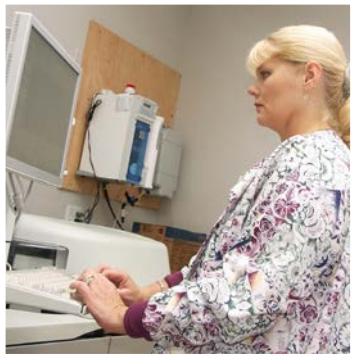
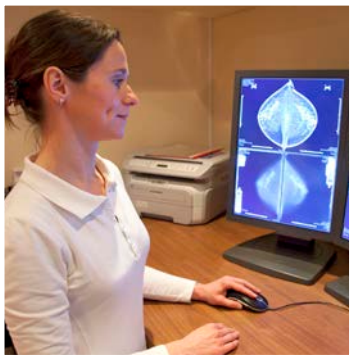


Breast Cancer Screening in Saskatchewan



25 Years of Saving Lives 1990-2015

SASKATCHEWAN CANCER AGENCY

SCREENING PROGRAM FOR BREAST CANCER

A PROGRAM OF THE SASKATCHEWAN CANCER AGENCY

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Foreword

Breast cancer is the most common type of cancer diagnosed and the second leading cause of death among Canadian women. In Saskatchewan approximately 750 new cases are diagnosed annually and an estimated 160 deaths occur from breast cancer.

In 1990, the Saskatchewan Cancer Agency took a significant step forward in cancer control with the start of the Screening Program for Breast Cancer. As the second province, following British Columbia, to implement a screening program, Saskatchewan was at the forefront of population-based screening. It is important to now look back and see how the program evolved and the impact on breast cancer in the province.

This report reflects 25 years of organized population-based breast screening in Saskatchewan. The information will help support the Cancer Agency to examine how the program is performing and to determine what enhancements are needed to make it more effective.

Early detection through population-based screening programs, combined with effective treatment offers the best opportunity to reduce mortality for women diagnosed with breast cancer. For the Cancer Agency this means that every woman screened is a potential life saved, and that is a significant goal to continue to work towards.

Kevin Wilson,
Vice President, Population Health, Quality and Research

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Acknowledgements

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Abbreviations

CPAC: Canadian Partnership Against Cancer

FFDM: Full Field Digital Mammography

IARC: International Agency for Research on Cancer

MGD: Mean glandular dose

PACS: Picture Archiving Communication System

PPV: Positive predictive value

PYLL: Person years of life lost

RIS: Radiology Information System

SCA: Saskatchewan Cancer Agency

SPBC: Screening Program for Breast Cancer

WHO: World Health Organization

Executive Summary

The Saskatchewan Cancer Agency's Screening Program for Breast Cancer is an organized population-based screening program for the early detection of breast cancer. Women 50 years of age and older are invited to participate. Following British Columbia, Saskatchewan started the screening program in mid-1990, with its first full year of operation in 1991. This report highlights program features and successes over a 25 year period (1990-2015). During this time, there has been a significant decrease in mortality that can be credited to both screening efforts and improved treatments.

The Saskatchewan program was set up with the following goals:

- Provide effective early detection of breast tumours
- Reduce breast cancer mortality and morbidity
- Encourage women to take an active role in their health
- Facilitate community-based care

Over the 25 years of the program we've provided:

Accessibility to services:

- Eligible women can book their screening appointment without a physician referral at all centres or on the mobile bus.
- Our client navigation program which began in 2006 has helped 14,330 clients with abnormal results through the diagnostic follow-up system reducing the time to resolution.

Screening capacity: We have provided 670,884 screens to 155,954 women from the 50-69 year old target population.

Early detection of tumours: Approximately 3,380 program-detected cancers were found. Cancers detected by the program were more likely to be at an earlier stage compared to those detected outside the program. Finding earlier stage cancers has contributed to decreased mortality.

Client satisfaction: Surveys show that our clients are overwhelmingly satisfied with program service delivery.

Some of the successes of the program include:

Improved coverage:

- The participation rate for women aged 50-69 has increased from 22 per cent in 1990-1991 to 40 per cent in 2014-2015.
- A high proportion of return clients after their first screen indicates a high level of satisfaction and engagement with the program.

Effective screening services: The program's effectiveness was demonstrated by high sensitivity, specificity and positive predictive values. In 2015, overall measures were as follows: sensitivity (88%), specificity (95%) and the positive predictive value (9%).

Executive Summary

Implemented digital mammography: Full-field digital mammography machines installed between 2009 and 2012 are used across all our centres. Radiology Information System (RIS) and Picture Archiving Communication System (PACS) installation began across all our breast cancer screening centres. These systems allow us to coordinate services and share images with healthcare facilities across the province in a secure and timely manner.

Reduced diagnostic interval (time from abnormal screen to diagnostic resolution): The median wait times for each test type are as follows:

Non-tissue biopsy

- Five weeks (pre-navigation 2005) to 3.1 weeks (post-navigation 2007)
- Current 2015 diagnostic interval: 1.9 weeks

Tissue biopsy

- Nine weeks (pre-navigation 2005) to 7.6 weeks (post navigation 2007)
- Current 2015 diagnostic interval: 3.8 weeks

Opportunities to further improve the program include:

- **Greater resources and workforce capacity needed to match population growth over succeeding years**: Our average eligible screening population has increased (86,436 in 1990-1991 to 135,531 in 2014-2015) placing a heavy demand on our health resources. This future demand can be addressed through building adequate capacity.
- **Implement initiatives to increase/maintain screening participation**: Participation has remained stagnant or has decreased slightly in recent years. Work is being done on initiatives to reach women where screening rates are lowest (e.g. low-income groups).
- **Reduce wait times from abnormal screen to resolution**: Appropriate follow-up to an abnormal screen is important. Reducing these wait times can help minimize the anxiety felt by clients and ensure timely access to care if needed.
- **Plan and implement an integrated health information system**: Visits to different providers across the screening process impacts time to diagnosis. The development of an integrated health information system would serve to reduce wait times, allow better tracking of health changes and aid in evaluating system performance.

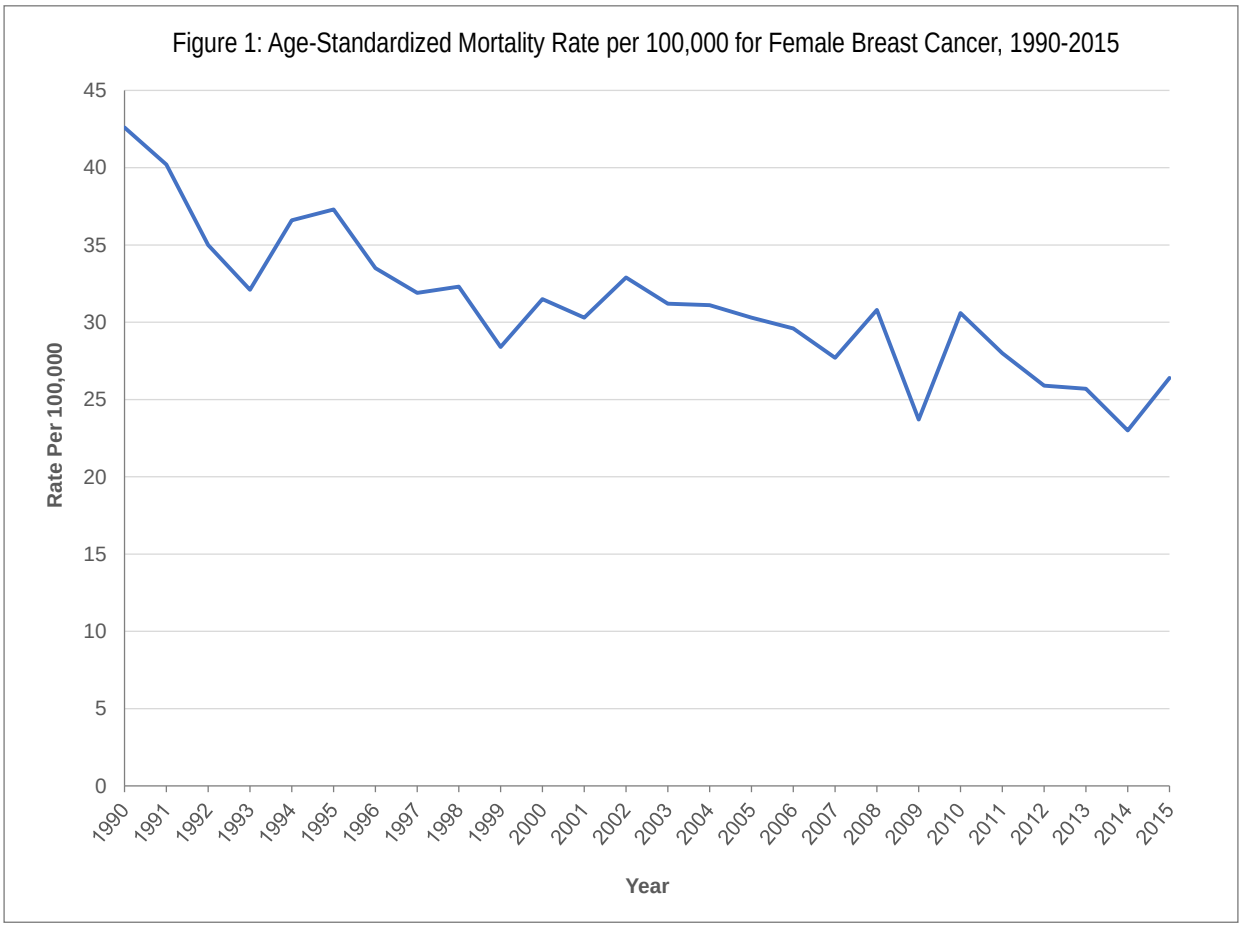
The past 25 years of program performance evaluated in this report have clearly demonstrated that screening saves lives. The program will continue to support women to be screened by providing them with high quality, safe, effective, client-centred services.

Introduction

The most common malignancy diagnosed in women worldwide[1] is breast cancer and Saskatchewan is no exception. It is the second leading cause of female cancer deaths in the province. These deaths often occur in younger women as shown by high potential years of life lost (PYLL = 137,000 in 2010-2012). For context, consider that prostate cancer's lower PYLL (35,600) in the same time period indicates deaths occur in older age groups[2].

Studies show regular mammography screening for women aged 50-69 is effective in helping reduce breast cancer mortality[3]. There has been a decline in our province's mortality rate by 38 per cent (42 in 1990 to 26 in 2015, per 100,000 population) (Figure 1).

Figure 1: Age-Standardized Mortality Rate per 100,000 for Female Breast Cancer, 1990-2015



Saskatchewan was the second province, after British Columbia, to introduce a breast cancer screening program. The Saskatchewan Cancer Agency's Screening Program for Breast Cancer started in 1990 as a pilot project for Regina and surrounding areas within a 44 kilometer radius. The second pilot included screening on a 37-foot mobile bus (Appendix 1). The program expanded in 1995 to cover the entire province with permanent centres (Regina, Saskatoon) and satellite centres in five other cities. The mobile bus now serves rural and remote areas of Saskatchewan on a two-year cycle (Appendix 2). Lloydminster was added as a satellite centre in 2012.

Introduction

Throughout the report the following will be addressed:

- Significant achievements
- Key performance measures
- Trends
- Comparison with national targets

About Organized Screening: The Screening Program for Breast Cancer

Screening as a secondary prevention strategy targets a disease in process[4] to reduce mortality. Early detection of tumours when they are small and less likely to have spread gives most women more treatment options, a reduced chance of cancer recurrence and an improved chance of survival. Mammography, a low dose X-ray of the breast can find changes in the breast, even when they are too small to feel or see. Mammography is recommended for women aged 50–69 by the Canadian Task Force on Preventive Health Care[5] and the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO).[1]

In order to maximize benefits, an organized approach to screening is required. This approach ensures this target population has access to and uses the screening services offered. Organized screening typically involves the following elements[6,7]:

- Identification and invitation of the target population (specified age categories, methods and screening intervals)
- Provision of a screening examination
- Follow-up of any abnormalities detected at screening
- Recall after a normal or benign screening examination
- Quality assurance
- Monitoring and evaluation
- A method to assess cancer in the general population

The Saskatchewan Cancer Agency's Screening Program for Breast Cancer is accredited by the Canadian Association of Radiologists. The screening examination provided through its centres has an effective follow-up process to assess abnormalities. This is coordinated by client navigators. Cancer data through the Saskatchewan Cancer Registry (as legislated in *The Cancer Act,* 2006)[8] is used to measure and report on performance using nationally and internationally accepted frameworks. Quality is assured through regular audits.

Introduction

Screening Eligibility in Saskatchewan

Clients who meet the following criteria are eligible to attend the program:

- A valid eHealth Saskatchewan services card
- Target population between the ages of 50 and 69
- No noticeable symptoms such as lumps, bloody nipple discharge or skin changes
- No breast implants
- Not on active follow-up for breast cancer
- Have not been diagnosed with breast cancer within the past five years

Pregnant or breast-feeding women are typically not screened. Women older than 69 years are screened upon client request.

Screening Process

The screening process is illustrated in Figure 2. Clients are sent their first invitation letter via the postal system during the year they turn 50. The client is responsible to call the program to make an appointment at the mammography centre. Upon registration at the centre, a mammography technologist takes a two-view bilateral mammogram. After the mammogram is reviewed by a radiologist, a result letter is sent to each client and her physician by mail.

