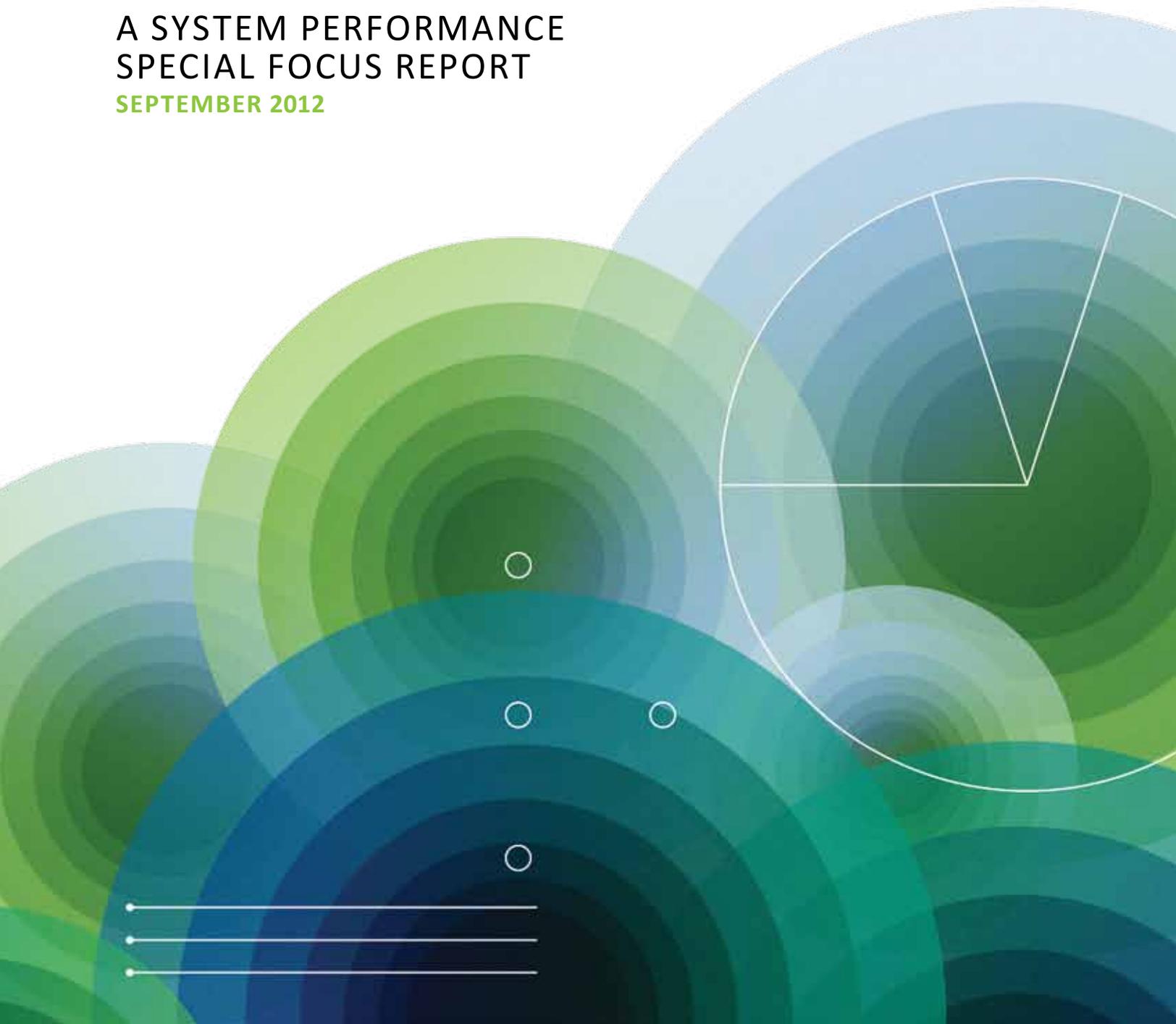# Breast Cancer Control in Canada

A SYSTEM PERFORMANCE SPECIAL FOCUS REPORT

SEPTEMBER 2012

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About the Partnership and System Performance Measurement

The Canadian Partnership Against Cancer (the Partnership) is an independent organization funded by the federal government to accelerate action on cancer control for all Canadians. Bringing together cancer experts, government representatives, the Canadian Cancer Society and cancer patients, survivors and their families to implement the first pan-Canadian cancer control strategy, the vision is to be a driving force to achieve a focused approach that will help prevent cancer, enhance the quality of life of those affected by cancer, lessen the likelihood of dying from cancer, and increase the efficiency of cancer control in Canada.

In support of this vision, one of the Partnership's key mandates is to measure and report on the quality of cancer control across the country. The Partnership has identified System Performance Analysis and Reporting as one of its core enabling functions for its new five-year mandate (2012 to 2017) and has developed a multi-faceted plan for advancing the understanding of cancer system performance in Canada and ultimately stimulating efforts to increase the effectiveness and efficiency of the cancer control system.

CANADIAN **PARTNERSHIP** AGAINST **CANCER**   **PARTENARIAT** CANADIEN CONTRE LE **CANCER**

About this Report

Considerable advances in breast cancer control, including improvements in screening and early detection, as well as diagnosis and treatment, have led to a reduction in the mortality rate for women diagnosed with breast cancer. In spite of these important successes, breast cancer remains the most common cancer diagnosed and the second-leading cause of cancer death among Canadian women. Breast cancer places a substantial burden on individual women and has a considerable impact on the delivery of health care in Canada.

This report presents and discusses a broad range of system performance measures assessing Canadian breast cancer control across the continuum. Previous system performance reports have featured colorectal cancer (in 2010) and lung cancer (in 2011). The decision to produce a system performance report on breast cancer in 2012 was influenced by a number of factors including: the heavy burden the disease places on Canadian women, the availability of data for measurement (e.g., population-level staging, diagnosis and treatment wait times, surgical rates, etc.), and the broad scope and range of disease control modalities (chemo-prevention, organized screening, genetic testing, hormone therapy, etc.). The report includes indicators of prevention, screening, diagnosis, treatment, research, long-term outcomes, and the patient experience throughout the breast cancer journey. Measures presented for the first time on a pan-Canadian level include stage distribution, biomarker testing patterns, mastectomy rates, and chemotherapy utilization.

The report is not intended to be a comprehensive review of the state of breast cancer control in Canada; its primary objective is to present indicator results where pan-Canadian data currently exist and signal opportunities for future measurement. The indicator results are compared by province and by territory (where data are available) and across a number of relevant demographic and socio-economic groupings. The measures are designed to identify potential gaps and to inform improvements in breast cancer control across the country.

The primary target audience for this report includes:

- provincial cancer authorities as they identify opportunities for advancing policy, planning, funding, and the development of quality standards and guidelines;

- clinicians and related professional groups as they examine local practice patterns and adherence to evidence-based guidelines;

- health services researchers as they identify opportunities for research; and

- breast cancer patients and survivors and their families as they inform themselves and advocate for patient-centred and supportive care that adheres to recognized best practices.

This report is the result of a multi-partner collaborative effort.

Evidence-based planning, management, and policy development have for some time been the standard for advancing Canada's health care system. While each province and territory is responsible for planning and funding cancer service delivery within its jurisdiction, national collaboration promotes the sharing of best practices, which in turn allows for the achievement of significant advances in quality across the country.

The indicators presented in this report are the result of a collaborative effort of a number of partners at the national and provincial and territorial levels. Consultations with a broad range of experts and knowledge leaders in the field of cancer control also informed the work.

At the provincial level, cancer agencies and programs provided detailed data on screening, diagnosis, treatment, research, and the patient experience to assist with the calculation of many indicators in this report. Detailed data specifications and calculation methodologies were developed and used in the production of provincial cancer agency data to ensure consistency and comparability.

At the national level, the Partnership worked closely with Statistics Canada as the survey administrator and data steward for the Canadian Community Health Survey (CCHS); the report uses CCHS information on health status, health-care utilization and health determinants for the Canadian population. Statistics Canada also maintains the Canadian Cancer Registry, which was used to generate key measures of long-term outcomes such as cancer incidence, mortality and survival, based on data submissions from the 13 provincial and territorial cancer registries. The Partnership worked with the Canadian Institute for Health Information (CIHI) in developing indicators related to cancer

surgery. The Canadian Breast Cancer Screening Initiative (CBCSI) provided information on breast cancer screening practices from organized provincial programs offering mammography.

An Editorial Panel of national cancer control experts oversaw the production of this report. A list of panel members is provided on the inside cover. Also guiding the overall work of the System Performance Initiative is the System Performance Steering Committee and Technical Working Group, each comprising representatives from all 10 provinces. Appendix I provides a list of the members of both groups.

How this report is organized.

The report is organized into seven sections (in addition to the *Introduction* and *Conclusions*). The first section provides key indicators describing the *burden of disease and long-term outcomes*. The next four sections present indicators addressing components of breast cancer control that have a direct impact on patients, and which largely reside within the formal cancer care delivery system: *Screening, Diagnosis, Treatment, and Patient Experience, Survivorship, and End-of-Life Care*. The sixth section addresses *Prevention*, which relates to the total population. The last section addresses breast cancer *Research*. The *Conclusion* summarizes key findings and steps needed to support further development of indicators and the ability to assess progress being made within the Canadian cancer system.

The indicator results are provided graphically in charts or tables with brief discussions of the results and implications of the findings in the context of the scientific literature. Boxes highlight supplementary information. A glossary defines of key terms. An online technical appendix provides information on indicator data sources and limitations, along with other details on indicator calculations.

Breast Cancer Burden and Outcomes

SECTION ONE

Breast Cancer Burden and Outcomes

Although the mortality rate for breast cancer is declining in Canada, the disease is the leading type of cancer among women, accounting for more than 25% of new cancer cases and 14% of cancer deaths.

Breast cancer is the most common cancer among Canadian women,[a] accounting for more than one-quarter (25.6%) of new female cancer cases in 2012.[1] The incidence of breast cancer[b] has remained stable in Canada from 1992 to 2007 at approximately 100 cases per 100,000 females (Figure 1.1). Data from the United States show a levelling off of incidence rates from 2004 to 2008, after a period of decline (from 1999 to 2004).[2]

Breast cancer mortality rates have been declining in Canada. In 2007, the age-standardized mortality rate was 21.7 deaths per 100,000, a decline from 30.4 per 100,000 in 1992 (Figure 1.1). A decline in breast cancer mortality has also been noted in the United States,[2] Australia and the United Kingdom.[3] Widespread adoption of mammography screening[4] and increased use of effective adjuvant therapies[5] are thought to be largely responsible for these observed mortality trends.

Age-standardized incidence and mortality rates of breast cancer in women, Canada – 1992 to 2007

Rate per 100,000 Population   Incidence   Mortality
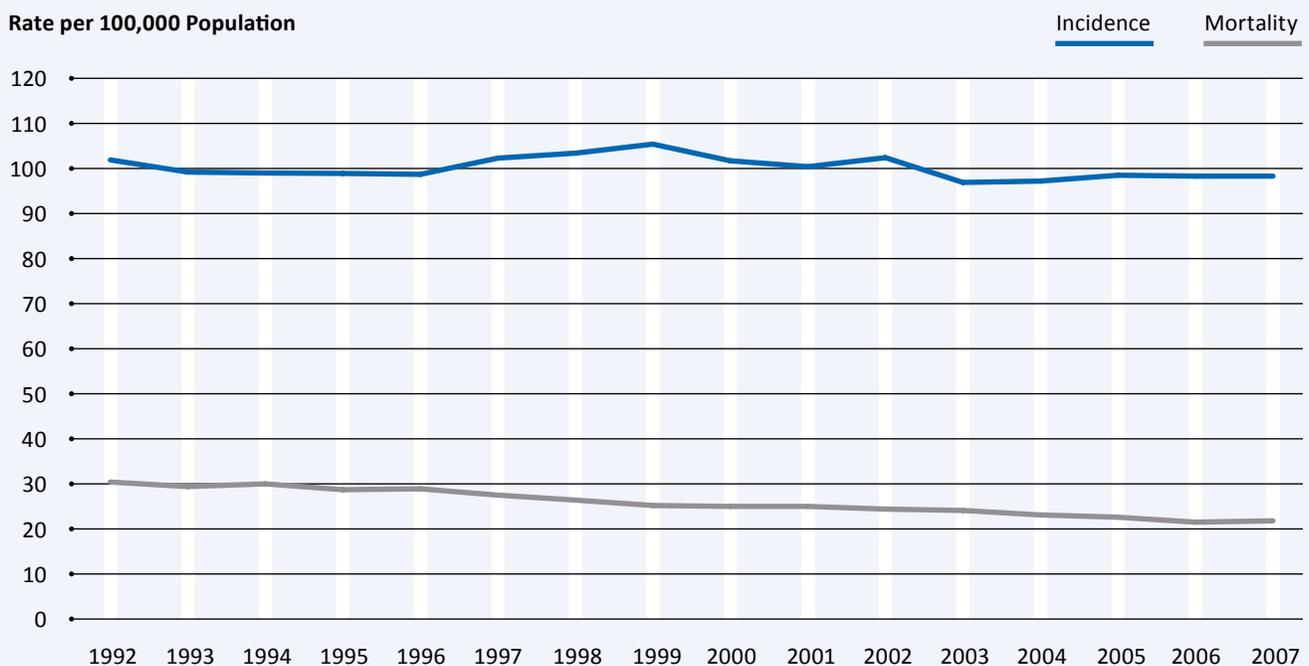
Data source: Statistics Canada – Canadian Cancer Registry, Vital Statistics Death Database.

There are variations in the incidence and mortality rates of invasive breast cancer across provinces and territories. The age-standardized incidence rate of breast cancer ranged from 64.6 per 100,000 in Nunavut to 100.6 per 100,000 in Ontario (Figure 1.2). During this period, the age-standardized breast cancer mortality rate ranged from 16.4 deaths per 100,000 in Nunavut to 22.8 deaths per 100,000 in Manitoba (Figure 1.3).

a) Although breast cancer does occur in men, it accounts for less than 1% of breast cancer cases in Canada. This report focuses on breast cancer in Canadian women.

b) This section examines incidence and mortality rates for invasive breast cancer only. In situ carcinomas are addressed in a separate section.

