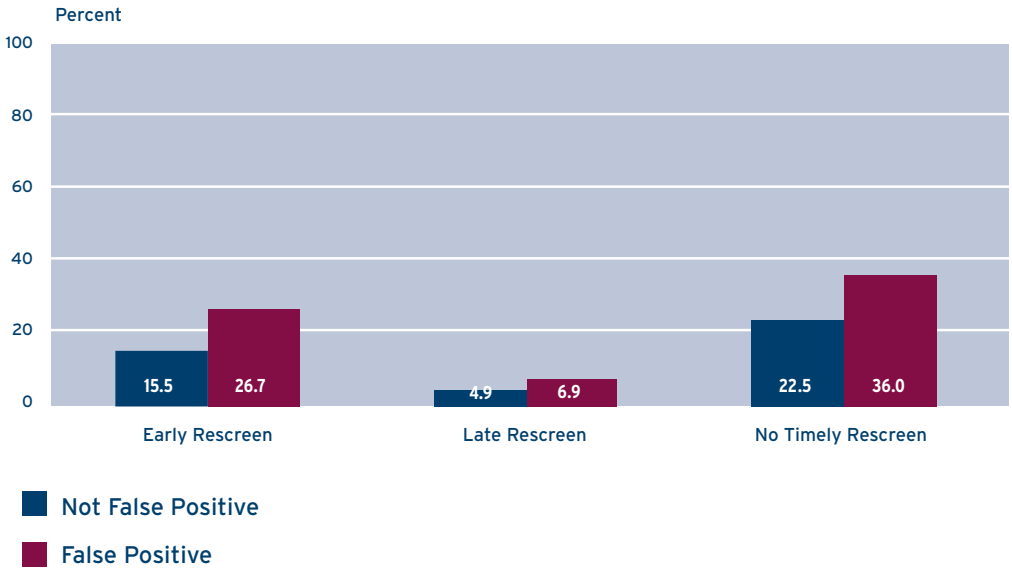


Among women who experienced a false-positive result in 2000 or 2001, 36% did not make a timely return compared to 23% of women who did not experience a false positive (OR_{adj}:1.8 (CI (1.75 - 1.86)), p≤0.0001). This is also consistent with previous reports (14). It is unclear whether this tendency not to make a timely return is a result of a negative experience with screening, the transfer of women into non-programmatic sector for ongoing care, or delays in returning to regular mammography due to ongoing clinical follow-up. The way in which a typical two-year screening interval is counted before returning to regular mammography may also have an impact (i.e., two years after the completion of follow-up vs. two years from the date of the original screen). Given that false positives in this context can be associated with biopsy and benign breast disease—both known breast cancer risk factors—this tendency toward not making a timely return warrants further investigation (15). Women who experienced false-positive results and made timely returns to screening were considerably more likely to have returned for rescreening within 16 months than those women who had not experienced false-positive results (26.7% versus 15.5% respectively—see Figure 12).

Breast Cancer Risk Factors

In general, women with breast cancer risk factors, including high breast density, current use of hormone replacement therapy (HRT), having a first child after age 30 or never having a baby (nulliparity) were more likely to make a return to screening within 30 months but the absolute differences between groups were small. As expected, women with a family history were considerably more likely to return early (within 16 months) for rescreening than women without a family history (OR_{adj}:2.5 (CI (2.46 - 2.60)), p≤0.0001). Women with a family history who did not return early were slightly less likely to return late, or not make a timely return, than women without a family history (Figure 13).