Client diagnostic follow up is navigated based on their physician's directive. All clients receive a call from either their physician or a client navigator if a mammogram result is abnormal. Clients can also elect not to be navigated when contacted.

A completed diagnostic follow-up confirms whether the abnormality is cancer or normal/benign. If cancer is confirmed, the woman will not return to the program until she has completed treatment and has been disease-free for at least five years. If normal/benign, the woman receives another screening invitation. Most women receive an invitation to be rescreened every two years.

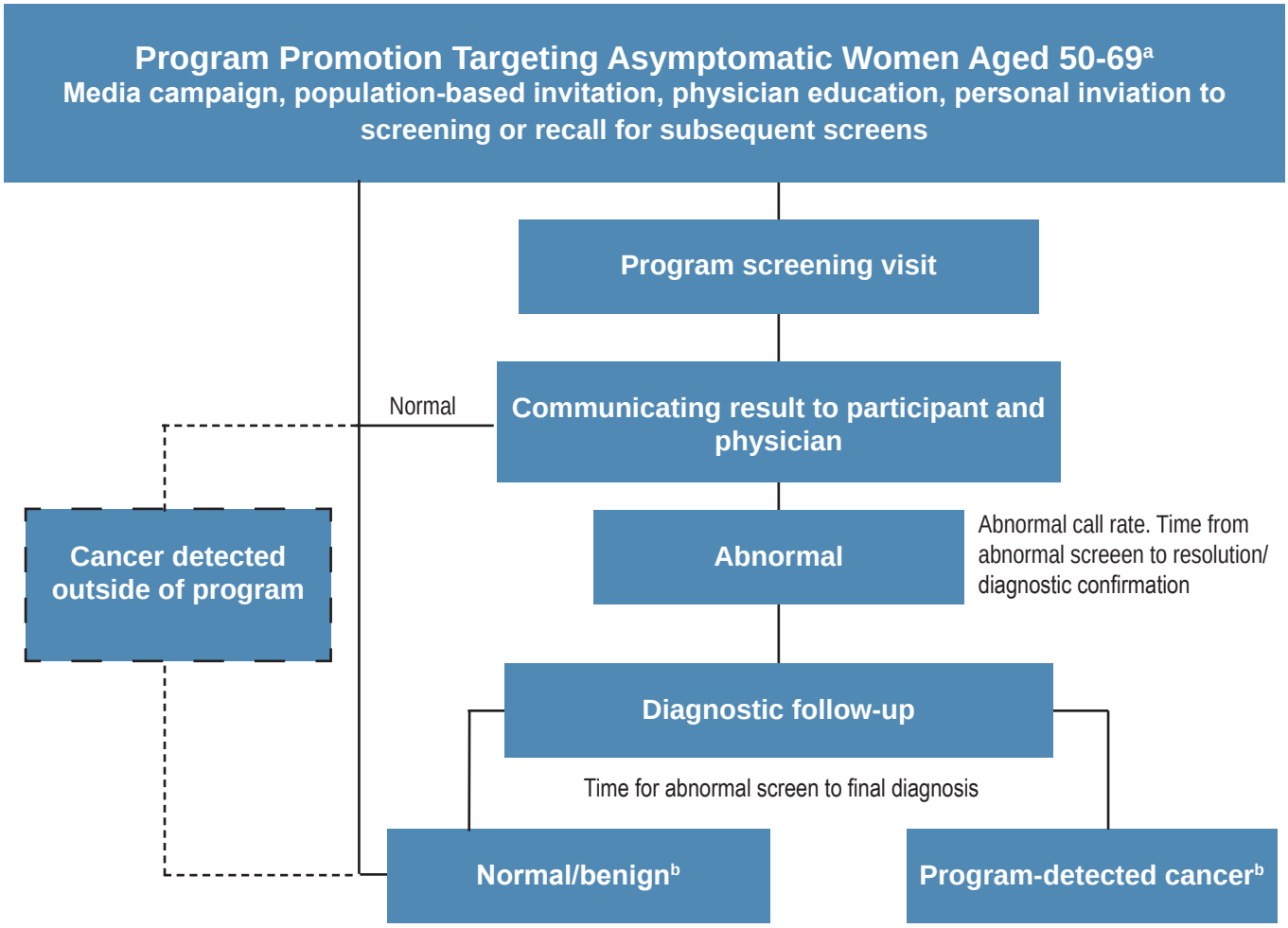
Women can be screened annually if:

- They have a family history of breast cancer (e.g. mother, sister or daughter)
- A radiologist makes the recommendation
- They have dense breasts

If a woman discovers abnormalities in her breast before her screening visit, she is encouraged to consult with her physician for further diagnostic assessment.

Introduction

Figure 2: Screening Process



a. Some women also undergo screening (opportunistic screening or diagnostic mammogram) and are diagnosed with cancer outside the program.

b. Cancers detected within 6 months of a screen are considered screen-detected as per national guidelines. Breast screening programs obtain final diagnosis from sources such as physicians, pathology reports and cancer registries.

Successes Over the Years

The Saskatchewan Cancer Agency has experienced some important milestones in its implementation of the Screening Program for Breast Cancer from 1990-2015:

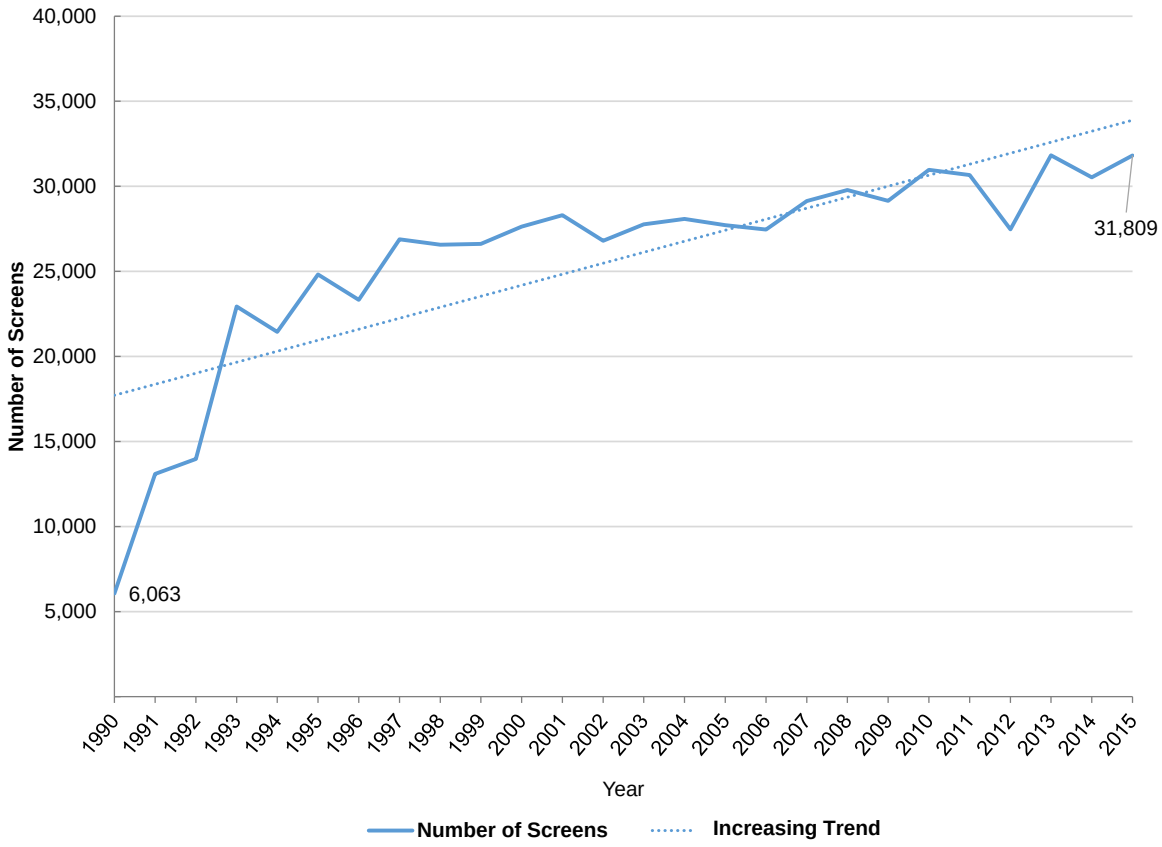
- Growth of screening volumes
- Expansion of the program to cover the full province
- Adoption of digital mammography technology at all our centres
- Increased program promotion and recruitment
- Effective client navigation program

25 Years of Growth

Screening Volumes

Overall, 670,884 women aged 50 to 69 were screened at least once from 1990-2015. The number of screens performed on this target population increased from 6,063 in 1990 to 31,809 in 2015 (Figure 3). Of note is that 3,380 cancers were detected through screening mammograms.

Figure 3: Overall Screening Volumes, 1990-2015

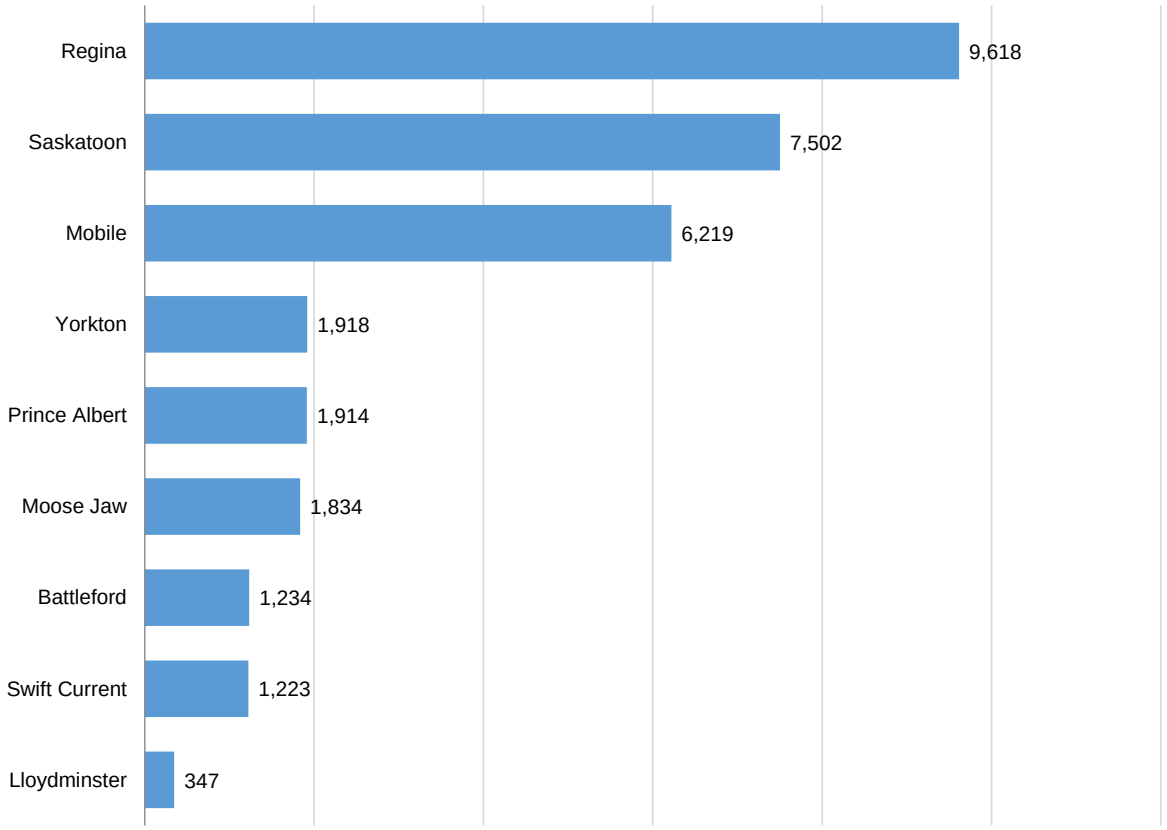


Successes Over the Years

Volumes by Centre

The screening program operates two permanent centres in Regina and Saskatoon and the mobile bus that travels throughout rural Saskatchewan. There are six satellite centres originally operated by the Saskatchewan health regions (as of December 4, 2017, the Saskatchewan Health Authority operates these sites). Figure 4 shows the number of screens performed by centre in 2015.

Figure 4: Number of Mammograms Performed by Centre, Women Aged 50-69, 2015



Note: Screens done on the mobile when in Regina were combined with the Regina site.

Successes Over the Years

Adapting to New Technology- Digital Mammography

When the program began in 1990, mammograms were originally printed on film. Today, with advances in technology, digital mammograms are recorded and saved as electronic files. Digital mammography has the following advantages[9]:

- Lower radiation dose
- Improved image quality and contrast resolution permits better visualization of breast tissue
- Allows optimization of individual processes (image acquisition, display and archiving)
- Possible benefits to young women and women with dense breasts

Digital mammography machines were installed between 2009 and 2012 in all centres offering screening mammography. The Radiology Information System (RIS) and Picture Archiving Communication System (PACS) installation was completed in 2017 across all our breast cancer screening centres. Both the RIS and PACS allow the images to be shared with health care facilities across the province in a secure and timely manner.

Improved Program Recruitment and Promotion

Eligible clients receive an invitation letter. This method is a widely used and effective strategy to promote participation[10]. The screening program receives the names of eligible clients through eHealth Saskatchewan. All women with a valid Saskatchewan health card are automatically registered in the Screening Program for Breast Cancer when they turn 50 years of age.