FIGURE 1.2

Age-standardized incidence rates of breast cancer (3-year average) in women, by province/territory – 2007 to 2009

Rate per 100,000 Population

Province/Territory	Rate
NU	64.6
NL	87.3
NT	92.0
PE	92.7
YT	93.0
BC	94.4
NB	95.5
AB	95.5
SK	97.7
CANADA	98.6
NS	98.8
MB	99.0
QC	100.3
ON	100.6
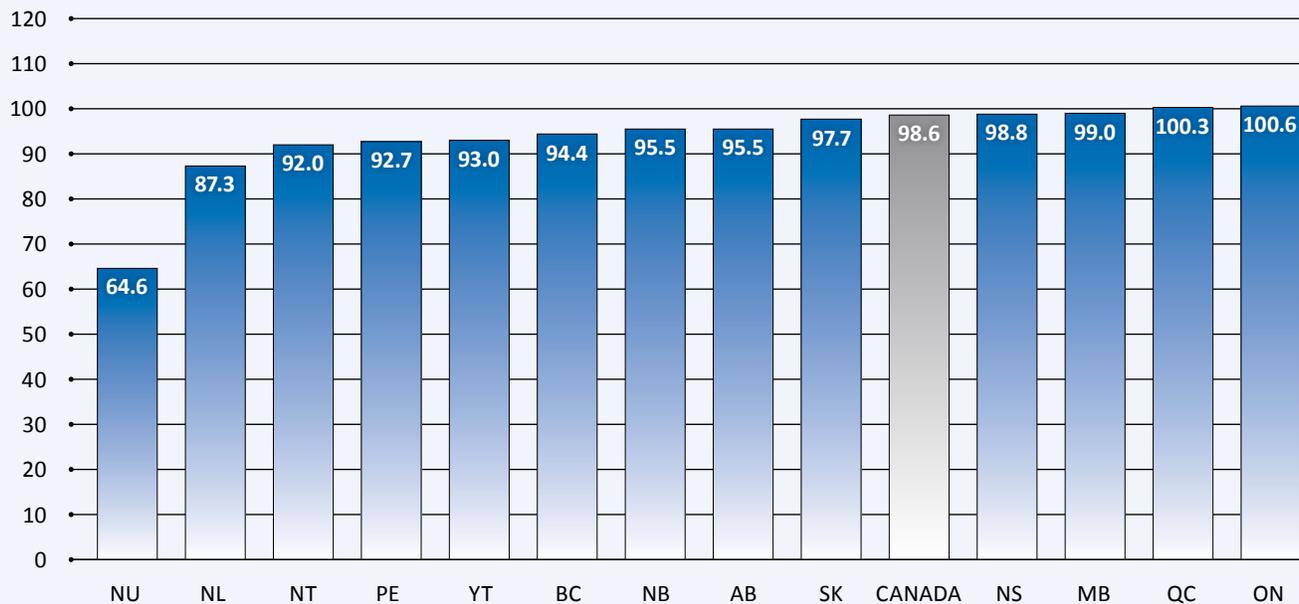
Note: Data for QC are for 2007. Age-standardized incidence rates for the territories were estimated based on the 5-year average from 2005 to 2009.

Data source: Statistics Canada – Canadian Cancer Registry.

FIGURE 1.3

Age-standardized mortality rates of breast cancer (3-year average) in women, by province/territory – 2007 to 2009

Rate per 100,000 Population

Province/Territory	Rate
NU	16.4
YT	18.0
BC	18.7
NB	19.8
AB	19.9
SK	20.1
NT	20.4
NS	20.6
NL	20.6
CANADA	21.0
ON	21.2
PE	22.1
QC	22.6
MB	22.8
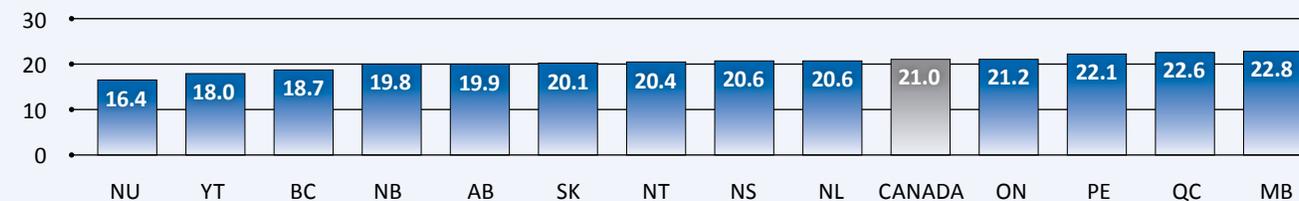
Note: Age-standardized mortality rates for the territories were estimated by the 5-year average from 2005 to 2009.

Data source: Statistics Canada – Vital Statistics Death Database.

Incidence rates of breast cancer are higher among women living in the highest-income neighbourhoods and in urban areas of Canada, while there is little variation in mortality by these factors.

Women living in the highest-income neighbourhoods in 2007 had significantly higher breast cancer incidence rates than women living in the lowest-income neighbourhoods. In addition, women living in urban areas had higher incidence rates than women residing in rural and remote areas of Canada (Figure 1.4).

The finding of higher rates of breast cancer among women living in high-income neighbourhoods is consistent with a Canadian study using data from 1992 to 2004.[6,7]

The Canadian data, however, show little variation in breast cancer mortality by neighbourhood income quintile and urban versus rural residence (data not shown). Differences across socio-economic groups and geographical regions in cancer screening uptake or in risk factor distribution may partly explain the association between breast cancer incidence and neighbourhood income and geography.[7,8]

FIGURE 1.4

Age-standardized incidence rates of breast cancer, by income quintile and geography, Canada – 2007

Rate per 100,000 Population
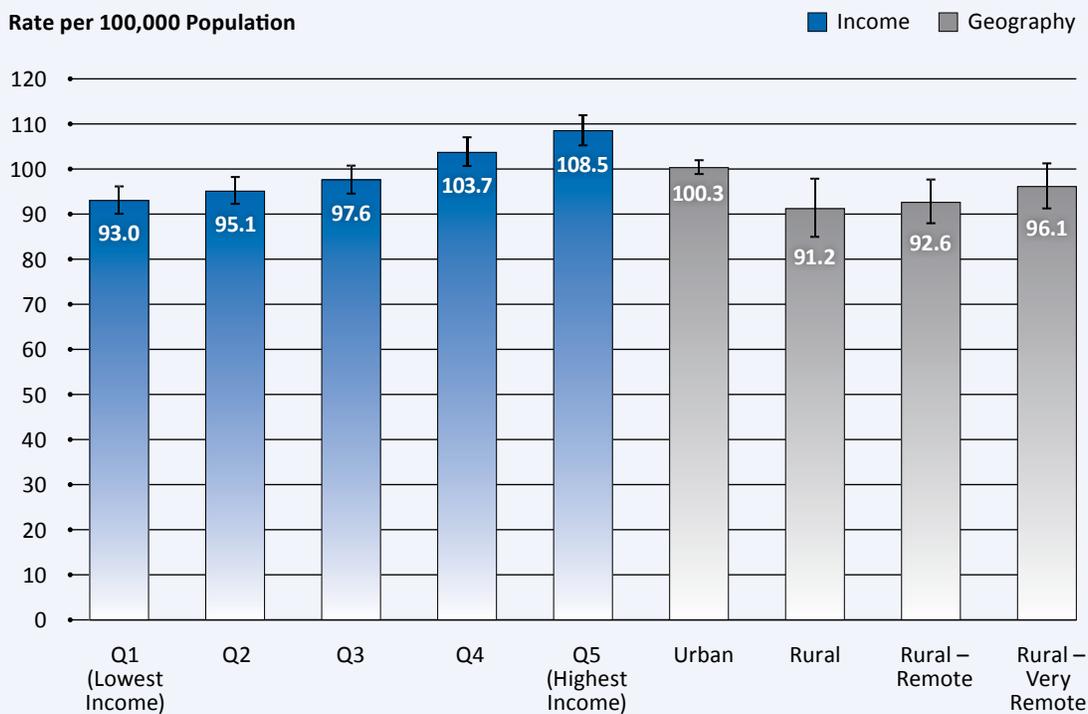
Income · Geography

95% confidence intervals are indicated on figure.

Data source: Statistics Canada – Canadian Cancer Registry.

The five-year relative survival ratio for breast cancer increased to 87% in 2005 to 2007 from 82% in 1992 to 1994.

Relative survival statistics are an important indicator of the cancer system's effectiveness in detecting and treating cancer.[9] Relative survival statistics are also useful to both clinicians and to people diagnosed with cancer, who often want to be informed of their chance of survival.[10] Five-year relative survival rates are an estimate of projected survival and are presented as the probability of surviving five years following a diagnosis of cancer.

For women diagnosed with invasive breast cancer in the period from 2005 to 2007, the five-year relative survival rate was 87.1% in Canada.

The five-year relative survival rate for breast cancer increased in all age groups from 1992 to 1994 and 2005 to 2007, particularly in the youngest age group examined (15 to 39 years) (Figure 1.5). In both periods, five-year relative survival was lowest among women aged 15 to 39, possibly reflecting the more aggressive nature of breast cancer tumours in premenopausal women.

FIGURE 1.5

Five-year relative survival for breast cancer in women, by age group, Canada – 1992 to 1994 and 2005 to 2007
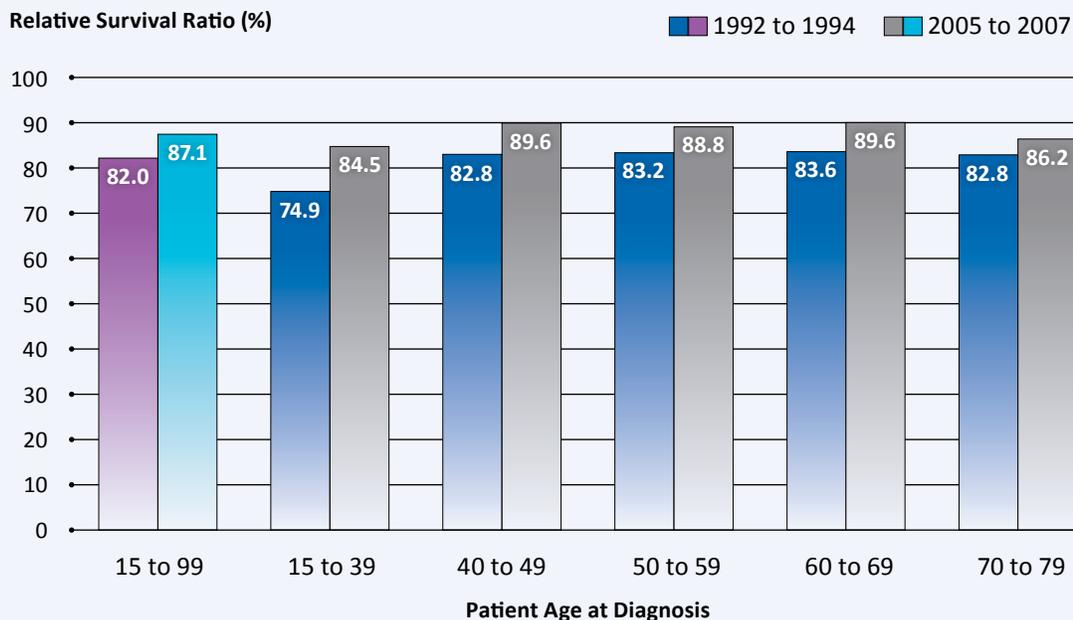
Relative Survival Ratio (%)

Legend: 1992 to 1994, 2005 to 2007

Patient Age at Diagnosis	1992 to 1994	2005 to 2007
15 to 99	82.0	87.1
15 to 39	74.9	84.5
40 to 49	82.8	89.6
50 to 59	83.2	88.8
60 to 69	83.6	89.6
70 to 79	82.8	86.2

Data source: Statistics Canada – Canadian Cancer Registry, Vital Statistics Death Database.

In both periods, five-year relative survival was lowest among women aged 15 to 39, possibly reflecting the more aggressive nature of breast cancer tumours in premenopausal women.

Breast cancer survival varies by neighbourhood income quintile, with women living in the highest-income neighbourhoods having better survival than women living in the lowest-income neighbourhoods.

Higher breast cancer survival has been observed among women of high socio-economic status compared with women of low socio-economic status.[11,12] This association has been shown to persist after controlling for certain tumour characteristics and treatment patterns[11] and may be largely explained by lower uptake of screening in lower-income women with resulting later stage disease at presentation.[12,13] Data from Canada show a 4.5 percentage point difference in the five-year relative survival for breast cancer between women living in neighbourhoods with the lowest and those living in the highest income quintiles (Table 1.1). Thus, while women living in high-income neighbourhoods experience a higher incidence of breast cancer than women in low-income neighbourhoods, the relative survival for women with breast cancer living in higher-income neighbourhoods is better than that for those living in low-income neighbourhoods.

TABLE 1.1

Relative breast cancer survival, by socio-economic status[c]

Time since diagnosis	Difference in survival between highest and lowest income quintile (percentage points)
1 year	1.5
2 years	2.8
3 years	3.6
4 years	4.2
5 years	4.5

The relative survival for women with breast cancer living in higher income neighbourhoods is better than that for those living in low-income neighbourhoods.

c) Both survival data and base life tables used for this analysis were available by socioeconomic status.

A look at some cancer subtypes

The vast majority of invasive breast cancers are of two histological types – ductal and lobular carcinoma – and these two subtypes show contrasting incidence patterns and age distribution.

Invasive ductal and lobular carcinomas are the two most common histological types of breast cancer. In 2007 in Canada, ductal carcinoma accounted for approximately 70% of all new invasive breast cancers and lobular carcinoma accounted for about 8% of all invasive breast cancers. These two invasive subtypes differ with respect to their clinical, molecular and pathological features. A growing body of research has linked the use of hormone replacement therapy (HRT) –

specifically combined estrogen and progesterone HRT – to an increased risk of lobular carcinoma but not ductal carcinoma.[14] Evidence of the risks associated with HRT that was widely publicized in 2002 led many women to discontinue HRT for menopausal symptom relief.[15]

As shown in Figure 1.6, the age-standardized incidence rate of ductal carcinoma has increased slightly in Canada, particularly during the mid- to late 1990s. In contrast, the incidence of lobular carcinoma has decreased slightly in Canada. In the United States, the age-standardized incidence of lobular and ductal carcinoma decreased from 1999 to 2004 by an average of 4.6% and 3.3% per year, respectively.