Figure 12 – Impact of False Positive on Retention and Screening Interval



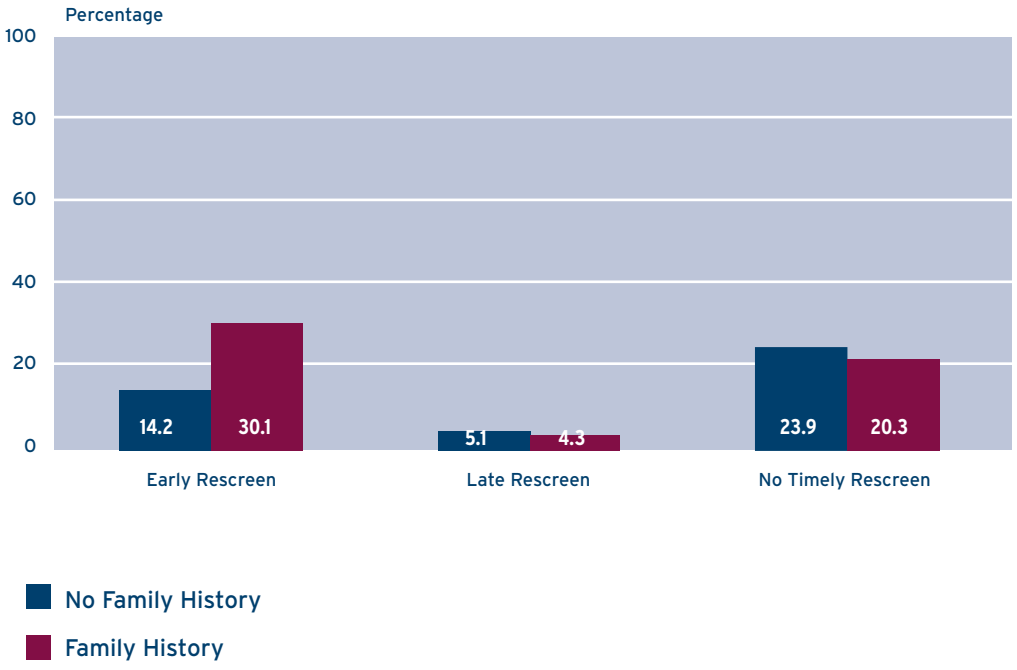
Program-specific factors

After controlling for variation in population demographics and breast cancer risk profile, there were still considerable differences among each of screening programs in terms of likelihood of women returning. In particular, women attending screening in Newfoundland and Labrador were most likely to return for early rescreening (OR_{adj}:2.8 (CI (2.64 - 2.90)), p≤0.0001) and least likely to not return within 30 months (OR_{adj}:0.6 (CI (0.54 - 0.60)), p≤0.0001). The inter-provincial program difference suggest that program capacity, program-specific participant retention strategies, and the availability of mammography from other sources which might draw women outside of the organized program settings—all factors that are unique to individual programs/provinces—would be worthy focal points for retention enhancement efforts.

Summary

This report suggests that among women using organized breast cancer screening services in Canada, most attend on a biennial basis (Main Report: Figure 5, Tables 6-8). These more detailed analyses show that several characteristics may explain some variation in retention and the interval associated with timely retention and early rescreening. These characteristics include: initial versus subsequent screen, previous false positive results, family history of breast cancer, and provincial screening programs. An examination of the associations between these characteristics and screening outcomes represents a worthwhile avenue for future analysis. Variation between provincial programs offers an opportunity to study the effect of differing recall policies on breast cancer detection, morbidity, and mortality, ultimately leading to effective screening policy across Canada.

Figure 13 – Impact of Family History of Breast Cancer on Retention and Screening Interval



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APPENDICES

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.

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Appendix 2: Database Technical Subcommittee

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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 invasive 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.

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 needle is inserted into a lesion and cells are drawn out using a syringe. The cells are stained and examined by a cytologist in a laboratory to determine if there are any malignant cells.

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 or ductal carcinoma in situ (DCIS) 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 abnormality under local anesthesia for subsequent microscopic examination by a pathologist.

Post-screen cancer
Cancers that occur after the recommended 12 or 24 months in women who do not return for their regular annual or biennial screen respectively (non-compliant cancers) or women who become symptomatic before their next regular screen (interval cancers).

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

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.

Rescreening
Subsequent screening, according to policy, after 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 the screening findings of the program.

Sojourn time
The time interval between the onset of detectable pre-clinical disease and symptomatic disease.

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

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