Another key element of the screening program is the information and education provided about cancer and screening tests. Some of the resource materials include:

- Information sheets
- Posters and brochures promoting screening mammography
- Material on the Saskatchewan Cancer Agency's website that provides information and outlines guidelines about the screening program

Promoting screening is also important to support and improve participation. The following communication tools have been used over the years:

- Advertisement (radio and print advertisements)
- Display materials for use at conferences and workshops
- Attendance at various community group activities and events

Successes Over the Years

Client Navigation Program

The client navigation program started in 2006. The purpose of navigation is to assist in reducing wait times by providing timely, seamless access, guidance and support to women who require follow-up tests and care when an abnormal mammogram result is identified.

The role of the client navigator is to help:

- Facilitate access and coordinate referrals to follow-up from an abnormal result
- Arrange follow-up appointments with healthcare providers and diagnostic centres
- Provide information and support
- Help the client understand the follow-up process and access educational resources
- Provide emotional support and address client concerns

Navigators receive permission from each client's physician to navigate the client. This is called a physician's directive. Three options are possible:

- Navigation is case by case
- Permission can be granted for all a physician's clients
- Permission is not granted (do not authorize navigation). The physician will then advise the client.

Since 2006, the navigators have successfully assisted 14,330 clients. In the most recent years for which data is available (2012-2015), the breakdown of the three options is as follows:

- Case by case (6%)
- Permission given to navigate all physician's clients (83%)
- Do not authorize navigation (11%)

Two evaluations were done to identify the strengths, weaknesses and to establish whether the original objectives of the program were achieved[11,12]. Overall, these evaluations confirmed that the program objectives were achieved.

Program Evaluation

The Screening Program for Breast Cancer measures performance using indicators developed by the Evaluation Indicators Working Group, a sub-committee of the Canadian Breast Cancer Screening Initiative (now with the Canadian Partnership Against Cancer)[10,13]. Monitoring and evaluation of organized programs provides an opportunity to understand the impact of organized breast cancer screening programs on breast cancer morbidity and mortality, as well as the potential harms associated with screening[13,14].

This 25th anniversary report presents mammography indicators for the target population of women aged 50-69. These indicators are grouped using the Canadian Partnership Against Cancer's quality determinants framework[9] as follows:

Client Feedback

Coverage:
- Participation rate
- Retention rate

Follow-Up:
- Abnormal call rate
- Diagnostic interval

Quality of Screening:
- Positive predictive value
- Sensitivity and specificity

Detection:
- Cancer detection rate

Extent of Disease at Diagnosis:
- Stage of breast cancer

Definitions for each indicator are provided in Appendix 3.

Program Evaluation

Client Feedback

Periodically we ask clients to participate in surveys that can help identify the level of satisfaction a woman has with the program, and identify areas for improvement. A survey completed in 2015 of 2,500 clients asked about satisfaction levels based on their latest visit to our permanent and satellite centres[15]. The survey asked about:

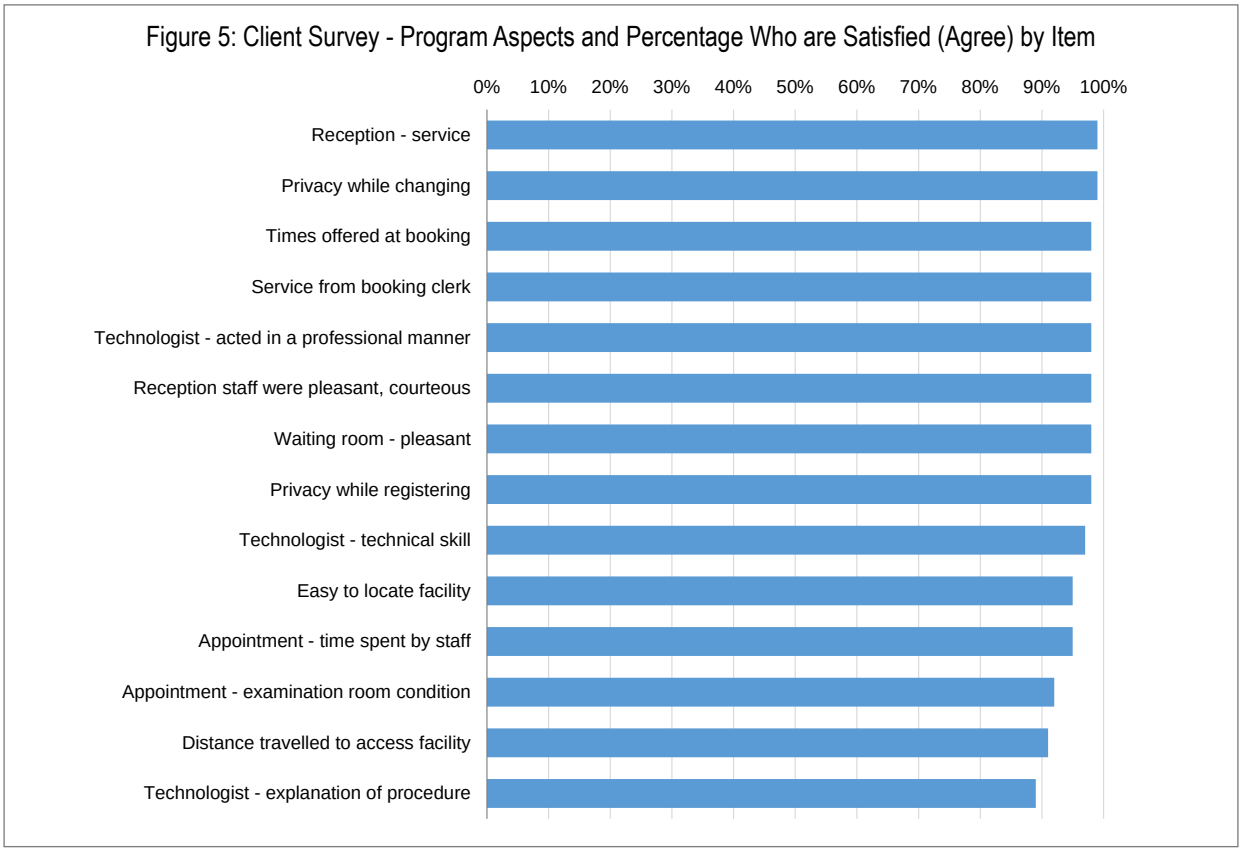
- Overall satisfaction
- Convenience, accessibility, physical environment
- Staff interpersonal skills
- Information transfer
- Mammography experience
- Reporting of mammography results

Almost all clients (99%) surveyed indicated:

- They were satisfied with care received at the Screening Program for Breast Cancer
- They would recommend the screening program to their friends and family
- They plan on returning for another mammogram at the appropriate time

Figure 5 shows a summary of survey results. The results indicate a high level of client satisfaction with services provided at the program centres. The areas identified in the survey for improvement related to information transfer:

- Satisfactory explanation on the possibility of being recalled for additional imaging
- More details on possible discomfort/pain the client could experience during screening



Program Evaluation

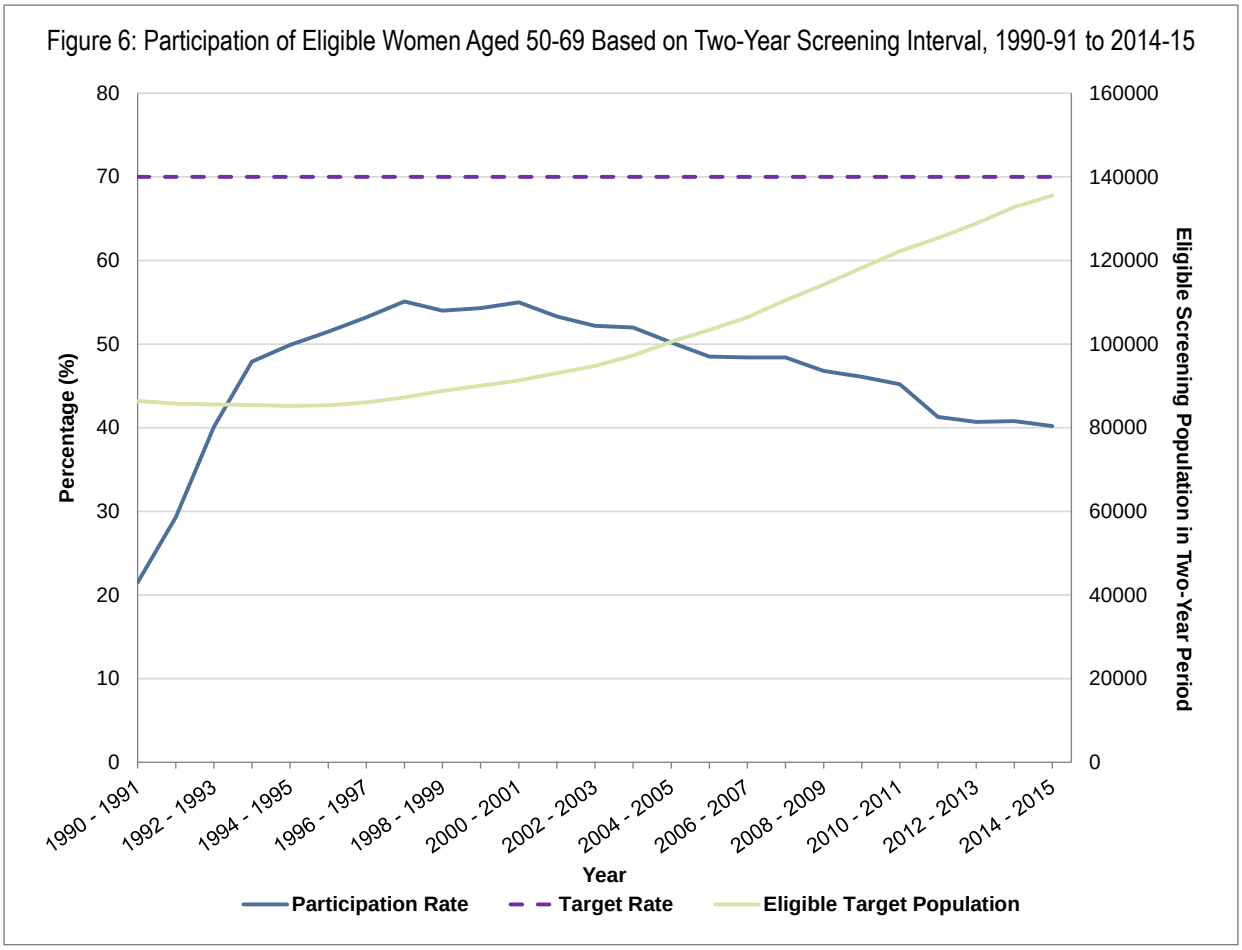
Coverage

Participation Rate

Participation is the number of eligible women who have had a screening mammogram within a two-year period (Appendix 3). The objective here is to maximize participation to realize significant reductions in mortality. Independent studies have indicated that mortality is reduced by up to a third, 7-12 years after participation rates of 70 per cent have been achieved in the target population[4]. Figure 6 describes those eligible for screening (average in each two-year period) as a green line while participation is highlighted in blue. During its first two full years of operation (1991-1992), 29 per cent of those eligible had a screening mammogram through the program. This increased to a high of 55 per cent in 1997-1998 and has steadily declined since to 40 per cent in 2014-2015.

Saskatchewan's eligible population has steadily grown from 86,437 in 1990-1991 to 135,531 in 2014-2015 (Figure 6). The screening program currently operates at about 95 per cent capacity. With an increasing target population, constraints in capacity can lead to clients opting to be screened at private diagnostic centres (opportunistic screening). Both these factors may contribute to reduced participation.