FIGURE 1.6

Age-standardized incidence rates of ductal and lobular breast cancer in women, Canada – 1992 to 2007

Rate per 100,000 Population
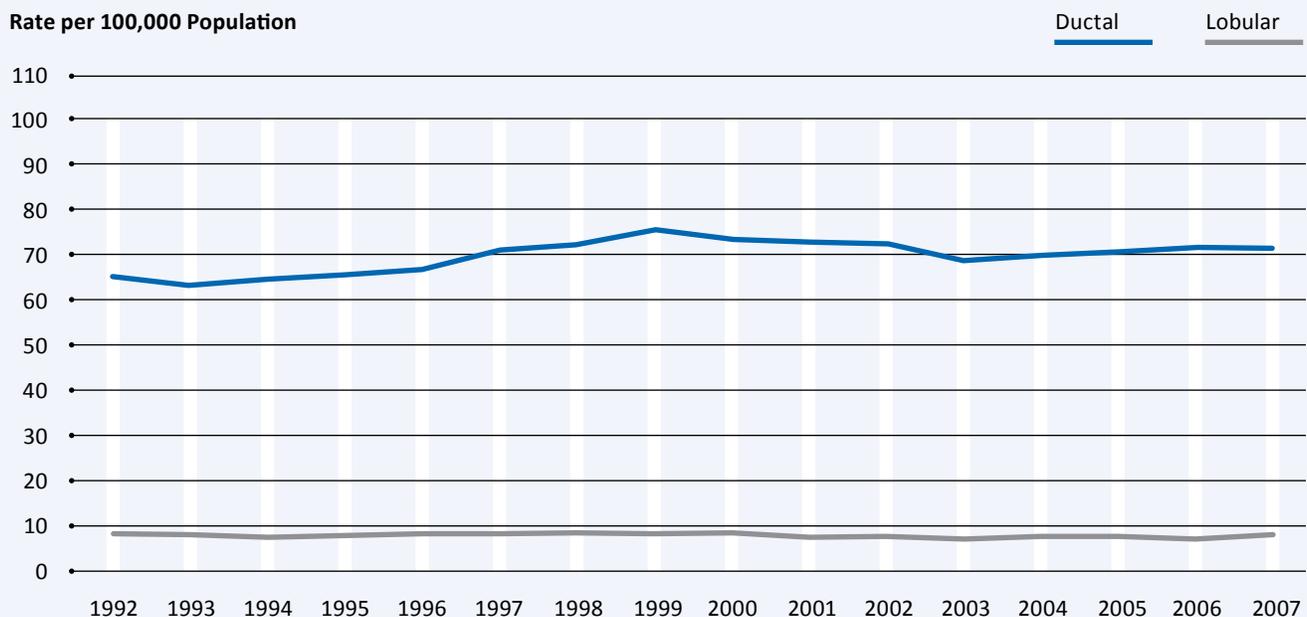
Ductal   Lobular

Data source: Statistics Canada – Canadian Cancer Registry.

The proportion of invasive breast cancers with a ductal histology increased from 63.6% in 1992 to 71.6% in 2007. The proportion of invasive breast cancer with a lobular histology remained relatively stable throughout this period at about 8% (data not shown). Diagnosis of lobular versus ductal carcinoma varied by age group. A diagnosis of ductal carcinoma was made more often among women younger than age 50 than in women 50 and older (77% versus 70%). In contrast, a diagnosis of lobular carcinoma was more common among women aged 50 and older than in women under 50 (8% versus 5%) (data not shown). Similar findings of a relationship between age and breast tumour histology have been observed in the United States.[16]

Ductal carcinoma in situ (DCIS) is the most common type of non-invasive breast cancer in women. Because DCIS is usually detected by mammography and more women are receiving regular mammograms, the incidence of DCIS has increased in Canada.

A diagnosis of DCIS increases a woman's risk of subsequently developing an invasive breast cancer.[17] DCIS is usually detected during screening mammography and because the use of screening has increased with the advent of widespread population-based screening programs, the incidence of DCIS has also increased. Data from Canada show that in 2007, the age-standardized incidence of DCIS was 13.0 per 100,000, an increase from 6.3 per 100,000 in 1992 (Figure 1.7). Data from the United States also show an increase in the incidence of DCIS. From 1983 to 2003, there was a 500% increase in DCIS incidence among women 50 years and older, with incidence starting to decline in 2003.[18] Among women younger than 50, there was a 290% increase in DCIS incidence, with incidence continuing to rise through 2006.[18]

Mortality from subsequent invasive breast cancer is relatively low among women initially diagnosed with DCIS. In a U.S. study using population-based data from the U.S. Surveillance Epidemiology and End Results (SEER), of the 7,072 women diagnosed with DCIS between 1978 and 1989 (and who had no previous breast cancer) 0.9% died from subsequent breast cancer within five years and 2.3% died within 10 years. This compares to five- and 10-year mortality rates of 7.3% and 14.2%, respectively, for all women with localized breast cancer (based on the SEER data).[19]

Data from Canada show that in 2007, the age-standardized incidence of DCIS was 13.0 per 100,000, an increase from 6.3 per 100,000 in 1992.

FIGURE 1.7

Age-standardized incidence rates of ductal carcinoma in situ (DCIS) in women, Canada – 1992 to 2007

Rate per 100,000 Population
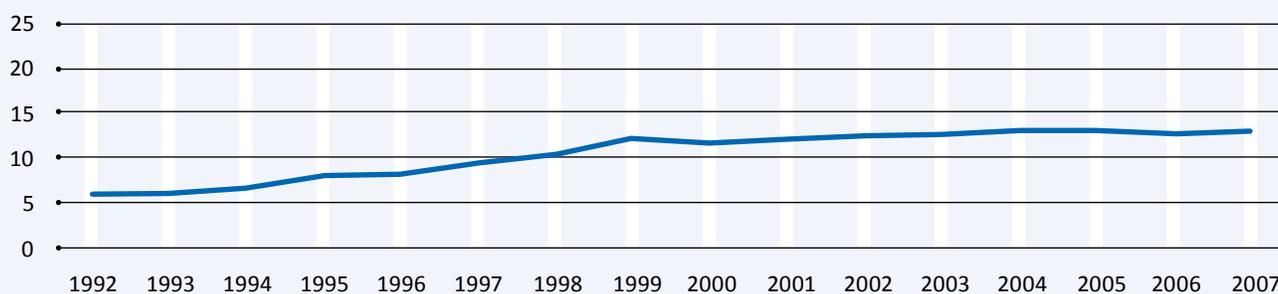
Note: ON is excluded.

Data source: Statistics Canada – Canadian Cancer Registry.

Conclusion

Although fewer Canadian women are dying from breast cancer than in the past, breast cancer continues to represent a significant burden. Early detection of breast cancer through screening and access to state-of-the art therapies can help further reduce the number of deaths from this disease and improve survival. Breast cancer incidence is one of the few health measures associated with a higher socio-economic status, with data from Canada showing an elevated risk of breast cancer among women living in neighbourhoods in the highest-income quintile. Because mortality from invasive breast cancer does not follow the same patterns by socio-economic status as does incidence (i.e., mortality rates are not statistically different across income groups), this suggests higher income women are being diagnosed with lower risk cancers (possibly due to higher screening rates in that group).

Breast Cancer Screening

SECTION TWO

Breast Cancer Screening

Screening for breast cancer is an established public health intervention.

This section examines breast cancer screening rates and how they vary by a woman's age, residence and socio-economic status. Evidence of the benefits of screening for breast cancer emerged in the 1980s following the publication of clinical trial results showing a significant reduction in deaths from breast cancer among women who had been randomized to a screening intervention relative to those receiving usual care.[20–26] In the wake of this evidence, organized breast cancer screening programs were established across Canada with the goal of identifying the disease early in asymptomatic women. Currently, all provinces and territories except Nunavut offer organized screening programs. As a result of these efforts, screening for breast cancer has become one of the most widely adopted public health interventions to help reduce the burden of cancer.

In Canada, women can be screened for cancer through an organized provincial or territorial screening program or undergo mammography at clinics outside the organized programs when referred by a physician.

Participation in organized screening programs varies by province

Organized breast screening programs are those that contact women in the target age group by mail, conduct mammograms in designated facilities, arrange for any necessary follow-up testing, recall women to screening when appropriate and have comprehensive quality assurance and outcome monitoring programs.[27] All provincial and territorial breast screening programs target women aged 50 to 69 at average risk of breast cancer and offer biennial mammograms (Ontario offers screening for average risk women 50 to 74 years of age). In addition, many jurisdictions provide program screening to women aged 40 to 49 and 70 years and older (but do not actively target women in these age groups); some programs require a physician's referral in these age groups. Appendix II includes a table that compares the key attributes of provincial and territorial screening programs operating across Canada.

Figure 2.1 shows the percentage of the target population screened by each organized provincial screening program (known as the organized program participation rate) for the latest available period (varying between 2008 and 2010). These rates range from 6% in Alberta to 56% in Quebec. The participation rate for Alberta is based only on the women screened through the Screen Test Program, an organized program that conducts approximately 10% to 12% of screening mammograms in the province, of which 65% are performed in mobile units in rural areas. Also shown in Figure 2.1 is the contribution of screening by the Alberta Society of Radiologists (ASR), which when included, brings the overall screening participation rate in Alberta to 57.3%.

In 2006, the Canadian Breast Cancer Screening Initiative (CBCSI) established a set of measures and targets that could be used to monitor and evaluate the performance of organized breast cancer screening programs in Canada.[d] Because adequate participation in organized breast screening is necessary for programs to be successful in reducing mortality from breast cancer, Canadian programs have set a target participation rate of 70% for women aged 50 to 69 over a two-year period.[28] As shown in Figure 2.1, screening within these organized programs fell well below this target in 2009 to 2010. Over the past few years, the organized program participation rates have been rising in several provinces while plateauing in others (based on comparisons with participation rates from 2005 and 2006 from the Public Health Agency of Canada).[29]

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d) The Canadian Breast Cancer Screening Initiative (CBCSI) is a federal program financed by the Public Health Agency of Canada. The objectives of the CBCSI are to foster the development of quality organized screening programs in Canada, facilitate the use of best practices in screening and assessment, assess screening in Canada against a set of recognized criteria, and monitor performance of organized screening programs.

FIGURE 2.1

Percentage of women (aged 50 to 69) who participated in an organized breast cancer screening program in the past 2 years, by province – 2009 to 2010

Percent (%)

■ Percent ■ Additional Percent

Province	Percent	Additional Percent
QC	56.4	
MB	56.2	
NB	56.1	
NS	55.4	
BC	50.8	
ON	46.4	
SK	46.0	
NL	39.2	
AB*	6.0	51.3
PE	—	
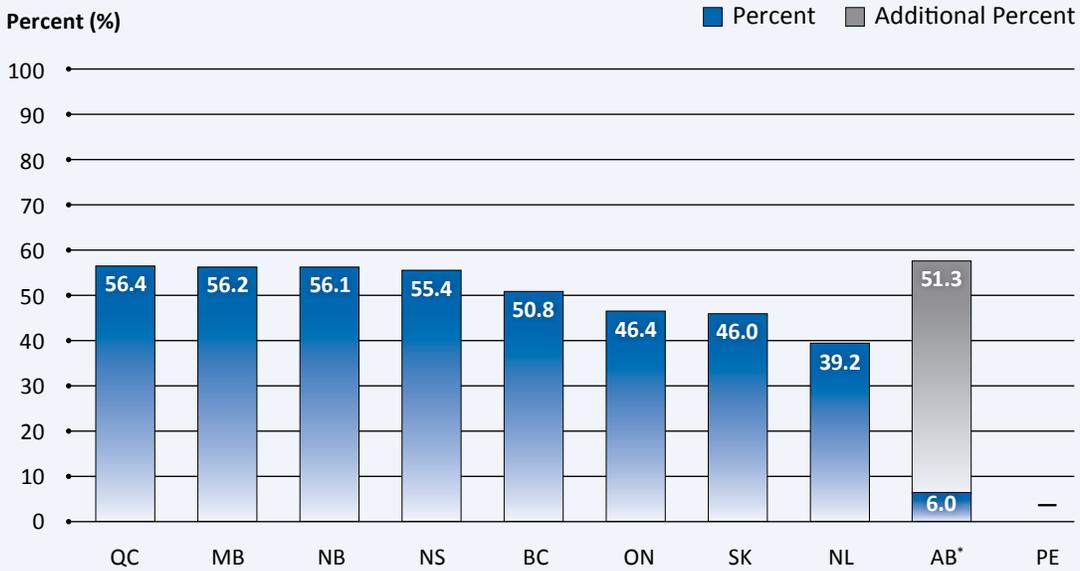
Notes: Data from MB are for 2008 to 2010. Data from QC are for 2009. Data from ON are for 2008 to 2009.

*In Alberta, the participation rate of 6% is for the Screen Test Program. Also shown on the graph is the contribution of screening by the Alberta Society of Radiologists (ASR), which brings the overall participation rate to 57.3% in 2009 to 2010.

"—" Data for PE are not available.

Data source: Provincial breast cancer screening programs.

Survey-based self-reported data suggest overall breast screening rates of above 70%.

Overall breast cancer screening can be estimated from self-reported data derived from the Canadian Community Health Survey.[e] See Box 2.1 for a description of a study comparing participation in programmatic breast cancer screening and screening conducted outside an organized program with self-reported screening rates from the CCHS. In 2008 (the latest year for which survey data are available), 72% of Canadian women aged 50 to 69 eligible for screening reported having had a screening mammogram in the past two years. Self-reported screening

rates ranged from 58% in Prince Edward Island to 75% in New Brunswick (Figure 2.2).

Comparison of the average self-reported screening rate of 72.4% with the programmatic participation rate of roughly 50% (with wide provincial variation) suggests that non-programmatic screening, or opportunistic screening, accounts for an average of approximately 30% of all screening. If non-programmatic screening is taken into account, the target of 70% is reached in the majority of provinces. However, data on follow-up and on other elements of quality for screening outside organized programs were not available for this report.

FIGURE 2.2

Percentage of eligible women (aged 50 to 69) reporting a screening mammogram in the past 2 years, by province/territory – CCHS 2008

Percent (%)

Note: A woman was deemed 'eligible' for screening mammography if her reason for undergoing mammography was NOT one of the following: to investigate a previously detected lump or breast problem, or as a follow-up to breast cancer treatment.

*Suppressed due to statistical unreliability caused by small numbers.
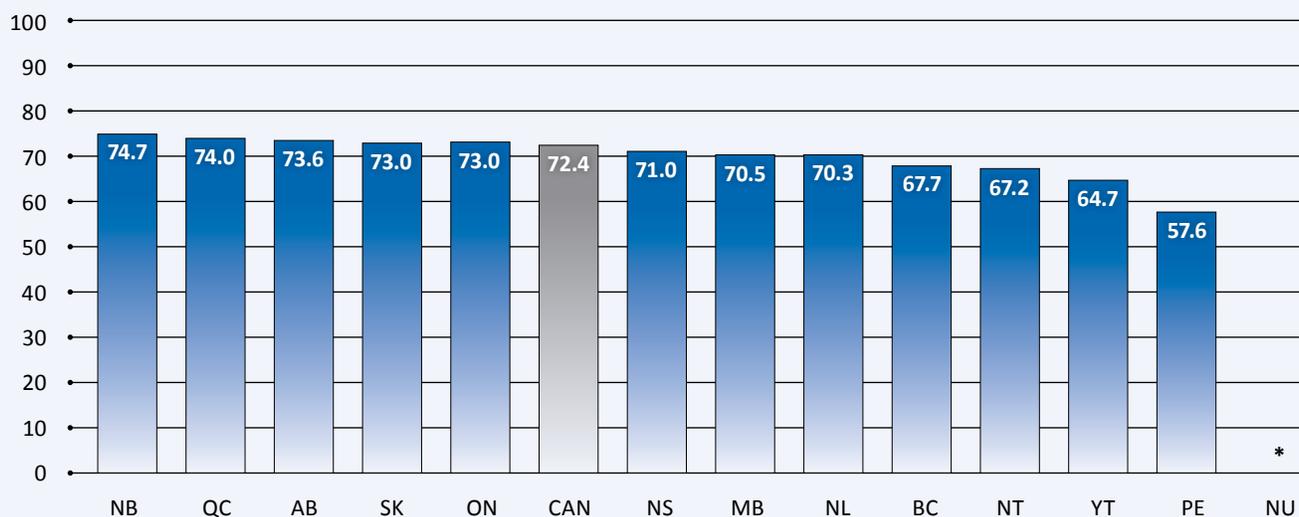
Data source: Statistics Canada, Canadian Community Health Survey.

e) The CCHS includes questions on mammography use that allow one to determine whether the mammogram was for screening or diagnosis and whether mammography was limited to asymptomatic women. A woman was deemed asymptomatic if her reason for undergoing mammography was not among the following: to investigate a lump or breast problem, as a follow-up to breast cancer treatment or any reason other than family history, routine screening or checkup, age or HRT use.

Self-reported breast cancer screening rates in the CCHS closely approximate screening taking place within organized programs and opportunistically

A working group convened by the Canadian Partnership Against Cancer estimated an overall mammography utilization rate that included reports from both organized and opportunistic screening.[30] Information on opportunistic screening was obtained using fee-for-service claims by physicians for mammography services. The group found that estimates of overall breast cancer screening were comparable to those based on self-reports by women from national surveys. This comparability supports the use of administrative data from the screening programs and self-reported data from the CCHS.

TABLE 2.1

Self-reported screening mammogram and overall utilization among women aged 50 to 69, by province adapted from Doyle, et al., 2011.[30]

Province	Self-reported screening mammogram in past 2 years,* percent	Overall mammography utilization, §2 years, percent
CAN	62.5%	63.1%
BC	60.1%	60.0%
AB	64.0%	62.8%
SK	63.7%	60.9%
MB	56.1%	63.7%
ON	62.7%	63.5%
QC	64.3%	64.6%
NL	61.5%	63.9%

*2008 Canadian Community Health Survey.

§ Based on reports of screening from fee-for-service claims by physicians and organized provincial programs for calendar years 2005 and 2006.

Differences in 2008 CCHS rates reported by Doyle et al. and in Figure 2.2 reflect differences in methodologies used. Figure 2.2 reports on the percentage of *eligible* women reporting a screening mammogram; that is, women reporting undergoing a mammogram for the following reasons were excluded from *both* the numerator *and* the denominator: a lump or breast problem, follow-up to breast cancer treatment or any reason other than family history, routine screening or checkup, age or HRT use. Doyle et al., while removing these women from the numerator, included them in the denominator.

Self-reported screening is common outside the target age groups.

As stated, organized screening programs target women aged 50 to 69 or 50 to 74. There is, however, considerable inter-provincial variation in the percentage of women aged 40 to 49 reporting receiving a screening mammogram in the past two years, with rates ranging from 21% in Saskatchewan to 52% in Alberta (Figure 2.3). While such variation may be due to a number of factors, some of the variation may reflect differences across provinces in the eligibility of women aged 40 to 49 for screening in the organized program (see Appendix II). Specifically,

in some provinces women in this age group are eligible, while in others they require a physician referral or are not eligible at all. The relatively high rate of screening mammography in Newfoundland and Labrador among women in this age group is somewhat surprising because the province's organized breast cancer program did not accept women aged 40 to 49 for screening in 2008. These women likely received their screening opportunistically. In April 2012, the breast cancer screening program in Newfoundland and Labrador was expanded to include women aged 40 to 49 who are referred to the program by their primary health-care provider.

In some provinces, women in the 40 to 49 age group are eligible for screening, while in other provinces they require a physician referral or are not eligible at all.

FIGURE 2.3

Percentage of eligible women (aged 40 to 49) reporting a screening mammogram in the past 2 years, by province/territory – CCHS 2008

Percent (%)

Note: A woman was deemed 'eligible' for screening mammography if her reason for undergoing mammography was NOT one of the following: to investigate a previously detected lump or breast problem, or as a follow-up to breast cancer treatment.

*Suppressed due to statistical unreliability caused by small numbers.

^{E} Interpret with caution due to a large amount of variability in the estimate.

Data source: Statistics Canada, Canadian Community Health Survey.

Many women who fall outside the target ages for routine screening (that is, who are younger than 50 or older than 69) reported that they had had a mammogram in the past year, according to CCHS 2008 data (Figure 2.4). In fact, the percentage of women reporting a screening mammogram in the past year was 62% among those in the target age group and 38% among those outside the target group. Screening among these out-of-target age groups has implications for resources and capacity at the provincial level. Variation by province in this use of screening is noteworthy.

Women below and above the target age groups reported getting screened.

FIGURE 2.4

Percentage of women (aged 35+) reporting a screening mammogram in the past year, by age group, Canada – CCHS 2008

Percent (%)

Age at time of survey
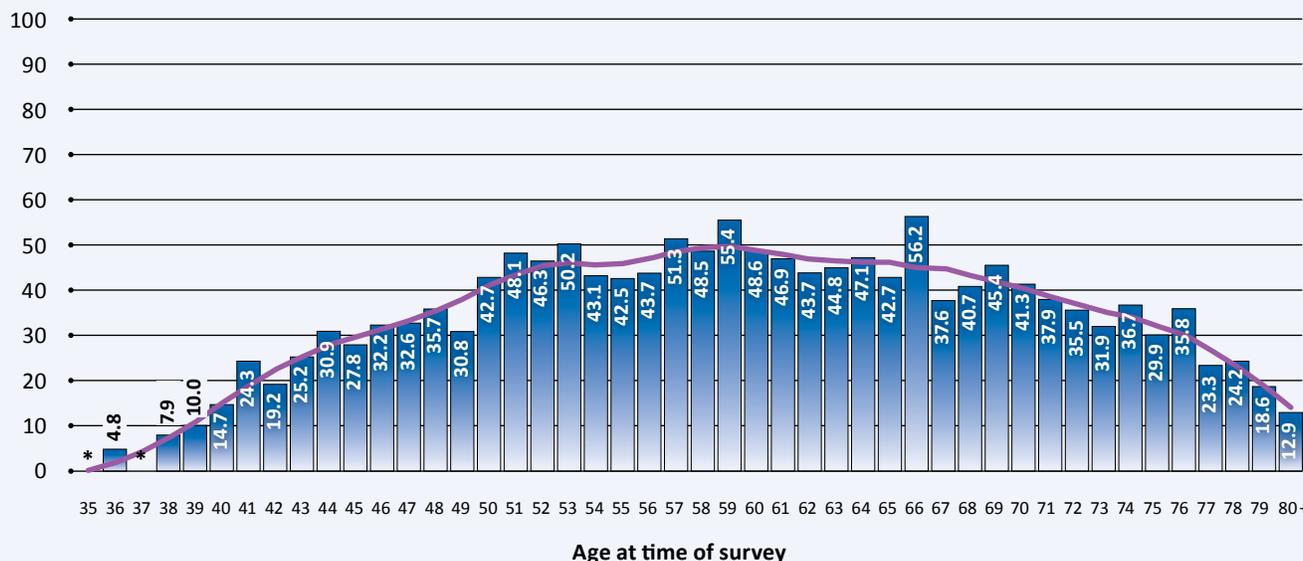
Note: A woman was deemed to have had screening mammography if her reason for undergoing mammography was NOT one of the following: to investigate a previously detected lump or breast problem, or as a follow-up to breast cancer treatment.

*Suppressed due to statistical unreliability caused by small numbers.

The purple line shows the fitted smooth curve of observed data.

Data source: Statistics Canada, Canadian Community Health Survey.

Self-reported breast screening rates vary by income and educational level, but not by urban or rural residence.

Despite near universal coverage of breast cancer screening across Canada through provincial and territorial health plans, there are differences in mammography use by socio-economic factors such as income and education level.

Self-reported mammography use was 16 percentage points higher for women living in neighbourhoods whose residents had the highest income level as compared with those

with the lowest income level in 2008 (77% versus 61%; Figure 2.5). Likewise, mammography use was 10 percentage points higher among women with the highest as compared with the lowest education level (75% versus 65%; Figure 2.5). Socio-economic trends among women aged 40 to 49 were similar to those of women aged 50 to 69.

These results are consistent with those reported in other studies. Lower levels of both income and education correlate with lower levels of mammography use.[6,31-33]

FIGURE 2.5

Percentage of eligible women (aged 50 to 69) reporting a screening mammogram in the past 2 years, by income quintile and household education, Canada – CCHS 2008
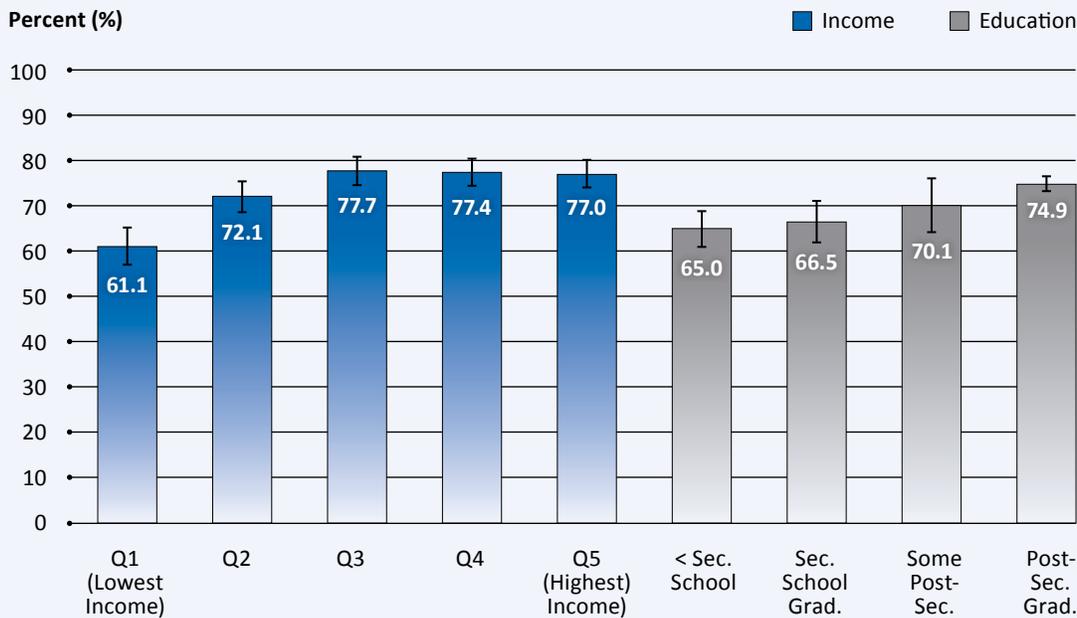
Mammography use was 10 percentage points higher among women with the highest as compared with those with the lowest education level.

Note: A woman was deemed 'eligible' for screening mammography if her reason for undergoing mammography was NOT one of the following: to investigate a previously detected lump or breast problem, or as a follow-up to breast cancer treatment.

95% confidence intervals are indicated on figure.

Data source: Statistics Canada, Canadian Community Health Survey.

There was no distinct pattern in self-reported screening rates according to urban or rural residence among women aged 50 to 69 (Figure 2.6). Among women aged 40 to 49, however, self-reported screening rates tended to be higher among women residing in urban areas than among those in rural or very remote areas (39% versus 31%) (data not shown). The absence of a gap between urban and rural screening rates among women aged 50 to 69 may reflect the success of mobile screening programs and other initiatives aimed at bringing screening services closer to women living in rural and remote communities.

Recent immigrants are less likely to be screened than the general population.

Self-reported screening rates were lower in 2008 among recent immigrants (women living in Canada for 10 years or less) relative to Canadian-born women and women who have resided in Canada for more than 10 years (42%, 74% and 70%, respectively; Figure 2.7).