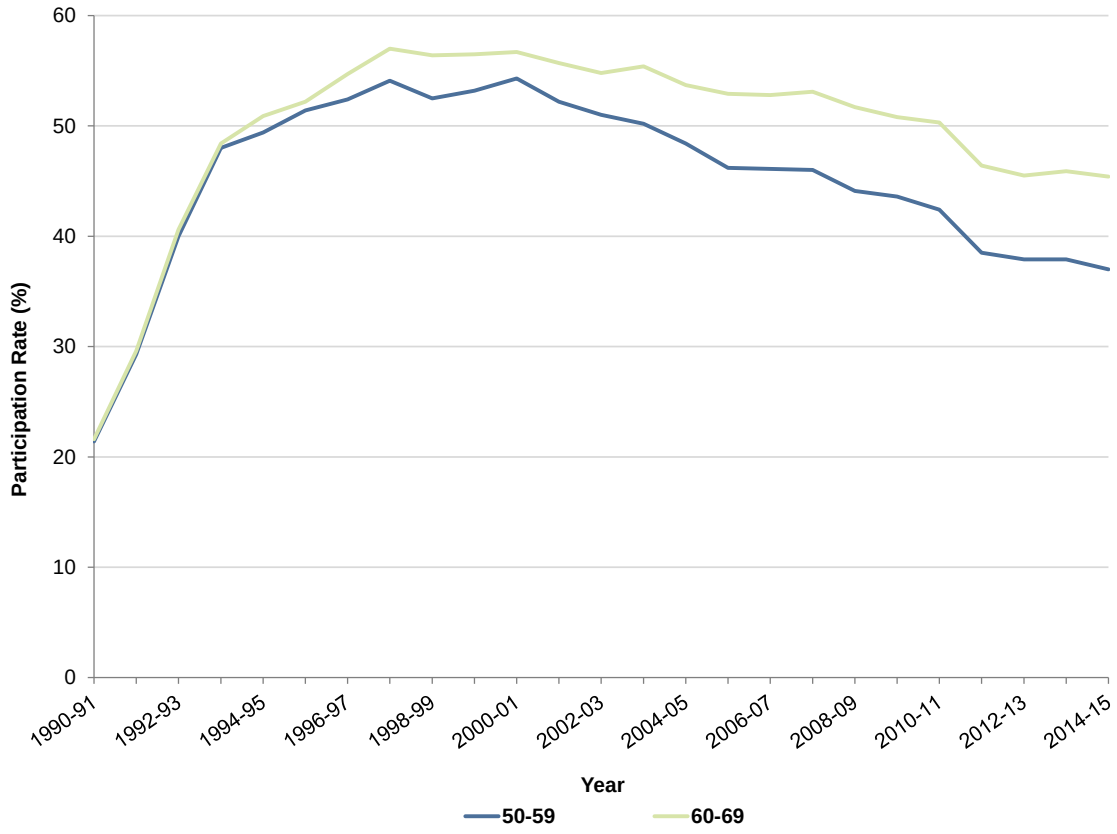
Figure 6: Participation of Eligible Women Aged 50-69 Based on Two-Year Screening Interval, 1990-91 to 2014-15



Program Evaluation

The decline in participation has been particularly marked in the 50-59 year group (blue line) compared to the 60-69 year group (green line) since 2000-2001 (Figure 7). Many factors can influence the participation rate, such as, acceptability, accessibility, program promotion, and the capacity of a screening program. Other reasons for variation in participation can include cultural and/or language barriers, and fear. Work continues to evaluate enablers and barriers to participation as part of updating the screening pathway.

Figure 7: Participation Rate Among Women Aged 50-69 by Age Group, 1990-2015



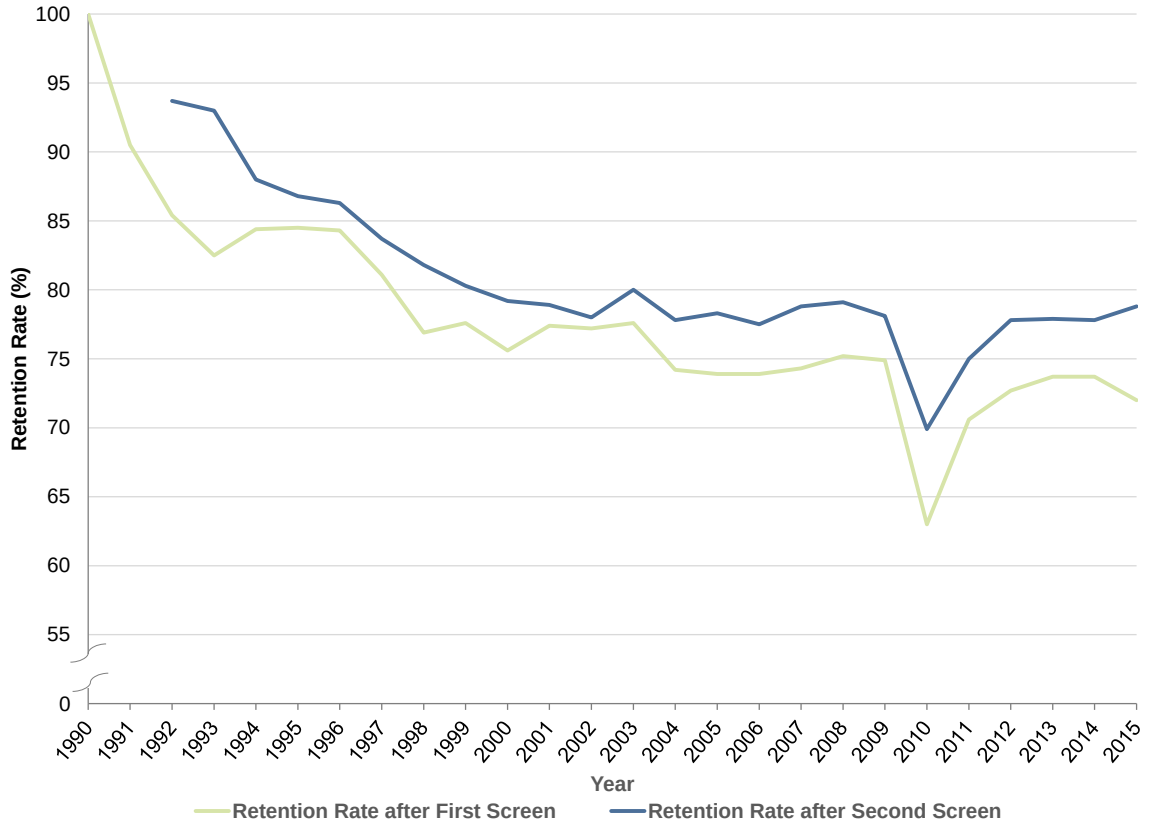
Retention Rate

Regular participation in screening (i.e. at least every 24 months) results in optimal benefits[10,13]. At present there is no indication that the benefits of screening are lost if rescreening occurs up to six months after the recommended interval. Therefore retention is measured using a 30-month interval (Appendix 3). Women older than 67 are not sent a recall letter as they are age ineligible to rescreen. Age ineligible clients who have previously been screened in the program can still call to make rescreen appointments but are excluded from this indicator.

Program Evaluation

Retention is fairly high overall and higher among clients after their second screen (blue line) compared to rates after first screen (green line) (Figure 8). These rates have gradually declined from program inception. In 2015, 78 per cent of women returned to screen after their second screen compared to 72 per cent after their initial screen.

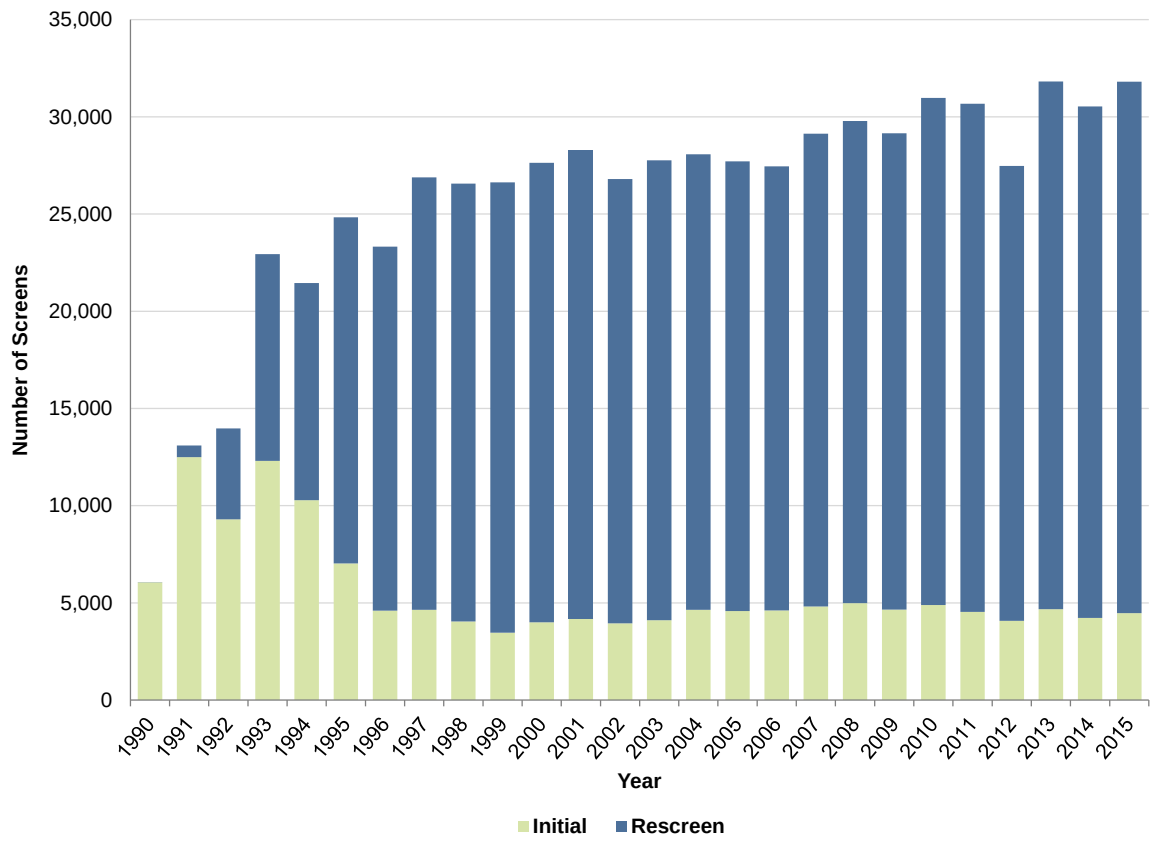
Figure 8: Retention Rate of Women Aged 50-67 Who Returned to Screen within 30 Months of Original Screen, by Screen Type, 1990-2015



This shows that repeat clients are satisfied. In 2010, the decreased retention rate could be explained by the screening program changing from analog film to digital mammography. Retention for both screen types has been stable in recent years but still falls below national targets. A similar trend is seen among other organized programs across Canada[14].

The mix of first-time and returning clients changed since the program began (Figure 9). The majority of women were new to the program when it was introduced. Over time, as women returned to rescreen, the proportion of returning women increased. By 1996, over 80 per cent of women were returning clients.

Figure 9: Proportion of Mammograms by Screen Type and Year of Mammogram, Women Aged 50-69, 1990-2015



Follow-up

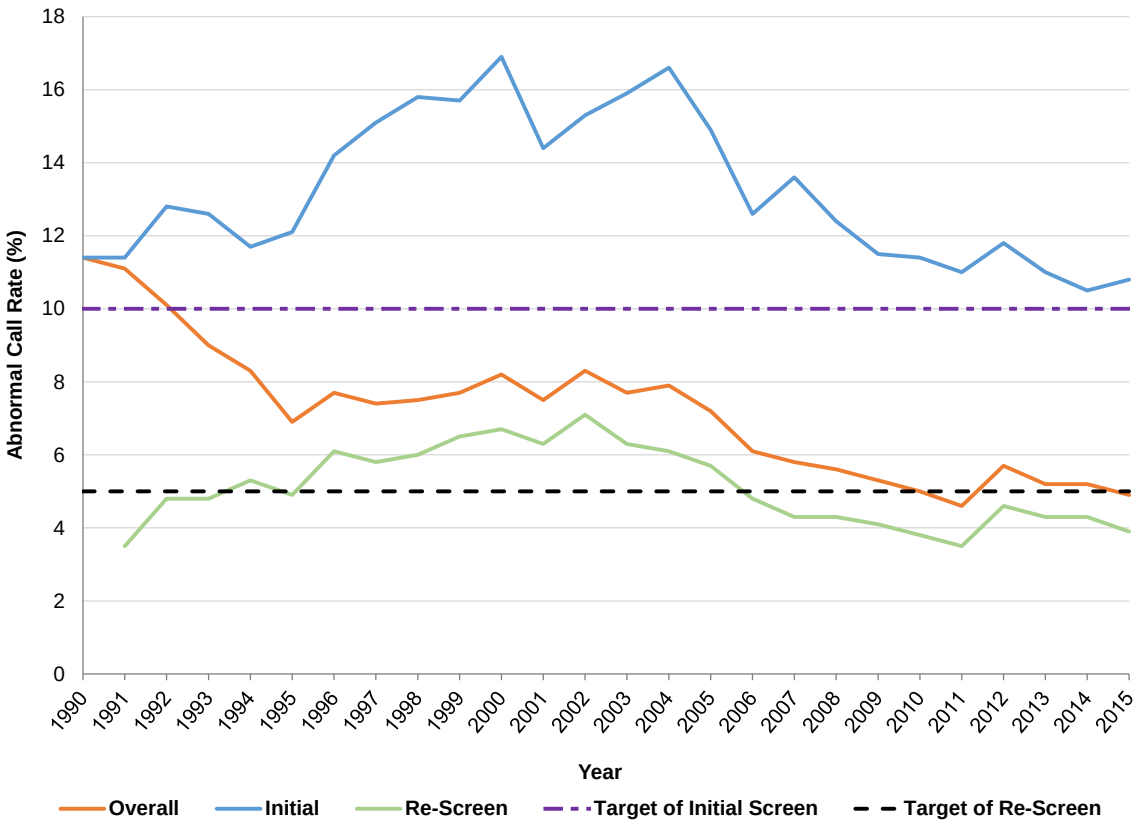
Abnormal Call Rate

The abnormal call rate is the percentage of all women screened who are referred for further testing because of abnormalities seen on the mammogram[13].

The overall abnormal call rate declined from 11.4 per cent in 1990 to 4.9 per cent in 2015 (Figure 10). The quality of the mammogram, screening technology and interpretation can influence abnormal calls. For example, improvements in x-ray film contributed to a slight increase in abnormalities found during 1996. Digital mammography being the present standard will impact abnormal call rates.