The estimate for women who have resided in Canada for 10 years or less is to be interpreted with caution because of the small sample size. However, these findings are consistent with the literature, which suggests that the longer an immigrant has been in Canada, the more likely he or she is to utilize the health system in a fashion similar to Canadian-born individuals.[34-36] Immigrant status has also been shown to be strongly linked to receipt of breast cancer screening in other studies.[31-33]

Notes for figures 2.6 and 2.7: A woman was deemed 'eligible' for screening mammography if her reason for undergoing mammography was NOT one of the following: to investigate a previously detected lump or breast problem, or as a follow-up to breast cancer treatment.

95% confidence intervals are indicated on figure.

Data source: Statistics Canada, Canadian Community Health Survey.

FIGURE 2.6

Percentage of eligible women (aged 50 to 69) reporting a screening mammogram in the past 2 years, by geography, Canada – CCHS 2008
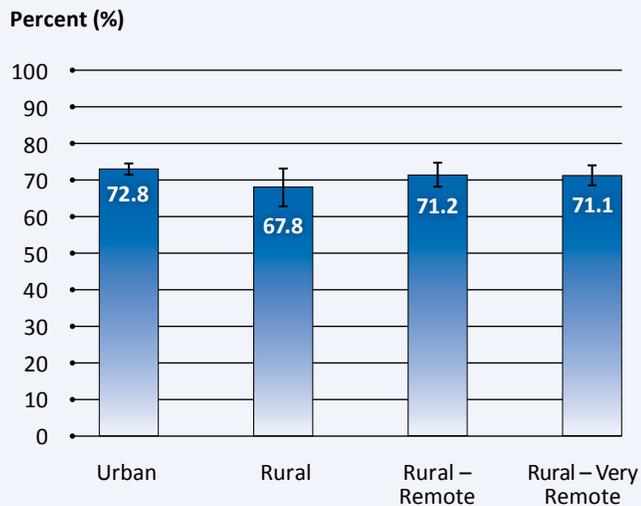
Percent (%)

FIGURE 2.7

Percentage of eligible women (aged 50 to 69) reporting a screening mammogram in the past 2 years, by length of time (years) in Canada since immigration – CCHS 2008

Percent (%)
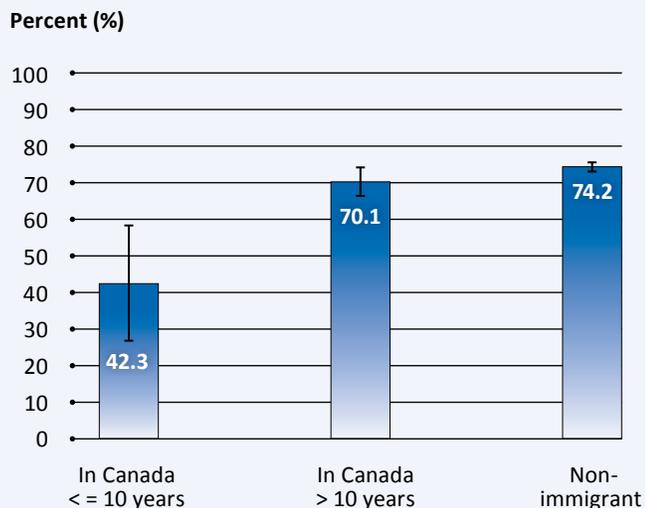
Breast screening guidelines continue to evolve

National guidelines disseminated by the Canadian Task Force on Preventive Health Care were recently revised, and recommend that women at average risk for breast cancer between ages 50 and 74 be routinely screened with mammography every two to three years.[37] In the Task Force's view, the decision to begin mammography screening before age 50 is an individual one that must take into account women's preferences and values regarding specific benefits and potential harms of screening.[37] The Task Force recommends that women aged 75 and older discuss the risks and benefits of screening with their health-

care provider and jointly decide whether to proceed with screening.[37] To view the guidelines and supporting documentation, go to www.canadiantaskforce.ca/ recommendations/2011_01_eng.html.

Screening programs aimed at average-risk women rely on mammography. Certain women face a higher-than-average risk of breast cancer because of their genetic makeup and therefore protocols and image techniques, including the use of Magnetic Resonance Imaging (MRI) scans and ultrasound, are often recommended (Box 2.2).

BOX 2.2

Testing options for women at above-average risk of breast cancer

Fewer than 1% of women in the general population are estimated to be at very high risk for breast cancer.[38] Certain breast cancer gene mutations have been identified at the BRCA1 and BRCA2 loci, that confer to women a lifetime risk of developing breast cancer of up to 85%.[38] The lifetime risk for women in the general population is 10% to 12%.[38] Women at high risk develop breast cancer at an earlier age and their cancers tend to be more aggressive than breast cancers diagnosed in women at average risk. Women between the ages of 30 and 69 identified by a physician as being at high risk for breast cancer should, after appropriate counselling, receive annual mammogram and MRI screening, according to guidelines developed by Cancer Care Ontario and several other jurisdictions.[39-41]

Ontario recently implemented an organized screening program for women at high risk for breast cancer.[38,42] In other provinces, high-risk screening may be offered through specific programs; one example is the Calgary Breast Health Program in Alberta.[43]

Conclusion

Breast cancer screening is a well-established component of cancer control in Canada. When screening both within and outside organized programs is taken into account, screening rates (based on self-reported survey data) are above 70% in almost all provinces and territories for women in the targeted age group (50 to 69). Despite universal access to breast cancer screening, self-reported screening rates within this targeted group are below 70% for women living in lower-income neighbourhoods, women with relatively low education levels, and women who are recent immigrants. On the other hand, screening rates in rural and remote communities are equivalent to those in urban communities.

The observed differences in screening rates between provinces and territories have implications for program and resource planning. Canadian breast cancer screening guidelines were recently revised, and now recommend increasing the interval between mammograms for women aged 50 to 74 to every two to three years from every one to two years. As a result of these changes, the definitions for screening indicators used in this report may need to be revisited in the future.

Breast Cancer Diagnosis

SECTION THREE

Breast Cancer Diagnosis

The diagnosis of breast cancer is complex, involves many steps and takes time.

Diagnosing breast cancer can involve many steps, from the first identification of a problem to determining the clinical characteristics necessary to plan treatment. The diagnostic process may also involve many tests and procedures, including image-guided core biopsies, surgical (open) or core (needle) biopsies, and laboratory testing (notably pathology), all of which take time.

This section reviews several aspects of the breast cancer diagnostic process. First it describes the time taken to complete the steps needed to diagnose breast cancer after finding an abnormality on a screening mammogram. Second, the distribution of stage of disease is presented for Canadian women at the time they are diagnosed with cancer. Finally, data on laboratory testing for breast cancer biomarkers are reported. Data were not readily available to allow for the calculation of meaningful indicators of the quality of diagnostic testing for breast cancer patients or the use of recommended modalities such as image-guided core biopsies. Data collection efforts will focus on addressing these gaps for future reports.

Delays in resolving suspicious breast cancer screening results delay treatment and contribute to anxiety.

Timely resolution of an abnormal breast cancer screen result facilitates prompt initiation of treatment and may improve patient outcomes. A suspicious screening result can cause anxiety and worry, even if the diagnosis of breast cancer is ultimately negative.[44] Delays in diagnostic resolution can prolong this anxiety.

Causes of delays in the resolution of an abnormal screening result are varied and may include health system factors (including insufficient scheduling capacity for timely return), provider factors (for example, not communicating the results in a way that the patient understands) and patient factors (such as not following up on an appointment).[45] Prompt and adequate follow-up of women with abnormal screening results is necessary for screening programs to be successful in reducing breast cancer mortality.[46]

Data on wait times from abnormal screening result to resolution are available from provincial screening programs.

Organized breast cancer screening programs are now offered in all provinces and two territories, with participation rates ranging from 6% to 56% across jurisdictions (see Figure 2.1 in the Screening section).[f] As part of these programs, abnormal or suspicious screening results are assessed and additional testing and consultation are recommended to confirm or eliminate the possibility of breast cancer. All provincial programs collect data that permit calculation of time elapsed from an abnormal screening result to diagnosis.

Wait time targets have been set for the period between the receipt of an abnormal breast screen result and diagnosis.

To ensure the timeliness of a diagnosis following an abnormal screening result, targets were set by consensus among members of a working group of the Canadian Breast Cancer Screening Initiative. The Working Group on the Integration of Screening and Diagnosis set targets for the length of time needed to resolve abnormal screening results. If no tissue biopsy is necessary to resolve the abnormal result, the target is for 90% or more of cases to be resolved within five weeks. If a tissue biopsy is required, the target is for 90% or more of cases to be resolved within seven weeks.[48,g]

BOX 3.1

Only a portion of breast cancers are diagnosed through screening programs

The wait times data presented here represent wait times for abnormal results found through provincial screening programs. Wait times associated with abnormal results of breast screens outside organized screening programs are not available and therefore not reported here. Comprehensive Canadian data on the percentage of cancer diagnoses made through screening versus other means are not readily available. According to one U.S. population-based study, 42% of breast cancers were found by women with symptoms, such as a palpable breast lump, or by physicians – for example, during a woman's routine visit to her primary care physician.[47]

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f) The 6% rate is for Alberta and represents the percentage of the target population screened by the provincial Screen Test program, the only screening activity for which data on wait times to resolution are currently collected. In Alberta, Screen Test participants are predominantly residents of rural areas.

g) Tissue biopsy includes core (needle) biopsy and open (excisional) biopsy.

The provincial 90th percentile wait times to resolve abnormal screening results reveal that most provinces did not meet the established targets.

For women whose diagnoses could be resolved without a tissue biopsy (usually through a diagnostic mammogram, ultrasound, or both), the median time from screening examination to diagnosis ranged from 2.0 weeks in Manitoba to 5.1 weeks in Alberta (Figure 3.1).[h] The maximum time needed to resolve 90% of the cases (i.e., the 90th percentile wait time) ranged from 5.3 weeks in Saskatchewan to 10 weeks in Newfoundland and Labrador. Data for 2010 were available for seven provinces (data were not available for Ontario, Quebec, or Prince Edward Island). None of the provinces included in the analysis met the recommended target; however, Saskatchewan and Manitoba were very close to meeting it.

FIGURE 3.1

Median and 90th percentile wait time for resolution of abnormal breast screen for women (aged 50 to 69) not requiring a tissue biopsy, by province – 2010

Note: Alberta wait time data are from the Screen Test program only. Screen Test is an organized program that conducts approximately 10% to 12% of screening mammograms in the province, about 65% of which are performed on mobile screening units in rural areas.

"—" Data for PE and QC are not available for any of the measures. Data for ON are not available for the median and 90th percentile wait times.

Data source: Provincial breast cancer screening programs.

h) Time to diagnosis is based on the date of the first pathological biopsy result showing breast cancer, excluding fine-needle aspiration and all inconclusive procedures, or the date of the last benign test or pathological biopsy. These estimates exclude tests beyond six months post-screening.

When a biopsy was performed, the median wait time was shortest in Saskatchewan at 5.0 weeks and longest in Nova Scotia and Newfoundland and Labrador, where women waited 7.0 weeks for a diagnosis (Figure 3.2). The 90th percentile wait times relative to the median were much longer for women requiring a biopsy, ranging

from 11.9 to 22 weeks. Data were available for seven provinces (data for 2010 were not available for Ontario, Quebec or Prince Edward Island). None of the provinces included in the measurement has yet reached the targets set by the Working Group of the Canadian Breast Cancer Screening Initiative.

FIGURE 3.2

Median and 90th percentile wait time for resolution of abnormal breast screen for women (aged 50 to 69) requiring a tissue biopsy, by province – 2010

Province	Percentage below target	Median	90th percentile
QC	—	—	
PE	—	—	
SK	71.0%	5.0	11.9
MB	68.6%	5.1	14.1
ON	64.0%	—	
NB	57.4%	6.1	13.9
AB	57.1%	6.3	16.0
BC	55.6%	6.4	15.9
NL	53.0%	7.0	22.0
NS	51.6%	7.0	14.9

Note: Alberta wait time data are from the Screen Test program only. Screen Test is an organized program that conducts approximately 10% to 12% of screening mammograms in the province, about 65% of which are performed on mobile screening units in rural areas.

"—" Data for PE and QC are not available for any of the measures. Data for ON are not available for the median and 90th percentile wait times.

Data source: Provincial breast cancer screening programs.

Examining wait time trends from 2004 to 2010 reveals fluctuations in wait times for all provinces. Several provinces showed some improvement in median wait times, with a greater degree of convergence to provincial

median wait times over the measurement timeframe for women requiring a tissue biopsy than for women not requiring a biopsy (Figures 3.3 and 3.4).

FIGURE 3.3

Median wait time for resolution of abnormal breast screen for women (aged 50 to 69) not requiring a tissue biopsy, by province – 2004 to 2010

Weeks

Legend: BC, AB, SK, MB, ON, QC, NB, NS, NL
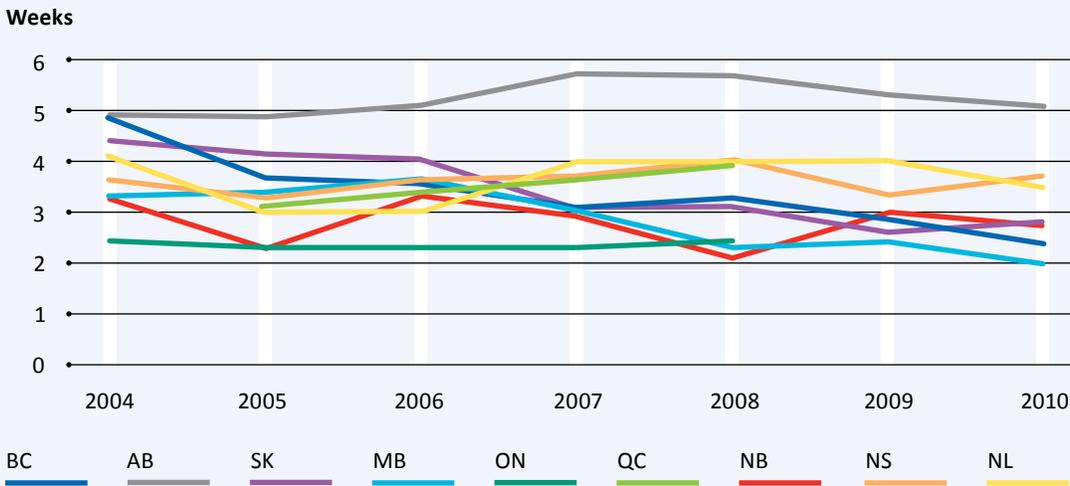
FIGURE 3.4

Median wait time for resolution of abnormal breast screen for women (aged 50 to 69) requiring a tissue biopsy, by province – 2004 to 2010

Weeks

Legend: BC, AB, SK, MB, ON, QC, NB, NS, NL
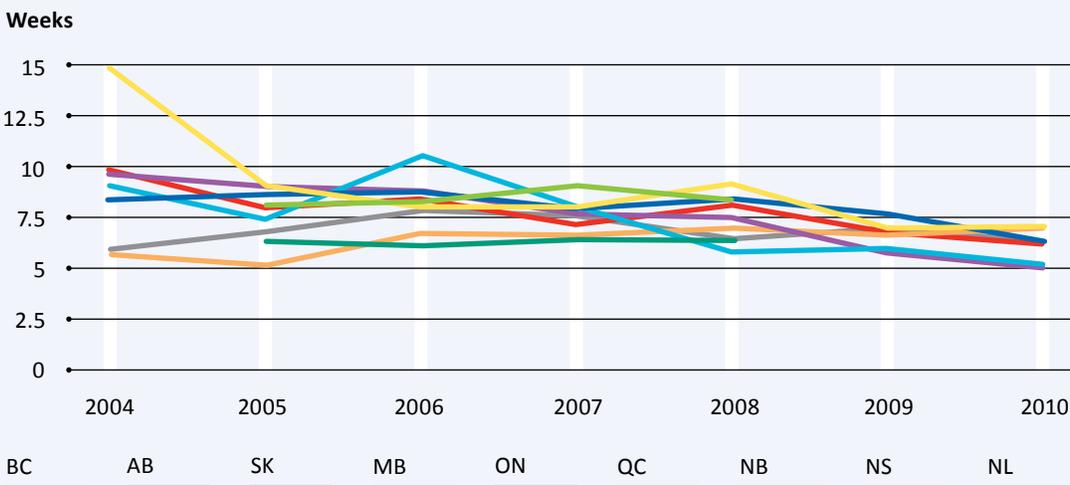
Improving access to biopsies and pathology results, when needed, may help reduce the delay that women experience following an abnormal breast screening result.

Notes for figures 3.3 and 3.4: Alberta wait time data are from the Screen Test program only. Screen Test is an organized program that conducts approximately 10% to 12% of screening mammograms in the province, about 65% of which are performed on mobile screening units in rural areas.

Data source: Canadian Breast Cancer Screening Database for 2004. Provincial breast cancer screening programs for 2005 and onward.

Figure 3.3: Data for QC are not available for 2004. Data for ON and QC are not available from 2009 onward. Data for PE are not available.

Figure 3.4: Data for QC and ON are not available for 2004. Data for ON and QC are not available from 2009 onward. Data for PE are not available.

Improving access to biopsies and pathology results, when needed, may help reduce the delay that women experience following an abnormal breast screening result. Interestingly, women with an abnormal screening result who were eventually found to have breast cancer had shorter wait times for resolution than did women whose biopsy findings showed a benign result (data not shown), suggesting that physicians or health systems may have expedited the biopsy in situations where breast cancer was more strongly suspected based on the radiological results.

Breast cancer staging is essential for treatment planning and monitoring cancer trends.

Cancer stage describes the extent or severity of disease based on the size and location of the tumour and the degree to which it has spread to lymph nodes and distant areas of the body.[49]

Cancer stage at diagnosis is a key factor in determining prognosis and informing decisions on patient treatment and care. Beyond staging's key role in clinical practice, the availability of population-level cancer stage data adds value to outcome measures such as incidence, mortality and survival. These measures, when available by stage, are critical to evaluating the success of cancer screening and early detection efforts. Furthermore, without stage information, it is difficult to accurately monitor patterns of care that may signal opportunities for quality improvement. The most commonly used cancer staging system is that developed and maintained jointly by the American Joint Committee on Cancer (AJCC) and the Union for International Cancer Control (UICC), which is the system used across Canada for staging of most cancers.

This section examines the availability of stage data and the distribution of stage at diagnosis for breast cancer.

BOX 3.2

Use of bone scans, chest x-ray, liver ultrasound and CT/PET scans in the staging of breast cancer

For most women with breast cancer, particularly those with non-metastatic disease, stage is determined following definitive surgery and relies heavily on the pathologist's examination of excised tissue. Bone scans, chest x-ray, liver ultrasound and computed tomography (CT) and positron emission tomography (PET) scans can also be used to detect metastatic disease and assess stage. Guidelines in place since 2001 indicate that these tests are not routinely recommended (pre- or postoperatively) for women with newly diagnosed breast cancer who are asymptomatic for metastases.[50,51] For a patient with a pathology-confirmed Stage II tumour, a bone scan is recommended postoperatively as part of baseline staging, with liver ultrasound and chest x-ray an option for those with at least four positive lymph nodes. For a patient with a pathology-confirmed Stage III tumour, a bone scan, liver ultrasound and chest x-ray are recommended postoperatively as part of baseline staging. The use of CT may be considered for patients with Stage III cancer.

Nine provinces have met the Partnership's Collaborative Staging Initiative goal for the 2010 diagnosis year.

For the 2010 diagnosis year, nine provinces met the Partnership's Collaborative Staging Initiative goal of having stage information available in the provincial registry for at least 90% of breast cancer cases (the same goal applies to colorectal, prostate, and lung cancer) (Figure 3.5).[i] In fact, the rate of stage reporting for breast cancer was at, or very near, 100% in seven provinces. With the achievement of population-based staging, the epidemiology of breast cancer in Canada can be described more precisely (for example, survival by stage can be calculated once a few diagnosis years of complete staging is available). In addition, interprovincial comparisons can be made for indicators related to practice patterns (e.g., guideline concordance). For example, the Treatment section of this report describes indicators measuring the percentage of patients with Stage I or II breast cancer diagnosed in 2009 receiving breast conserving therapy; this would not be possible without population-based staging.

FIGURE 3.5

Percentage of stageable incident cases for which stage data are available in provincial registries – breast cancer, by province – 2009 to 2010

Percent (%)

2009 ■ 2010

Province	2009	2010
BC	—	100
MB	100	100
PE	100	100
SK	100	100
NS	99.9	99.9
AB	100	99.7
NB	100	99.6
NL	87.9	98.4
ON	94.8	93.9
QC	—	—
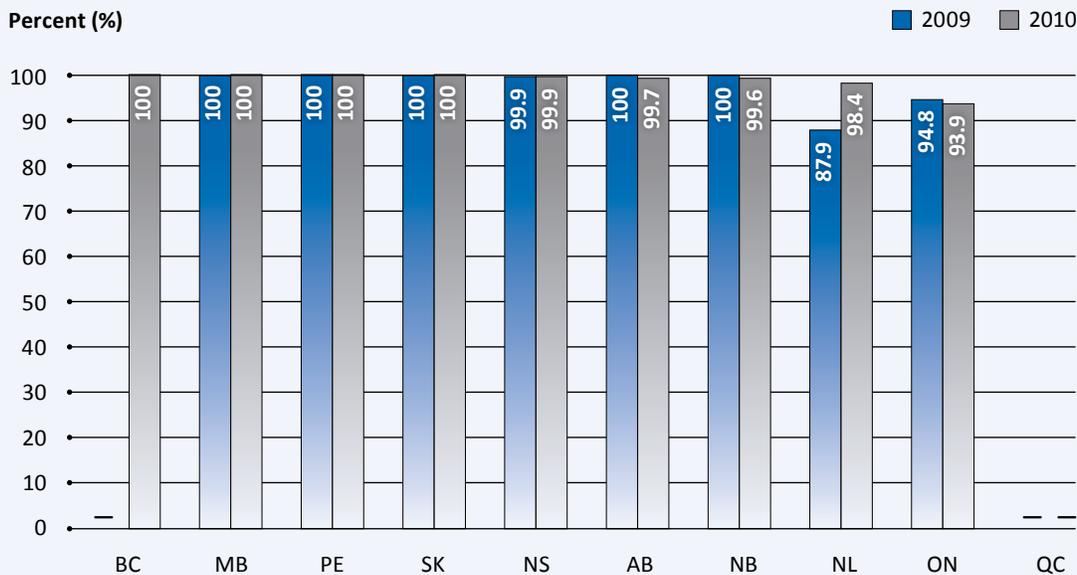
"—" Data are not available for BC (2009) and QC (2009 and 2010).

Data source: Provincial cancer agencies.

90%

The Partnership's Collaborative Staging Initiative goal is to have stage information available in the provincial registry for at least 90% of breast cancer cases.

i) Appendix IV describes staging data collection methodologies, including collaborative staging and the American Joint Committee on Cancer Tumour Node Metastases coding.

80% of breast cancer cases in Canada are diagnosed at an early stage of disease.

As shown in Figure 3.6, more than 80% of invasive breast cancer cases diagnosed in 2010 were diagnosed with early stage (I or II) disease (data not available for Quebec). Some interprovincial variation in breast cancer stage distribution is evident (Figure 3.6). In 2010, Newfoundland and Labrador had a higher percentage (27%) diagnosed with advanced disease (Stage III or IV) relative to the average of 19% for all nine provinces with stage data (as a percentage of women diagnosed with invasive breast cancer). The overall average of 5% of breast cancer cases diagnosed with metastatic (Stage IV) disease matches the U.S. Surveillance Epidemiology and End Results (SEER) program average of 5%.[52,j]

FIGURE 3.6

Distribution by stage at diagnosis of women diagnosed with invasive breast cancer in Canada in 2010, by province
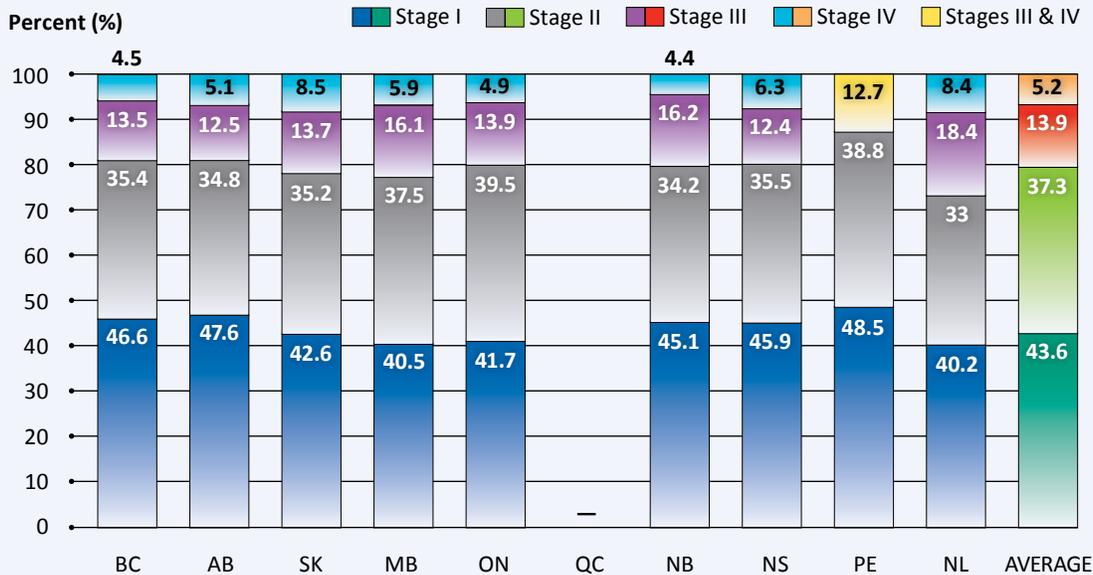
Starting with the 2010 diagnosis year, population-level staging allows for valid comparison of stage distribution across provinces.

Percent (%)

Legend: ■ Stage I ■ Stage II ■ Stage III ■ Stage IV □ Stages III & IV

	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	AVERAGE
Stage IV	4.5	5.1	8.5	5.9	4.9		4.4	6.3		8.4	5.2
Stage III	13.5	12.5	13.7	16.1	13.9		16.2	12.4		18.4	13.9
Stages III & IV									12.7		
Stage II	35.4	34.8	35.2	37.5	39.5		34.2	35.5	38.8	33	37.3
Stage I	46.6	47.6	42.6	40.5	41.7	—	45.1	45.9	48.5	40.2	43.6

Note: Stage III and IV are combined for PE due to small case volumes.

"—" Data are not available for QC.

Data source: Provincial cancer agencies.

j) SEER data are based on a sample of cancer treatment facilities from 18 geographic areas (including 10 states) across the United States.

Figure 3.7 shows the distribution of breast cancer cases for all eight reporting provinces in 2010, by detailed stage, including Stage 0 and stage unknown. The detailed stage data (e.g., Stage IIB, Stage IIIA) are useful because certain treatment protocols are specified at the detailed level.[53] Almost 13% of breast cancer cases were Stage 0 (which includes mostly in situ carcinomas such as DCIS) in the eight reporting provinces. In all, 3.3% of cases were stage unknown; these are cases for which information available in patient charts was not adequate for ascertaining stage or cases identified only through a death certificate. By comparison, the U.S. SEER program reports 2% of cases as stage unknown.[52] The percentage of cases with stage unknown by province in 2010 ranged from 0.6% to 5.6% for the nine reporting provinces; see Appendix III for further information.