Higher abnormal call rates for first-time clients reflects existing abnormalities detected at initial screen[9,10]. Radiologists do not have previous X-rays for comparison, making it difficult to distinguish abnormalities in the breast from normal changes due to aging. The abnormal call rate for first-time clients changed over the 25 year period, from a low of 11.4 per cent in 1990 to a high of 16.9 per cent in 2000 and then decreased to 10.8 per cent in 2015. Contrast that with rates for return clients: from 4.8 per cent in 1992 to 3.9 per cent in 2015, with a high of 7.1 per cent in 2002.

Figure 10: Abnormal Call Rate for Women Aged 50-69 by Year and Screen Type, 1990-2015



A high abnormal call rate can indicate that clients are undergoing unnecessary follow-up tests. Factors that can affect the abnormal call rate include: recommended screening interval, radiologist experience and reading volumes, the incidence of breast cancer, and population characteristics[13].

Diagnostic Interval: Wait Times from Abnormal Screen to Resolution

Annually, approximately seven per cent of clients need follow-up tests after receiving an abnormal screen result. The time from receiving an abnormal result to its diagnostic resolution can be a stressful and emotional period for clients and their families[16]. The objective is to ensure clients get a diagnostic resolution as soon as is possible.

The amount of time for diagnostic resolution depends on the mammographic suspicion, clinical complexity of the case, type of diagnostic test(s) required, as well as provincial and programmatic capacity. Non-tissue biopsy tests (typically involving imaging) are processed faster. A tissue biopsy, where a piece of tissue is removed to be analyzed by a laboratory outside the Saskatchewan Cancer Agency takes time to resolve.

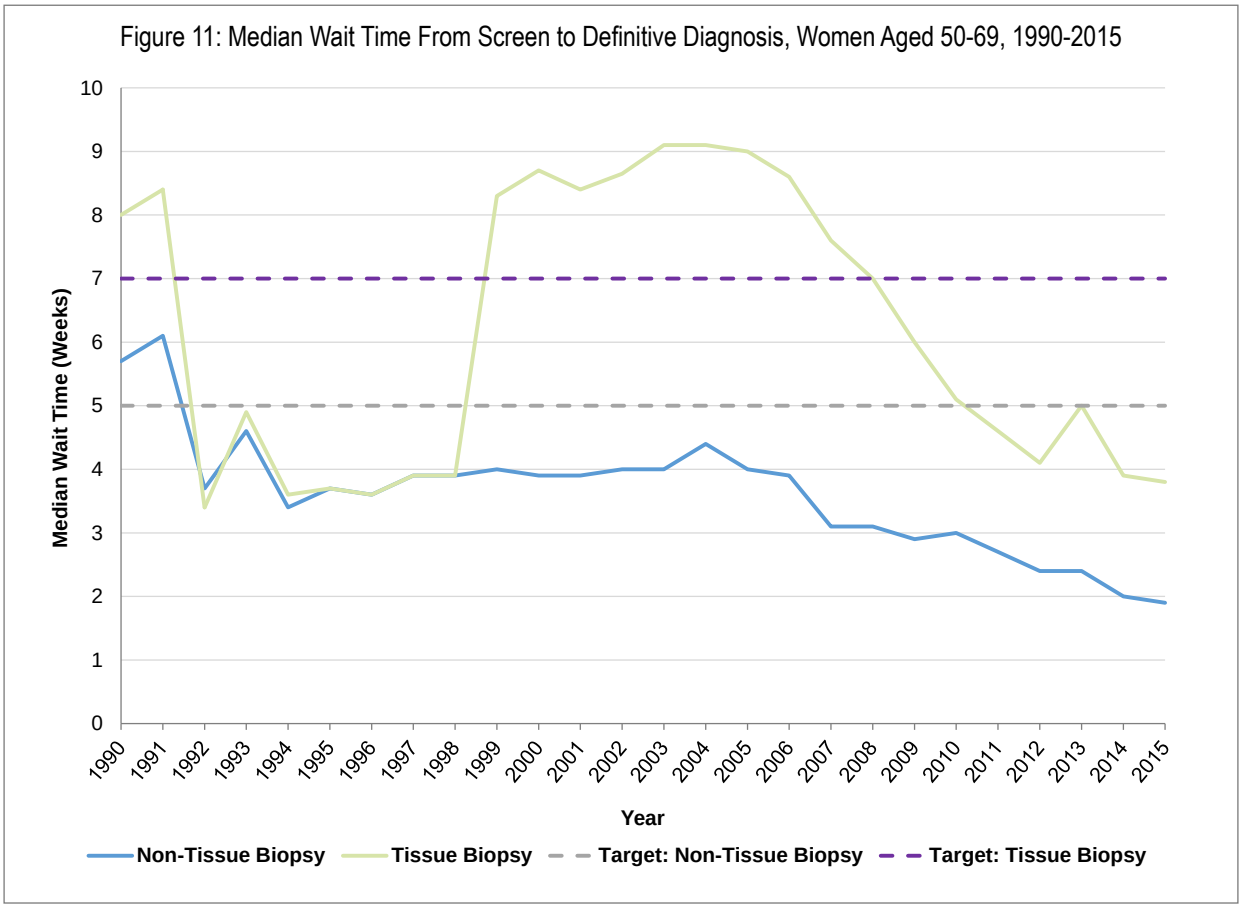
Program Evaluation

The Saskatchewan Cancer Agency follows existing national targets[4,7] that specify 90 per cent of clients complete follow-up:

- Within five weeks for non-tissue biopsy (blue line)
- Within seven weeks for tissue biopsy (green line)

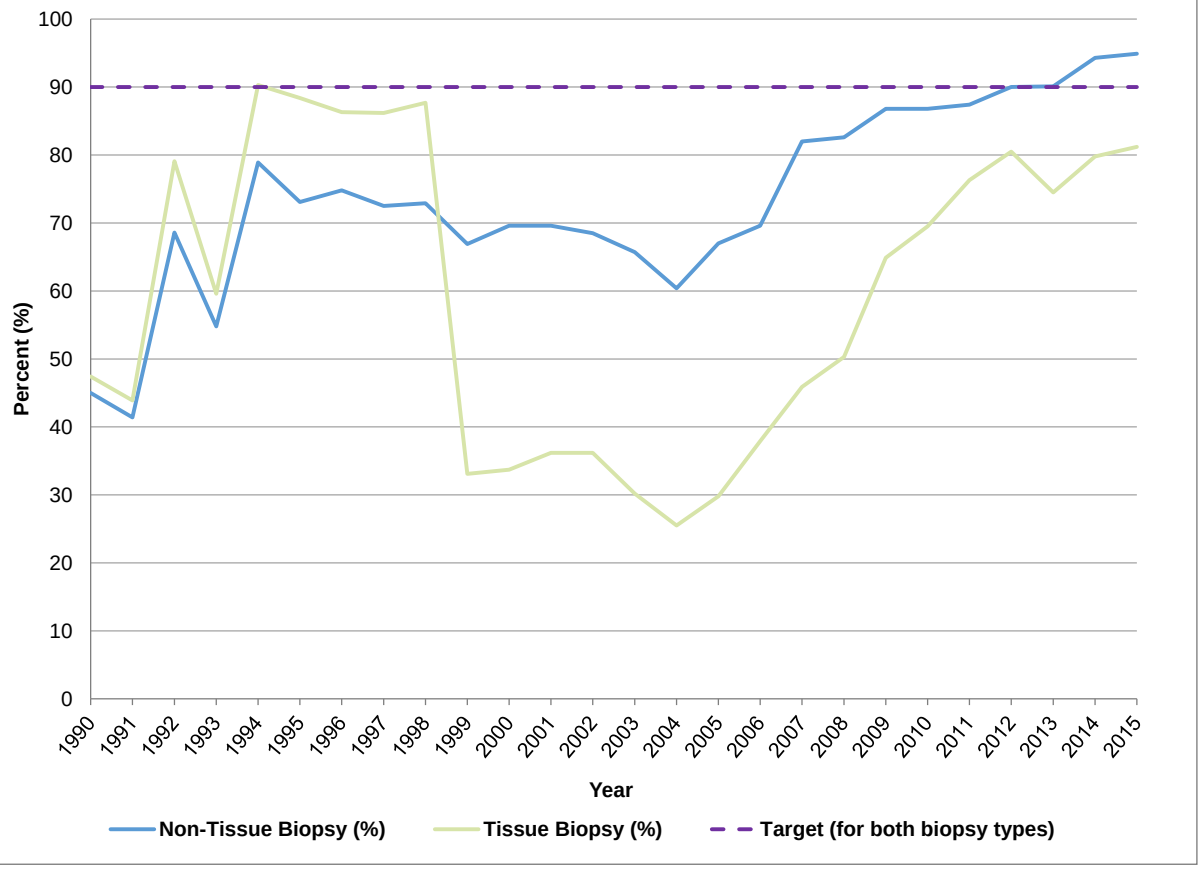
The Saskatchewan Cancer Agency analyzes the diagnostic interval using two approaches:

1. The median wait times (Figure 11) for tissue and non-tissue biopsies were roughly similar until 1998. Wait times for tissue biopsies reached a maximum of 9.1 weeks in 2003 and 2004. A client navigation program started in 2006 to address this issue. The wait times for tissue and non-tissue biopsies:
   - Reduced to seven weeks and 3.1 weeks respectively in 2008
   - Showed additional reduction in 2015
2. Proportion of clients with completed follow-up tests within national diagnostic interval targets (Figure 12): The target for non-tissue biopsies has been met and the Saskatchewan Cancer Agency is working with relevant partners to find ways to meet the tissue biopsy target (Appendix 3).



Program Evaluation

Figure 12: Proportion of Wait Times Within <5 Weeks for Non-Tissue Biopsy and <7 Weeks for Tissue Biopsy, Women Aged 50-69, 1990-2015



Quality of Screening

Quality is the "…degree to which screening our target population increases the likelihood of reliably classifying whether they have or do not have cancer. We want this to be consistent with currently applicable standards and best practices."[17,18]. The Screening Program for Breast Cancer uses positive predictive value, sensitivity and specificity to determine the quality of screening and how well the process works. These measures are calculated using data on screen results (normal or abnormal) and any cancer diagnoses subsequent to the screen. Each indicator is discussed below.

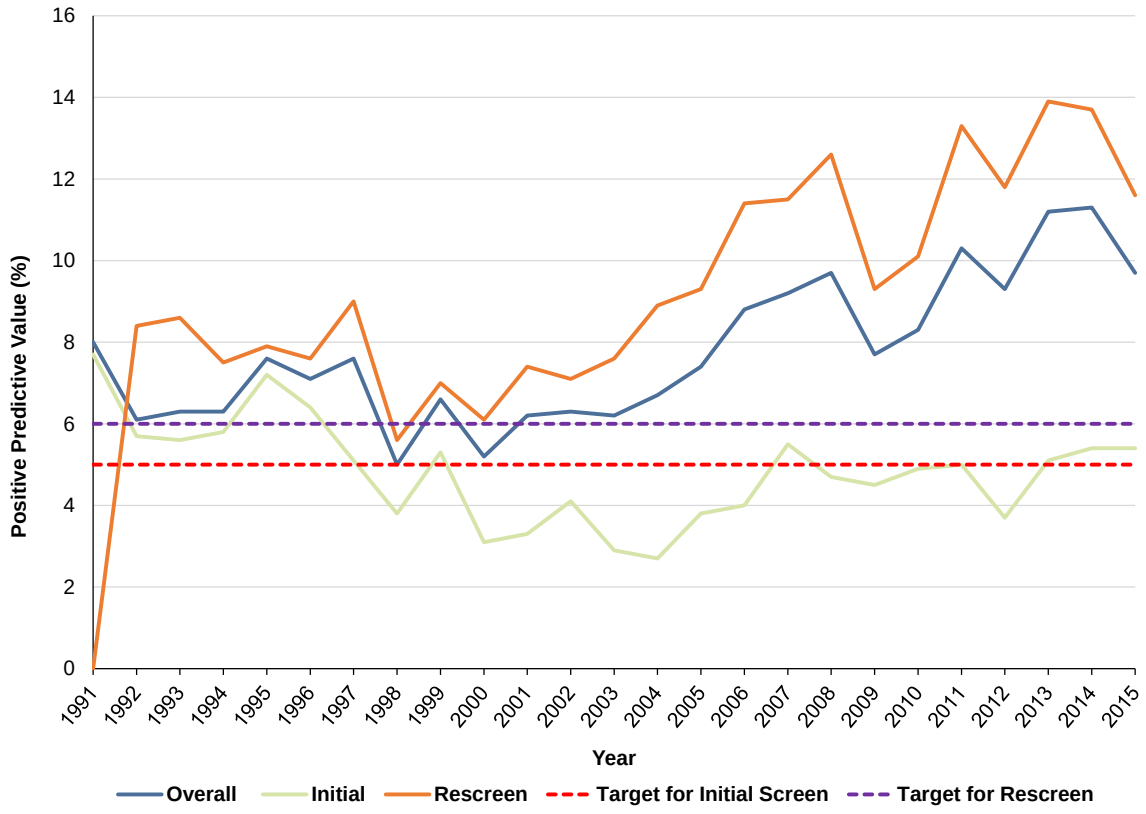
Positive Predictive Value

The positive predictive value is the percentage of women with an abnormal result who are diagnosed with breast cancer after completion of a diagnostic work-up. The positive predictive value measures the probability that the patient actually has the disease if the mammogram is abnormal.