FIGURE 3.7

Distribution by stage at diagnosis of women diagnosed with breast cancer in 2010, Canada

Percent (%)

3.3% Stage Unknown
4.5% Stage IV
0.1% Stage IIINOS
3.0% Stage IIIC
2.2% Stage IIIB
6.3% Stage IIIA
9.6% Stage IIB
20% Stage IIA
12.9% Stage 0
38.2% Stage I
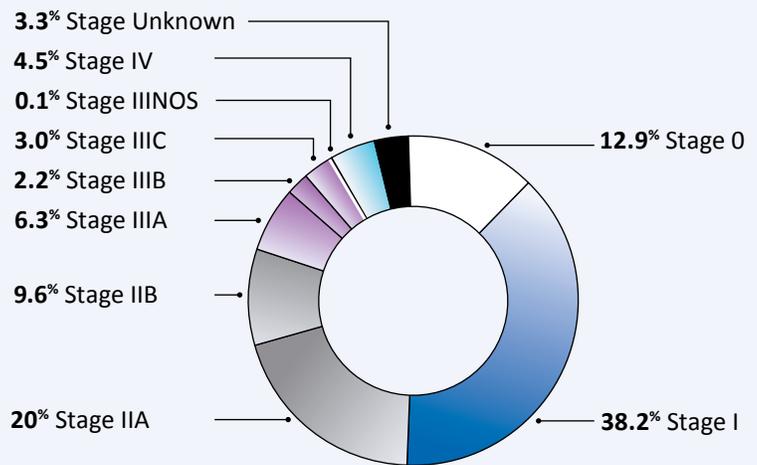
Note: Stage 0 includes in situ. NOS means stage not otherwise specified.

Data include AB, BC, MB, NB, NL, NS, PE and SK.

ON is excluded because the province does not report in situ cases.

Data source: Provincial cancer agencies.

The results of tumour biomarker tests guide treatment decisions for women diagnosed with breast cancer.

Most breast cancer cells have specific receptors for hormones or growth factors on their surface that are essential for their growth. These receptors can be used as targets for drugs to inhibit tumour growth. Knowing that specific tumour markers are present can be useful in selecting appropriate adjuvant drug therapy. Such tumour markers can be assessed on a core biopsy or surgical resection specimen.

The most commonly used biomarkers for predicting the response to therapy are estrogen receptors (ER) and progesterone receptors (PR). A task force convened by the National Comprehensive Cancer Network (NCCN) recommended that all women with invasive primary breast cancer be tested for ER and PR status.[54] There is insufficient evidence to recommend routine testing for ER and PR status for women with DCIS or metastatic disease.[55]

Women with early stage invasive breast cancer who have estrogen receptors on at least 1% of their breast cancer cells (ER positive) have a better prognosis than patients who are ER negative. ER-positive women generally benefit from adjuvant hormonal therapy (tamoxifen or an aromatase inhibitor) that reduces the risk of recurrence and improves survival.[54,56] ER-negative patients do not show a similar benefit from such therapy. The general consensus on PR status alone is that it is prognostic, but it is not a good predictor of response to hormone treatment.[54,56]

Another useful tumour marker in the management of breast cancer is the protein human epidermal growth factor receptor 2 (HER2). Another NCCN task force recommended that all women with invasive breast cancer be tested for HER2.[57] Breast cancer cells making an excess of the HER2 membrane protein or gene copy (HER2 positive) tend to be more aggressive and are less responsive to hormone treatment. However, treatments that specifically target the HER2 surface protein are effective, including trastuzumab (Herceptin), which can be used as adjuvant therapy or for treatment of metastatic disease.[58]

Immunohistochemistry is the standard method for biomarker testing in breast cancer.

The current standard method of testing hormone receptor status is by immunohistochemistry (IHC), which identifies specific protein markers in tumour tissue. The majority of ER and PR testing is done on surgical resection specimens, but it may be performed on core biopsies.[58] Given the importance of hormone receptor status in determining appropriate adjuvant therapy, accurate testing for ER and PR in breast cancer patients is essential.[54,59,60] Accurate and reliable IHC testing is a key issue: high false negative rates have been reported (20% to 60%). In such cases, women may not receive the most effective treatment. The American Society of Clinical Oncology and the College of American Pathologists have released guidelines for breast cancer predictive factor testing, aiming to standardize and improve the accuracy and quality of IHC testing.[59,60] Cancer Care Ontario, through the Program in Evidence-Based Care, also published a guideline with a similar intent.[61]

HER2 testing can be performed with IHC or by in situ hybridization (ISH).[57] However, results from an audit program in Australia indicated that the latter might be a more reliable method of HER2 testing.[62] The consensus recommendation for testing for HER2 in the United States and Canada is to first use IHC, which is more cost-effective, and then retest borderline cases using an ISH method (fluorescent, silver or chromogenic ISH).[58,63]

Timely and accurate immuno-histochemistry testing is important for effective treatment.

BOX 3.3

Quality control of immunohistochemistry testing in Canada

Although IHC testing is widely performed, no national accreditation body exists to evaluate current practices and ensure that standards are met. Several external testing programs for diagnostic IHC are available, however, such as those offered by the College of American Pathologists and Nordic immunohistochemical Quality Control.[64] In Canada, there is a voluntary initiative supported by the Canadian Association of Pathologists called Canadian Immunohistochemistry Quality Control (cIQc), in which participating laboratories can examine and compare their results with other labs, with the goal of identifying and addressing any concerns quickly.[64] Some provinces have mandatory quality assurance programs in place for IHC testing. One example is Ontario, where all laboratories that conduct IHC testing must participate in a quality management program to meet accreditation requirements.[65]

ER and PR hormone receptor testing is done for most women with breast cancer.

The first indicator examines use of ER and PR hormone receptor tests. Among the nine provincial cancer agencies reporting use of ER and PR tests in 2010, 95% of women newly diagnosed with invasive breast cancer in 2010 had an ER test, a PR test, or both. There was little variation in testing among the nine provinces reporting ER and PR testing (the range was 92.2% to 98.1%).

The percentage of invasive breast cancer patients who were tested and determined to be ER or PR positive (or both) among the nine provinces reporting testing practices ranged from 83.5% in New Brunswick to 89% in Alberta, with an overall average of 85% (Figure 3.8). This rate is consistent with the 75% to 85% of breast cancers expected to be either ER or PR positive.[66]

BOX 3.4

ER and PR indicator interpretive note

ER or PR status is most useful when assessed in addition to information on the histological type, grade and stage of breast cancer. Because valid stage data are not available for all jurisdictions, ER and PR testing data are not available by stage from all provincial cancer agencies. Information on the use of ER and PR testing is presented in this report, where available, as a first step toward better understanding its use in Canada. These results are not meant to reflect the performance of jurisdictions, but rather to provide a first look at patterns of testing in Canada.

FIGURE 3.8

Percentage of women newly diagnosed with invasive breast cancer in 2010 who were tested as ER or PR positive (or both), by province

Percent (%)
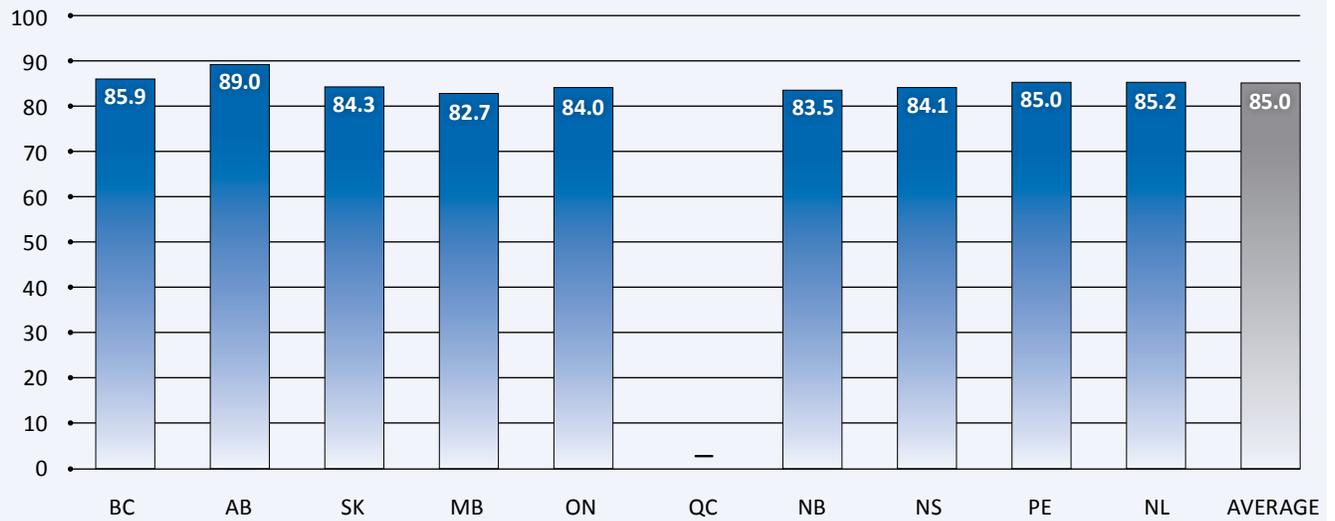
	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	AVERAGE
(bar value)	85.9	89.0	84.3	82.7	84.0	—	83.5	84.1	85.0	85.2	85.0
Percent ER- or PR-tested	97.0	98.0	96.0	97.2	92.2	—	97.9	95.4	97.1	98.1	94.7

The bar graph includes women newly diagnosed with invasive breast cancer in 2010, who were staged and who had an ER or PR test completed.

"—" Data are not available for QC.

Data source: Provincial cancer agencies.

The percentage of women with invasive breast cancer for whom HER2 tests are done ranges from 87% to 96% across provinces.

The percentage of women with invasive breast cancer who had an HER2 test in 2010 ranged from 87% to 96% in the nine provinces providing testing data. Among women with a test ordered, 14% were found to be HER2 positive. Test positivity ranged from 8.7% to 14.8% among the nine provinces reporting information on test results (Figure 3.9). To put these findings into perspective, the literature suggests that HER2 positivity among women with invasive breast cancer can range from 15% to 25%,[54,66] although differences in definitions may limit the applicability of this comparison.

FIGURE 3.9

Percentage of women newly diagnosed with invasive breast cancer in 2010 who were tested as HER2 positive, by province

Percent (%)
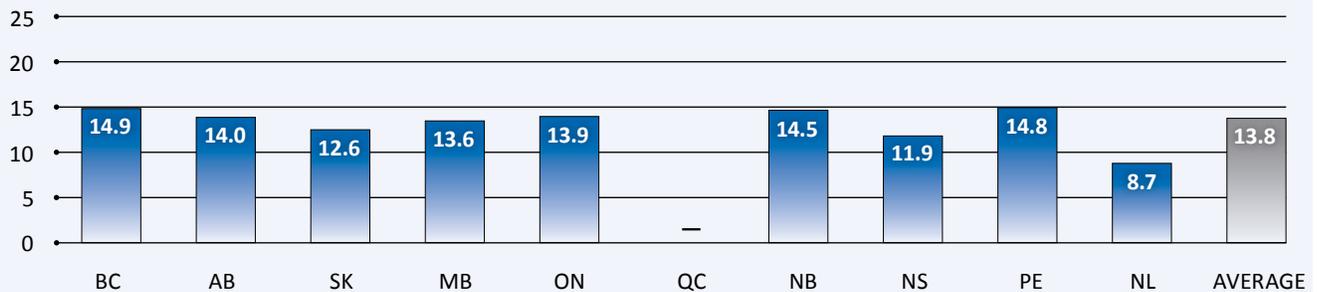
	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	AVERAGE
Bar value	14.9	14.0	12.6	13.6	13.9	—	14.5	11.9	14.8	8.7	13.8
Percent HER2-tested	93.5	96.0	93.6	89.6	87.3	—	90.5	89.0	89.1	93.3	90.3

The bar graph includes women newly diagnosed with invasive breast cancer in 2010, who were staged and who had an HER2 test completed.

Note: For NL, HER2 testing was performed outside Newfoundland and Labrador at a centralized lab.

"—" Data are not available for QC.

Data source: Provincial cancer agencies.

Conclusion

The diagnosis of breast cancer is complex, involves many steps and relies on sophisticated laboratory analyses. Accurate and timely diagnostic results are needed to expedite treatment that is tailored to a woman's individual clinical circumstances. This section has provided information on the status of some indicators relating to aspects of the diagnostic process.

For women who are screened for breast cancer through organized provincial programs, there appear to be delays in resolving suspicious screens that are beyond the wait time targets set by a working group of the Canadian Breast Cancer Screening Initiative. The delays are especially prolonged for women who require a biopsy.

As of the 2010 diagnosis year, nine provinces had met the Partnership's goals for reporting comprehensive and standardized staging data using collaborative staging. According to these reports, 80% of invasive breast cancer cases in Canada are diagnosed early (at Stage I or II). There is some variation in the distribution of stage at diagnosis by province, with some provinces having a relatively high percentage of women being diagnosed at a late stage, when prognosis is less favourable.

This report presents a first look at ER, PR and HER2 testing in Canada and, in provinces where data are available, it appears that uptake of testing is high and ER or PR positivity rates are in line with what is expected based on the literature.

Future data collection efforts will focus on expanding the scope of indicators on cancer diagnosis and taking advantage of the emerging datasets on synoptic pathology and radiology, among others.

Breast Cancer Treatment

SECTION FOUR

Breast Cancer Treatment

Breast cancer treatment is complex and may involve multiple modes of therapy.

This section presents a select number of system indicators on the treatment of breast cancer. Treatment for breast cancer is resource-intensive and is often multimodal, involving the treatment of local disease with surgery, radiation therapy, or both, and the treatment of local and more advanced disease with chemotherapy, targeted therapy (e.g., trastuzumab), and endocrine therapy (e.g., tamoxifen). The goals of breast cancer treatment include:

- Eliminating the primary tumour(s) and any regional spread
- Preventing local recurrence

- Preventing distant recurrence
- Prolonging survival or preventing deaths
- Reducing symptoms and minimizing side effects

A rich body of breast cancer research (see the Research section), especially a number of clinical trials, has informed the development of a broad range of treatment guidelines and standards of care. These guidelines provide recommendations on the use of surgery, radiation and systemic therapy, as well as supportive care and follow-up to achieve the outcomes listed above. *Equitable* access to *timely* treatment consistent with *evidence-based guidelines* is the standard for effective care.

The equitability component of the standard is measured in this section through indicators of overall treatment rates by age, socio-economic status and geography. Timeliness is measured through wait times. Concordance with selected treatment guidelines is examined from a pan-Canadian perspective and by province.

The first set of indicators examines the use of mastectomy versus breast conserving surgery in the surgical treatment of breast cancer.