Program Evaluation

Positive predictive value is consistently higher for rescreen clients than at initial screen because radiologists are able to compare to a previous screen to distinguish “true abnormalities” and reduce the likelihood of a false positive result. The positive predictive value for initial screens declined (from 8.1 in 1990 to 5.4 in 2015) and rescreen values increased from 8.4 per cent in 1992 to 11.6 per cent in 2015 (Figure 13).

Figure 13: Positive Predictive Value (%) in Screening Program Clients Aged 50-69, by Screen Type and Year, 1990-2015



There has been a greater proportion of rescreens than initial screens in recent years. Therefore, both the overall and rescreen positive predictive value increase but decrease at initial screen. A decrease in the abnormal call rate together with a relatively stable cancer detection rate contributed to an increase in the positive predictive value. This high positive predictive value reflects partly the effectiveness of our screening program at minimizing unnecessary follow-up.

Sensitivity and Specificity

Sensitivity and specificity indicators relate to both invasive and ductal carcinoma in situ cancers (see glossary).

Sensitivity measures if a client has breast cancer, how often a mammogram will produce a positive result. It is the proportion diagnosed with program-detected breast cancer after receiving an abnormal result through the screening program[13]. Overall in 2015, 88 per cent of clients diagnosed with breast cancer had received an abnormal screen test result (Figure 14: green line).

Specificity indicates if a person does not have breast cancer, how often the mammogram result will be normal. It is the proportion of women without a breast cancer who had a normal test result through screening[13]. On average, approximately 93 per cent of clients without cancer had a normal screen test result (Figure 14: blue line). Specificity was lower on initial screen (87% on average) compared to rescreen (95% on average). This is because rescreen clients generally have had a greater number of previous screens to which their most current screen can be compared.

Figure 14: Sensitivity (%) and Specificity (%) in Screening Program Women Aged 50-69, 1990-2015

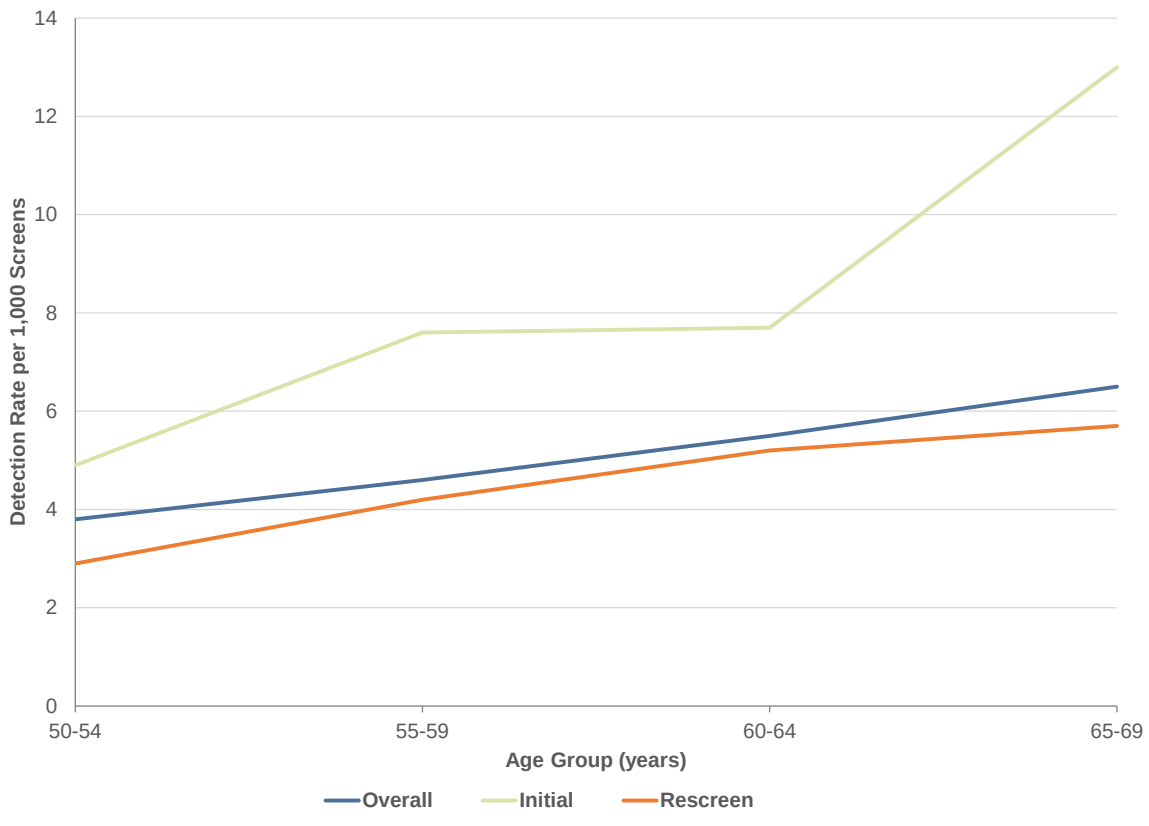
A number of factors affect sensitivity and specificity, including the following: radiologist/ nurse examiner level of expertise, mammographic technology used (digital vs. film especially for women with higher breast density), number of previous screens, client age, underlying incidence rates, rate of disease progression, breast density and use of hormone replacement therapy.

Detection

Cancer Detection Rate

The detection rate[13] shows how effective the program is at finding both invasive and pre-invasive cancers (ductal carcinoma in situ)[9] (for definitions see Appendix 3). The risk of developing cancer increases as one ages. For example, the overall cancer detection rate among women aged 50-54 (4.6 per 1,000 screens) is lower compared to women aged 65-69 (6.5 per 1,000 screens) (Figure 15).

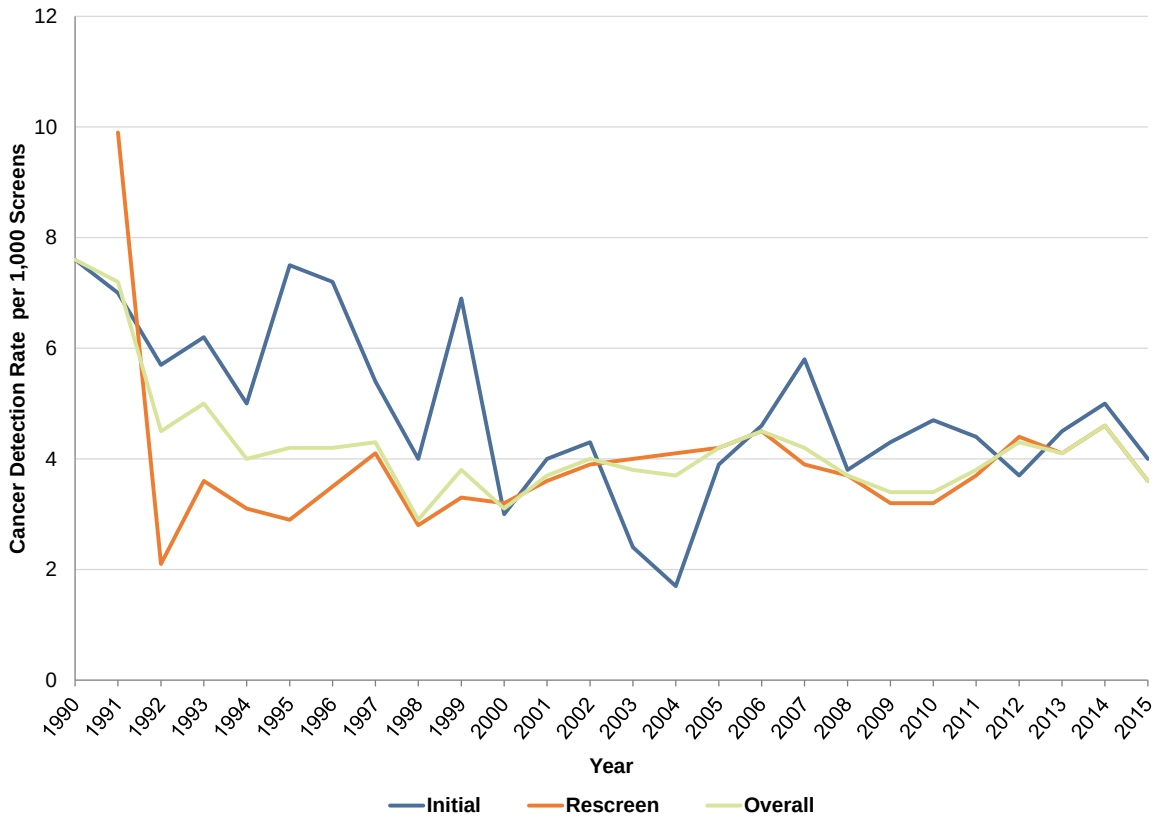
Figure 15: Cancer Detection Rate by Age Group, 1990-2015



Program Evaluation

Cancer detection rates are shown as overall and by client type (first-time, return clients) (Figure 16). There has been a decline in overall rates from 7.6 in 1990 to 3.6 in 2015 (per 1,000 screens). The high rates in early program years reflects cancers that remained asymptomatic. This rate dropped as the program became more established. A greater proportion of returnees compared to first-time clients in later years contributed to this decrease.

Figure 16: Invasive and DCIS Cancer Detection Rates for Women Aged 50-69 by Screen Type, 1990-2015



First-time clients had higher rates than returnees. The higher rate for first-time clients reflects prevalent or existing cancers in women who may not have been previously screened. The application of digital mammography and improved radiology expertise stabilized detection rates in later years[13]. Rates for first-time clients fluctuated from 7.0 in 1991, to a low of 1.7 in 2004 and has since remained stable around 4.0 (per 1,000 screens). For return clients, the cancer detection rate decreased from 9.9 in 1991 to 3.6 cases per 1,000 screens in 2015. In 2015, the detection rate for invasive cancers was 4.0 per 1,000 screens and 3.6 per 1,000 screens for initial and rescreens respectively.

Program Evaluation

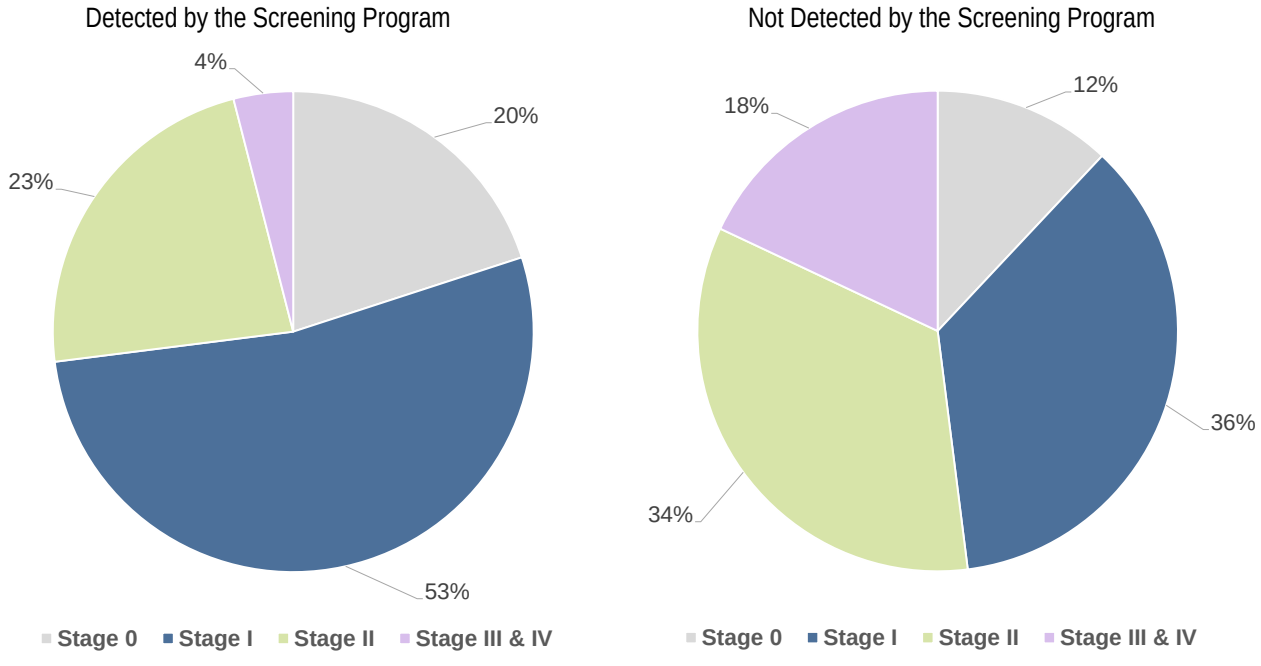
Extent of Disease at Diagnosis

Staging of Breast Cancer

A cancer's stage is based on the size and location of the primary tumour, as well as whether it has spread to other areas of the body. It is an important prognostic factor that indicates the extent of the cancer at diagnosis and is used to plan appropriate treatment.

The TNM system is used to stage breast cancers in Saskatchewan. This system consists of three components: tumour size (T), spread to regional lymph nodes (N), and whether it has spread further (metastasis; M)[19]. Survival usually decreases as the stage of cancers increases. Therefore, reducing the number of deaths from breast cancer depends partially on detecting cancer at an early stage. Breast cancers detected through the Screening Program for Breast Cancer were found at an earlier stage than cancers detected outside (Figure 17). Stage 0 (mainly in situ) and Stage 1 cancers accounted for 73 per cent of screening program-detected cancers compared to 48 per cent of cancers detected outside the program. Stage III and IV cancers made up four per cent of program-detected cancers compared to 18 per cent outside the program.

Figure 17: Staging of Breast Cancers in Women Aged 50-69 by Screen-Detected Cancer Status, 1990-2015



Quality Assurance and Safety Activities

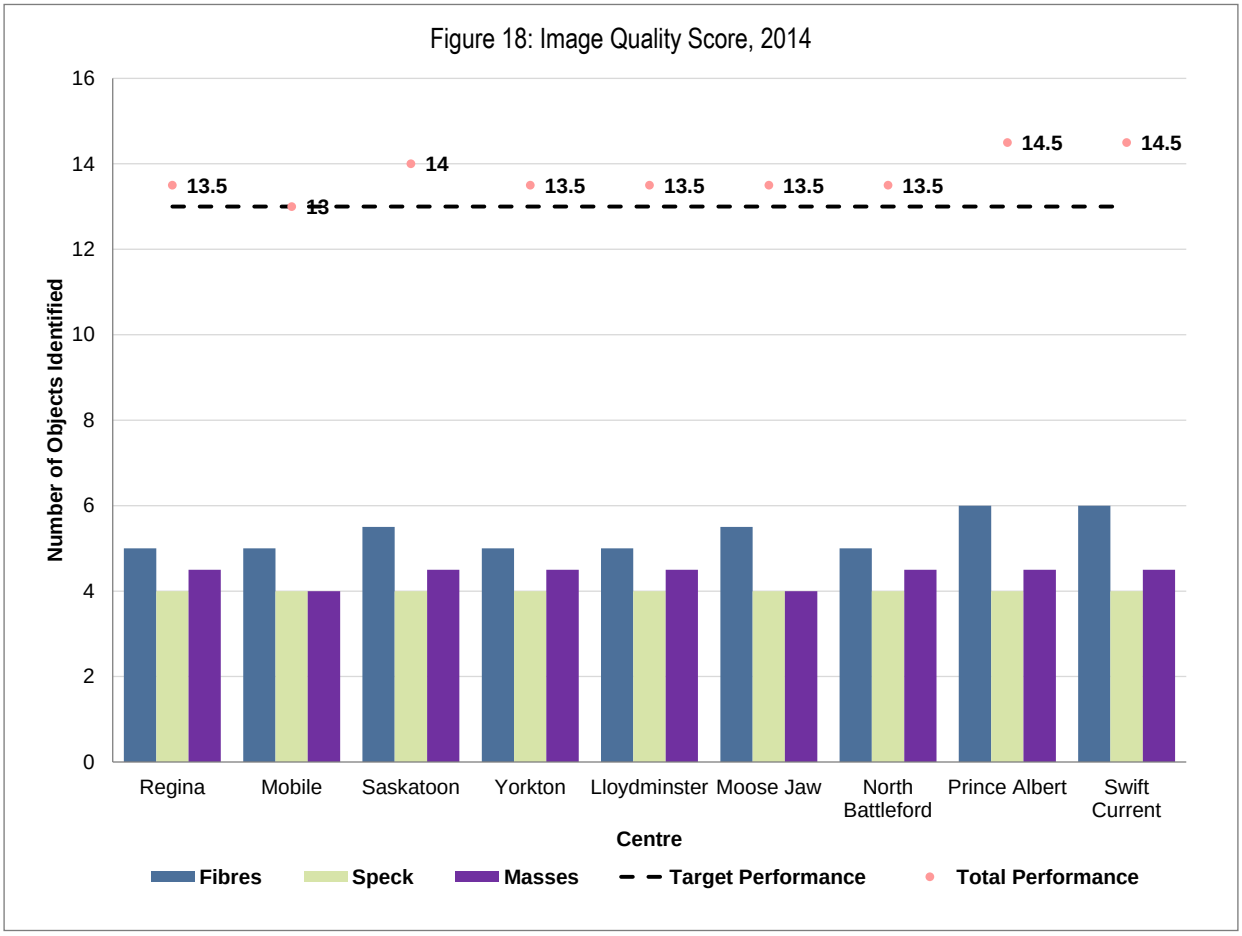
Monitoring Quality

Mammography is currently the most reliable screening method available for early detection of breast cancer. Radiologists and staff participate in regular sessions where screening mammography images, follow-up information and breast cancers diagnosed in program clients are reviewed. Radiologists also receive feedback annually using the performance measures presented in this report.

Ensuring Image Quality

Standard quality assurance equipment audits are performed at regular intervals (daily, weekly, annual) at all centres and assess image quality using a Mammographic Accreditation Phantom. The phantom is a Lucite block used to simulate X-ray attenuation of a compressed human breast containing details ranging from visible to invisible on a mammographic image.

Figure 18 depicts the overall image quality at each centre assessed in 2014 as an example.



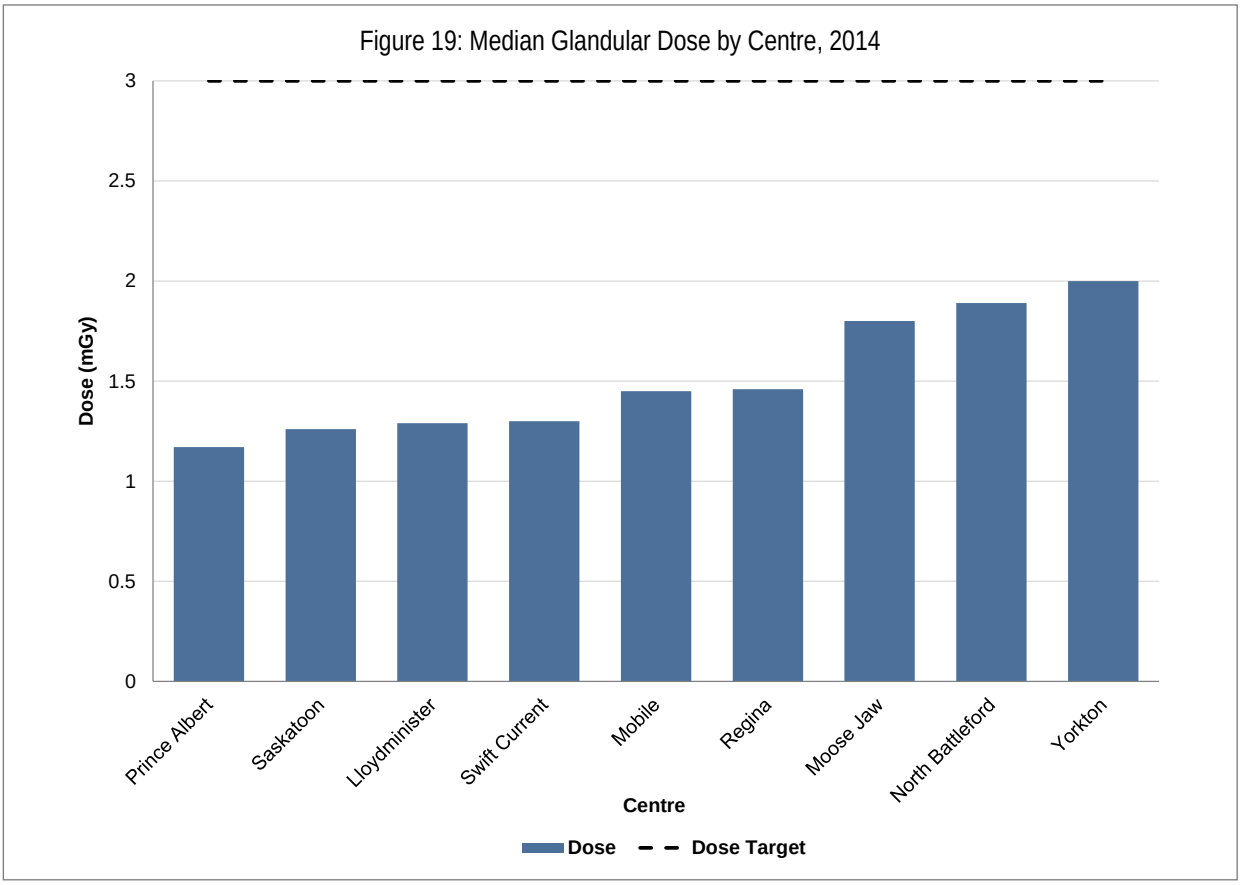
This is determined by the number of fibers, specks and masses identified in the image. A fiber is regarded as visible if it is found at correct orientation and location and at least half of its length is recognized with a performance criteria of ≥ 5. A speck group is regarded as visible if it is found at the correct orientation and location and at least four of its specks are recognized with a performance criteria of ≥ 4. A mass is regarded as visible if it is found at correct location and its circular appearance is recognized with a performance criteria of ≥ 4. In order to pass this performance measure, the total image quality score must be ≥ 13. The total image quality score across all our centres in 2014 was generally above this benchmark.

Keeping Our Clients and Staff Safe

The Screening Program for Breast Cancer has a responsibility to ensure that services meet national safety and accreditation standards for both clients and employees. This is done by keeping a record of the mean glandular dose (MGD[20]; see glossary) on all mammography machines. The acceptable limit for the dose for the phantom is between 3 and 5 mGy. The MGD across all centres has been within these limits (Figure 19: 2014 measurements).

Every mammogram technologist wears a dosimeter during mammograms which records radiation exposure. The dosimeters are sent to Health Canada every quarter. Health Canada maintains a national registry for the dosimeter measurements for all registered Canadian dosimeter users. Screening program technologists have never received any radiation dosage.

Figure 19: Median Glandular Dose by Centre, 2014



Future Direction

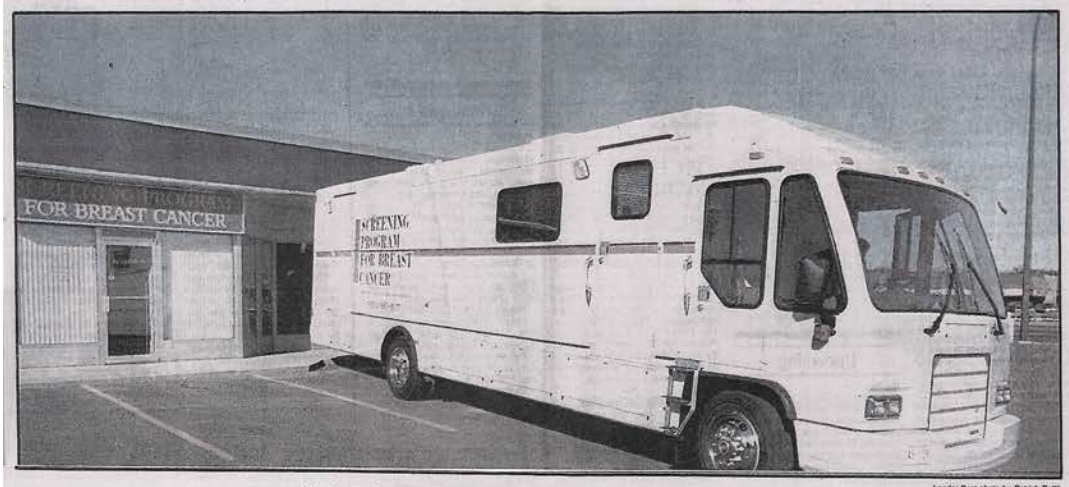
Organized screening programs are designed to optimize benefits for clients.They cover all elements of the screening process (Figure 2). Such organized programs also have the potential to achieve higher participation and retention rates than opportunistic screening. Sustained increases in participation have been shown to decrease mortality due to breast cancer, the goal of screening. Therefore, it is important to monitor screening effectiveness. We recognize that there be will challenges in the future. The program continues to work with screening and assessment partners to improve performance and effectiveness. The following describes some of these challenges which will require strategies for improvement:

- Greater resources and workforce capacity needed to match population growth over succeeding years: Saskatchewan faces a growing elderly population and an increasing number of cancer cases over the coming decade. The eligible screening population has grown from 86,436 in 1990-1991 to 135,531 in 2014-2015. This increasing demographic trend is expected to continue and places a heavy demand on health resources. An analysis of screening workforce capacity and related training opportunities (e.g. technologists, radiologists) to inform planning and policy is needed.
- Reviewing the breast pathway: Studies have shown that sustained participation at 70 per cent for seven to 12 years reduces breast cancer mortality by up to a third[4]. Participation has remained stagnant or has decreased slightly in recent years. A number of factors related to social determinants of health and in the community can influence participation. Initiatives are being developed to better reach women where screening rates are the lowest (e.g. low income groups). Research has shown that referral by a physician also influences participation[21,22]. The screening program is in the process of developing strategies to assist healthcare providers in their practices. We are working on evaluating these and other participation enablers and barriers as part of a review of the breast pathway in Saskatchewan.
- Reduce wait times from abnormal screen to resolution: Timely follow-up of abnormalities identified through screening is required to realize reductions in mortality. The negative implications of failure to appropriately follow-up are substantial. An abnormal result precipitates acute anxiety among women that may persist for several months following the screen. Reducing these wait times will minimize client anxiety[16].
- Plan and implement an integrated health information system: Visits to different providers across the screening process impacts time to diagnosis for clients. The development of an integrated health information system has the potential to reduce wait times, allow better tracking of health changes and aid in evaluating system performance. Such a resource can assist in more effective decision making.
- Apply reliable and effective technologies that could improve program performance: Further evaluation is necessary to determine if digital breast tomosynthesis is feasible as a mammography adjunct.

Appendix 1: The Early Years

Lifestyles

The Leader-Post Regina Mon., Oct. 1, 1990 Section C



The Screening Program for Breast Cancer takes its show on the road

Leader-Post photo by Patrick Pettit

Program started to detect early cancer

By MARGARET HRYNIUK
for The Leader-Post

Jean, a 57-year-old nurse who should know better, had never carried out breast self-examinations and, although she's in the high risk age group, had never had a mammogram. She, like most people, thought cancer couldn't happen to her.

In April, however, she received an invitation to take part in the Screening Program for Breast Cancer, and dutifully went for a mammogram. Her doctor phoned her the same day he received the report: Her mammogram was abnormal. Shortly after, she had an ultrasound and was seen by a surgeon. On June 19, she underwent surgery, which revealed a cluster of benign cysts. She returned home the following day.

"But, given my age and personal and family history, I was sure I had cancer. I count myself lucky," she says, relief still evident in her voice. "And I'm really grateful for the screening program. I'm at fault for not having had a mammogram for the last eight years, but now I've been told to have an examination every year. And I will."

Jean is one of the 2,404 women to participate in the screening program from its official opening — April 30 to the end of August. She is also one of the 223 women whose mammogram was abnormal during that period of time.

Although the Regina statistics are still not complete, it's estimated that 10 per cent of all mammograms will be abnormal. Of these, three per cent will require referral to a surgeon and, of these, 1.5 per cent will have a biopsy. Breast cancer will be found in .5 per cent of those biopsies.

It was such statistics that prompted the formation of this program. In Saskatchewan, 500 women a year develop breast cancer, an increase of 34 per cent from 1977 to 1987. Every year, 156 women die from breast cancer.

Because the only current hope for reducing this mortality rate is early detection, the program was initiated by the Saskatchewan Cancer Foundation, with funding from the Saskatchewan Department of Health, and two pilot projects were officially announced in mid-January of this year.

The first of these projects is the stationary centre in Regina. The bright and stylish office in a strip mall on north Albert Street opened on the last day of Cancer Month — the second one to be established in Canada — and since then the stream of women through the door has exceeded expectations.

During the next two years, all women between the ages of 50 and 69 and living in Regina and within a radius of 44 kilometres will be invited to have a mammogram at the centre. These invitations are sent out according to their hospital services number and, of these, 70 per cent are expected to respond. This translates into 22 women a day but, during every month since the opening, 24 to 36 women a day have attended.

"The response has been just excellent," says Loretta Eberts, previously a registered nurse and director of health promotions for the Department of Health, and now director of the screening program. "And they love the centre."

So they should. Designed in the centre's trademark colors of dusty rose and silver, the upbeat yet comfortable ambience features such non-clinical touches as French doors, floral watercolors by a local artist and the staff's Saskatchewan-made, dusty-rose fashion uniforms.

The visit begins with a brief medical history followed by two videos. To minimize apprehension, each woman is shown a five-minute video on the mammography procedure, and an 18-minute video illustrating breast self-examination. Then the mammogram, described by Eberts as: "A specialized positioning of each breast, and a certain degree of breast compression to allow the X-ray to penetrate. The compression is uncomfortable but it's a momentary discomfort — 20 seconds — and the benefits are life saving."

These X-rays are processed at the centre and read by a radiologist the same or next day. They are pronounced normal or abnormal and, if abnormal, the radiologist's report is sent to the family doctor. The woman receives a report within the week and, if it indicates a normal X-ray, requested to return in two years. Dr. Joan Baldwin, the medical director, spends half a day per week at the clinic, advising, assuring quality and reviewing all follow-up forms from doctors.

"We're very pleased with the results," says Eberts. "We're finding cancers so tiny: pinpoint malignancies which, by the time they grew to a size they could be felt, the woman's chances of survival would be less. Also, the smaller the size, the less vigorous the treatment — probably a lumpectomy, compared to a mastectomy and full chemotherapy or radiation.

"And that's the whole purpose of this program: to find cancers before they're felt."

But this purpose is to find these cancers in women across the province and so, on Sept. 18, the second pilot project was launched: a mobile unit opened its doors in Shellbrooke and, during the next year and a half, will travel to 13 centres in northern Saskatchewan.

"We know that Saskatchewan can support two stationary centres but we don't know the best method of delivery for rural women," explains Eberts. "Although the precedent was set by the TB vans in the '40s, women are much more mobile today, so we shouldn't have to go to each small town. Still, we don't know how far they'll drive."

The 37-foot-long van is wheelchair accessible, completely self-contained and contains the same X-ray machine — " A lovely piece of equipment. Best on the market," says Eberts — as in the stationary unit.

Although women view the breast-examination video in the van's small dusty-rose and silver reception are, the mammogrm video will be shown at meetings conducted by the health promotion co-ordinator a week prior to the van's arrival.

Appointments may be made by phoning the same toll-free number as for the appointments at the stationary unit: 1-800-667-7554. And, as at the stationary unit, women who are not within the project's target population and therefore not individually invited, may also have a mammogram.

Eberts says there is no doubt in her mind that, by 1992, a permanent provincial program will be in place, and all women in the province will be personally invited to participate. Still, there is no place for complacency, she says.

"We really stress the practice of monthly self-examination. The mammogram is not 100 per cent sure. Nevertheless, women in the 50-to-69 age bracket should have one every two years, and those with a family history of breast cancer should be examined by their doctor and have a mammogram annually.

"The statistics on breast cancer are scary: There's no way of preventing it and no real cure. The only hope is early detection. But the postive side of the picture is that now we have a program for this."

Breast Cancer Screening Program

The Facts

- ☑ The incidence of breast cancer continues to increase. In Saskatchewan, between 1977 and 1987, the number of breast cancer cases increased by 34 per cent.
- ☑ Approximately 500 women in the province develop breast cancer each year.
- ☑ Breast cancer is the leading cause of morbidity and mortality from cancer in Saskatchewan women.
- ☑ The average Canadian woman has a one in 10 chance of developing breast cancer in her lifetime.

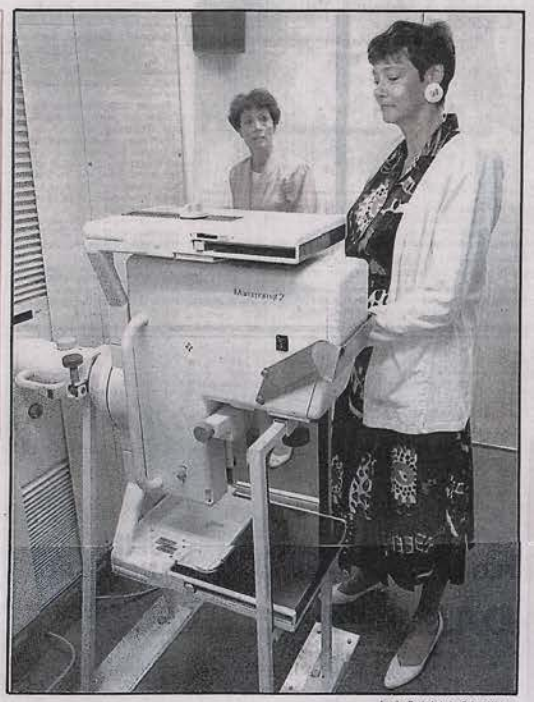
Prevention

- ☑ There is no known way of preventing the development of breast cancer.
- ☑ Early diagnosis is the most effective way of decreasing mortality.
- ☑ Early detection through screening asymptomatic (no breast lumps) women has been shown in international studies to prevent approximately 37 per cent of the deaths from breast cancer in women over the age of 50.
- ☑ Through early detection, the required treatment is less extensive, less invasive, less distressing to the patient and less expensive to the health-care system.

Mammography

- ☑ Mammography is the best method for early detection of breast cancer.
- ☑ It is simple, sensitive, cost-effective.
- ☑ Radiation levels are low so this is no longer a concern.
- ☑ The screening program is only for those women with no signs and symptoms of breast cancer.

Information provided by Dr. Joan Baldwin



Leader-Post photo by Robert Watson

Loretta Eberts (front) and Anita Chorneyko wait for an X-ray

Appendix 2: Mobile Bus Route

Appendix 3: Indicator Definititons, Screening Program Compared with National Targets

The following table compares the screening program's mammography indicators with national targets. These indicators are for screening program centres only and do not reflect all breast cancer screening activity in the province. Performance should be evaluated within this context. The screening program meets or exceeds many targets. This table is adapted from the Quality Determinants of Organized Breast Cancer Screening Programs Report[19].

Indicator	Definition	National Target (ages 50-69)	SPBC Indicator
COVERAGE			
Participation Rate (%) (2014-2015)(1)	Percentage of women who have a screening mammogram (calculated biennially) as a proportion of the eligible population	70% of the eligible population (age 50-69)	40.2%
Retention Rate (%)(3) (2015)	The estimated percentage of women who are rescreened within 30 months of their previous screen) (for rescreens only)	90% re-screened within 30 months (after second screen)	71.9% (rescreen)
FOLLOW-UP			
Abnormal Call Rate (%)(2) (2015)	Percentage of women screened who are referred for further testing because of abnormalities found with a program screen	< 10% (initial)	10.8% (initial)
		< 5% (rescreen)	3.9% (rescreen)
Diagnostic Interval (%)(2) (2015)	Total duration from abnormal screen to resolution of abnormal screen	90% within 5 weeks if no tissue biopsy	94.9% within 5 weeks if no tissue biopsy
		90% within 7 weeks if tissue biopsy	81.2% within 7 weeks if tissue biopsy
QUALITY OF SCREENING			
Positive Predictive Value (%) (2015)(2)	Proportion of abnormal cases with completed follow-up found to have breast cancer (invasive or in situ) after diagnostic workup	5% (initial)	5.2% (initial)
		6% (rescreen)	11.2% (rescreen)
Sensitivity (2015) (%)(2)	The proportion of women with an invasive breast cancer diagnosed after receiving an "abnormal" screening result.	No target set	88.4%
Specificity (2015) (%)(2)	The proportion of women without an invasive breast cancer after receiving a "normal" screening result.	No target set	95.5%
DETECTION			
Invasive Cancer Detection Rate (2015) per 1,000 screens(2)	Number of women detected with invasive cancer during a screening episode per 1,000 women screened	> 5 per 1,000 (initial) > 3 per 1,000 (rescreen)	4.0/1,000 screens (initial)
			3.6/1,000 screens (rescreen)
Cancer Detection Rate (2015) (per 1,000 screens)(2)	Number of women detected with invasive cancer or ductal carcinoma in situ during a screening episode per 1,000 women screened	Surveillance and monitoring purposes only	5.6/1,000 screens (initial)
			4.4/1,000 screens (rescreen)

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2. Canadian Partnership Against Cancer (CPAC). Report from the Evaluation Indicators Working Group: Guidelines for Monitoring Breast Cancer Screening Program Performance, 3rd Edition. 2013.
3. Ontario Breast Screening Program 2011 Report.

Glossary of Terms

Abnormal Call Rate
The percentage of women screened who are referred for further testing because of abnormalities found with a program screen.

Cancer Detection Rate
The number of women with a screen-detected breast cancer per 1,000 women screened.

Definitive Diagnosis
Definitive diagnosis of cancer is the first core or open surgical biopsy that confirms cancer. In rare occasions, fine needle aspiration (FNA) biopsy may also be used to definitively diagnose cancer. Definitive diagnosis of benign cases is the last benign test up to six months following an abnormal screen.

Diagnostic Interval
The total duration from abnormal screen to resolution of abnormal screen.

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 (or First) Screen
The first screening mammogram provided to a woman by the breast cancer screening program.

Interval Cancer
Any invasive breast cancer diagnosed in the interval following a normal screening result and before the next scheduled screening examination.

Invasive Cancer
The uncontrolled growth of cells resulting in the formation of a malignant tumour that invades underlying tissues.

Median
The mid-point in a set of data or measurements. The median is calculated by arranging the data in numerical order and finding the mid-point.

Normal Screening Episode
A screening episode that concludes with normal (non-cancer) findings. This includes both a normal screening mammogram and an abnormal screening mammogram with a normal (non-cancer) finding.

Participation Rate
The percentage of women who have a screening mammogram (calculated biennially) as a proportion of the eligible population. The eligible population consists of women aged 50-69 who do not have breast cancer.

Glossary of Terms

Positive Predictive Value
Percent of abnormal cases found to have breast cancer after diagnostic work-up.

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

Rescreen
Screens subsequent to the initial (first) screen with the program. This includes women who return after missing a scheduled round of screening.

Screen (or Program)-Detected Cancer
Cancer detected as a result of a positive (abnormal) test with histologic confirmation attributed to the screening findings of the program within six months of screen.

Sensitivity
The proportion of women with an invasive breast cancer diagnosed after receiving an abnormal screening result.

Specificity
The proportion of women without an invasive breast cancer after receiving a “normal” screening result.

Staging
The process of identifying the extent of cancer involvement. It is a way of describing the size of the tumour; the extent of spread locally; the extent of spread to the lymph nodes; and whether or not the disease has spread to other parts of the body.

TNM
A system used to stage tumours consisting of three components: tumour size (T), spread to regional lymph nodes (N), and metastasis (M).

Tissue Biopsy
A biopsy which provides breast tissue for histopathologic examination (does not refer to fine-needle aspiration biopsy which provides only cells). Includes both core and open biopsies.

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