Mastectomy rates are compared by province, patient age, neighbourhood income and travel time to a radiation treatment centre. Next, radiation therapy use is examined overall and for early stage breast cancer, including adjuvant therapy following breast conserving surgery (BCS). The relationship between interprovincial variations in mastectomy rates and radiation therapy rates is also examined. Wait times for radiation treatment are presented according to nationally recognized targets. Finally, the percentage of breast cancer patients receiving chemotherapy is compared by province. Current data limitations in many provinces prevent the reporting of meaningful information on hormone therapy use, despite the importance of this modality to improved outcomes.

Note that unless otherwise stated, all indicators presented in this section are limited to invasive breast cancer.

BOX 4.1

Interpreting treatment-related indicators

The indicators presented in this section are based on administrative databases and are intended to identify potential opportunities for quality improvement, which would then require further examination through more detailed evaluation methods. Many factors are considered in treatment planning. Cancer-related factors include the stage of disease and tumour pathology and histology (e.g., hormone receptor status). A woman's age, menopausal status, genetic risk status (e.g., presence of BRCA mutations), health status and health-care preferences are also key determinants of choice of therapy.[53]

Data on some, but not all, of these factors are available for analysis using administrative records. Information from medical charts and other sources can be used to further explore variations in practice patterns and provide insights into quality improvement strategies. This more comprehensive synthesis of available information would be required to make more definitive judgments regarding quality of care.

In charts comparing provincial results, provinces are generally ordered from highest to lowest or lowest to highest to facilitate visual comparison. This ordering is not intended to rank the provinces by "best" or "worst" performance.

Most women with early stage breast cancer undergo either breast conserving surgery plus radiation therapy, or mastectomy.

Most women diagnosed with non-metastatic breast cancer are candidates for surgery, either BCS or mastectomy.[53] BCS (also referred to as lumpectomy or segmental resection) involves complete removal of the tumour along with a margin of non-cancerous breast tissue; mastectomy involves removal of the entire breast. BCS followed by radiation therapy (referred to as breast conserving therapy, or BCT) is less invasive than mastectomy and is associated with better cosmesis and psychological outcomes, but has comparable survival. BCT is therefore generally recommended for most women with Stage I or II breast cancer.[67]

This recommendation for the less invasive treatment option stems from the finding that there is no difference in overall survival between the use of mastectomy or BCT for early stage breast cancer.[68-70] Women who undergo BCT *had* been shown to be at an increased risk of local recurrence, particularly younger women, relative to those who choose mastectomy; however, adjuvant endocrine therapy has been shown to be effective in reducing the risk of recurrence and improving disease-free survival for women who undergo BCT.[71]

The following factors, among others, may influence the decision to treat women with early stage breast cancer with mastectomy rather than BCS:[72-75]

- Clinical factors, such as the presence of multi-centric disease, prior exposure to chest wall radiation therapy, collagen vascular disease or pregnancy

- Lack of access to, or availability of, radiation therapy (recommended after BCS), or the wish to avoid radiation (often not recommended after mastectomy)

- Acceptance of, and access to, breast reconstruction surgery

- The wish to avoid surveillance mammography for ipsilateral breast cancer

- Perceived lower risk of local recurrence, in particular for those who have a higher genetic risk due to family history, and young age (less than 35), although mastectomies do not necessarily offer a recurrence risk reduction in these situations

Some women who initially undergo BCS subsequently have a re-excision to remove additional tissue or have a mastectomy as part of treatment of their cancer. This may occur if there are persistently positive margins (cancer cells near the edge of the excised tissue) on pathology following BCS and BCS revision surgery. When assessing mastectomy rates for policy review and quality improvement purposes, it is instructive to differentiate between mastectomies being performed where (1) the patient is a candidate for BCS and it is not offered or not accepted, (2) the patient has an absolute or relative contraindication to BCT and (3) the patient underwent initial BCS, but mastectomy was subsequently performed (e.g., owing to positive margins).

In Canada, nearly 40% of breast cancer resections are mastectomies, but the provincial rates vary widely.

Figure 4.1 shows the percentage of surgical resections that are mastectomies among women with unilateral invasive breast cancer, by province; the *index* rate includes women for whom mastectomy was the initial procedure and the *final* rate includes women who received an initial mastectomy and those undergoing mastectomy following BCS. Overall, almost 40% of women with breast cancer who had their initial surgical procedures between 2007 to 2008 and 2009 to 2010 underwent a mastectomy (60% were treated using BCS).

BCS followed by radiation therapy is less invasive than mastectomy and is associated with lower morbidity and better cosmesis and psychological outcomes, but has comparable survival.

Examining the information by province, the final mastectomy rate ranges from a low of 26.5% in Quebec to a high of 68.7% in Newfoundland and Labrador. This wide range suggests substantial variation in practice across provinces. Comparing the index and final rates allows for further analysis of interprovincial variation. For example, while Newfoundland and Labrador had the highest final mastectomy rate, its index rate is closer to the mid-range. This suggests that a comparatively high proportion of patients in that province undergo eventual mastectomy after initial BCS. In contrast, Alberta's final mastectomy rate is 13 percentage points lower than Newfoundland and Labrador's, but its index rate is 4 percentage points higher. This is because in Alberta, a relatively small proportion of patients start with BCS and then undergo a mastectomy, compared with Newfoundland and Labrador.

Exploratory analyses suggest that part of the variation may be explained by the rate of use of core biopsy versus open excisional biopsy by province. This is an issue because current procedure codes do not distinguish open excisional biopsy from BCS, which is a methodological limitation affecting the ability to differentiate cases that start with BCS and go on to have a mastectomy, from cases that start with an open excisional biopsy then go on to have BCS or a mastectomy. The relationship between the index and final mastectomy rates, and what drives this relationship are important considerations when determining responses to these indicator results.

FIGURE 4.1

Percentage of breast cancer resections that are mastectomies,[*] by province – 2007 to 2009 combined

Percent (%)

Index   Final

	QC	MB	ON	CANADA	BC	NB	NS	AB	PE	SK	NL
Index	21.0	30.3	31.3	32.3	34.7	38.4	47.6	49.9	44.6	53.1	45.8
Final	26.5	36.0	37.5	39.5	45.9	47.1	55.2	55.7	58.5	64.9	68.7
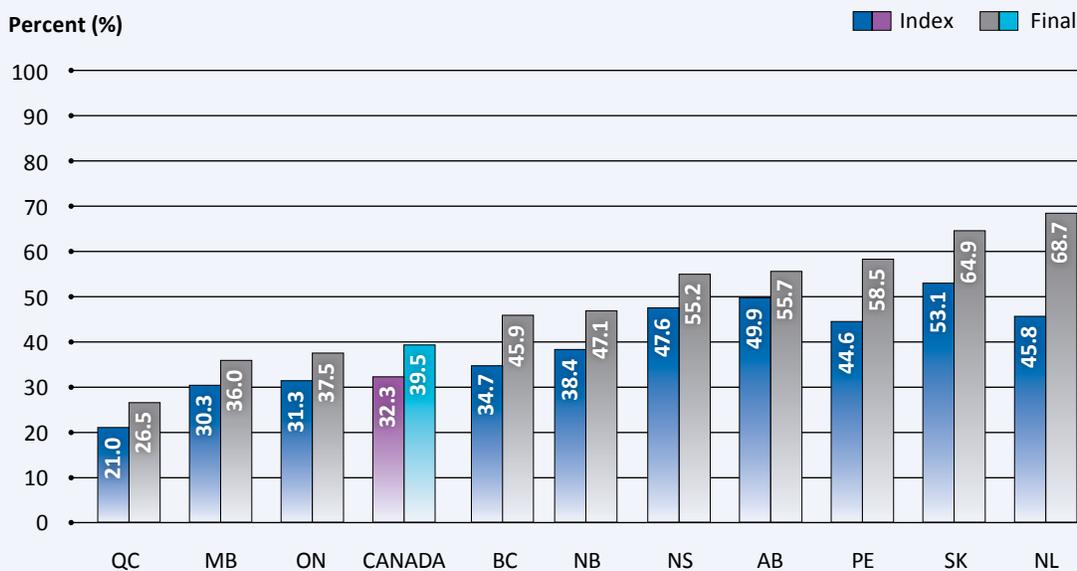
*The mastectomy data includes women who receive a mastectomy first (labelled Index), as well as women who receive breast conserving surgery first followed by a mastectomy within one year (labelled Final).

Includes women with unilateral invasive breast cancer whose surgery occurred between April 2007 and March 2010.

Data sources: Hospital Morbidity Database, Canadian Institute for Health Information, National Ambulatory Care Reporting System, Canadian Institute for Health Information, Fichier des hospitalisations MED-ÉCHO, ministère de la Santé et des Services sociaux du Québec, Alberta Ambulatory Care Reporting System, Alberta Health and Wellness.

Some evidence suggests that younger, more affluent women in the United States are opting for mastectomy instead of BCS.[74] These women may have a greater acceptance of mastectomy because of the severity of their disease, risk of progression, genetic factors or their acceptance of and access to breast reconstruction surgery. Figure 4.2 shows the pan-Canadian mastectomy rate by age group for women with unilateral invasive breast cancer. For women under age 40 and age 80 and older, mastectomy rates are 10 to 15 percentage points higher than for women aged 40 to 79.

Mastectomy rates are higher for women in lower income groups and for women living far from radiation treatment centres.

Figure 4.3 shows the pan-Canadian mastectomy rate by area income quintile (derived from patient postal code) for women with unilateral invasive breast cancer. Mastectomy rates tend to decrease with increasing income, with the rate for the lowest income quintile more than 6 percentage points higher than that for the highest income quintile. This is consistent with the findings of other studies.[76]

FIGURE 4.2

Percentage of breast cancer resections that are mastectomies,* by age group, Canada – 2007 to 2009 combined

Percent (%)

Age group	Percent
18 to 39	51.5
40 to 49	41.6
50 to 59	35.2
60 to 69	34.6
70 to 79	41.8
80+	49.6

FIGURE 4.3

Percentage of breast cancer resections that are mastectomies,* by neighbourhood income quintile, Canada – 2007 to 2009 combined

Percent (%)

Income quintile	Percent
Q1 (Lowest Income)	42.4
Q2	41.8
Q3	39.6
Q4	38.5
Q5 (Highest Income)	36.1

*The mastectomy data includes women who receive a mastectomy first as well as women who receive breast conserving surgery first followed by a mastectomy within one year.

Includes women with unilateral invasive breast cancer whose surgery occurred between April 2007 and March 2010.

Data sources: Hospital Morbidity Database, Canadian Institute for Health Information, National Ambulatory Care Reporting System, Canadian Institute for Health Information, Fichier des hospitalisations MED-ÉCHO, ministère de la Santé et des Services sociaux du Québec, Alberta Ambulatory Care Reporting System, Alberta Health and Wellness.

*The mastectomy data includes women who receive a mastectomy first as well as women who receive breast conserving surgery first followed by a mastectomy within one year.

Includes women with unilateral invasive breast cancer whose surgery occurred between April 2007 and March 2010.

Data sources: Hospital Morbidity Database, Canadian Institute for Health Information, National Ambulatory Care Reporting System, Canadian Institute for Health Information, Fichier des hospitalisations MED-ÉCHO, ministère de la Santé et des Services sociaux du Québec, Alberta Ambulatory Care Reporting System, Alberta Health and Wellness.

Some evidence exists suggesting that women living in rural communities are more likely to undergo a mastectomy than are urban women.[77-79] It may be that women living in rural communities find it more difficult to access facilities offering radiation therapy. They may opt for a mastectomy to avoid the disruptions associated with multiple trips to a treatment centre. Figure 4.4 shows mastectomy rates across Canada by one-way travel time to the nearest radiation treatment centre. The rate is constant until one-way travel time exceeds 40 minutes (6th decile), when the rate increases by 7 percentage points. The mastectomy rate increases by another 6 percentage points past 95 minutes and reaches 57% beyond 172 minutes of one-way travel time. The extent to which these patterns are due to travel time-related barriers or to other factors associated with living in a rural area (including clinical practice patterns) is not clear.

Some evidence exists suggesting that women living in rural communities are more likely to have a mastectomy than are urban women.

FIGURE 4.4

Percentage of breast cancer resections that are mastectomies,* by travel time from residence to nearest radiation treatment centre, in minutes, Canada – 2007 to 2009 combined

Percent (%)

Travel Time in Minutes to Nearest Treatment Centre

Travel Time	Percent
0 to 10	41.4
11 to 15	41.7
16 to 20	40.0
21 to 26	39.0
27 to 32	38.8
33 to 40	38.9
41 to 61	46.0
62 to 94	45.8
95 to 171	52.1
172 to 1714	57.1

*The mastectomy data includes women who receive a mastectomy first as well as women who receive breast conserving surgery first followed by a mastectomy within one year.

Includes women with unilateral invasive breast cancer whose surgery occurred between April 2007 and March 2010.

The driving time intervals represent decile cut-off points based on the actual driving time data distribution.
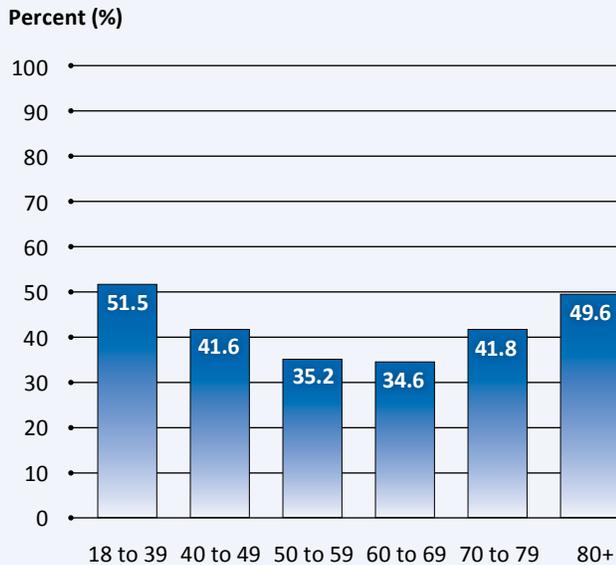
Data sources: Hospital Morbidity Database, Canadian Institute for Health Information, National Ambulatory Care Reporting System, Canadian Institute for Health Information, Fichier des hospitalisations MED-ÉCHO, ministère de la Santé et des Services sociaux du Québec, Alberta Ambulatory Care Reporting System, Alberta Health and Wellness.
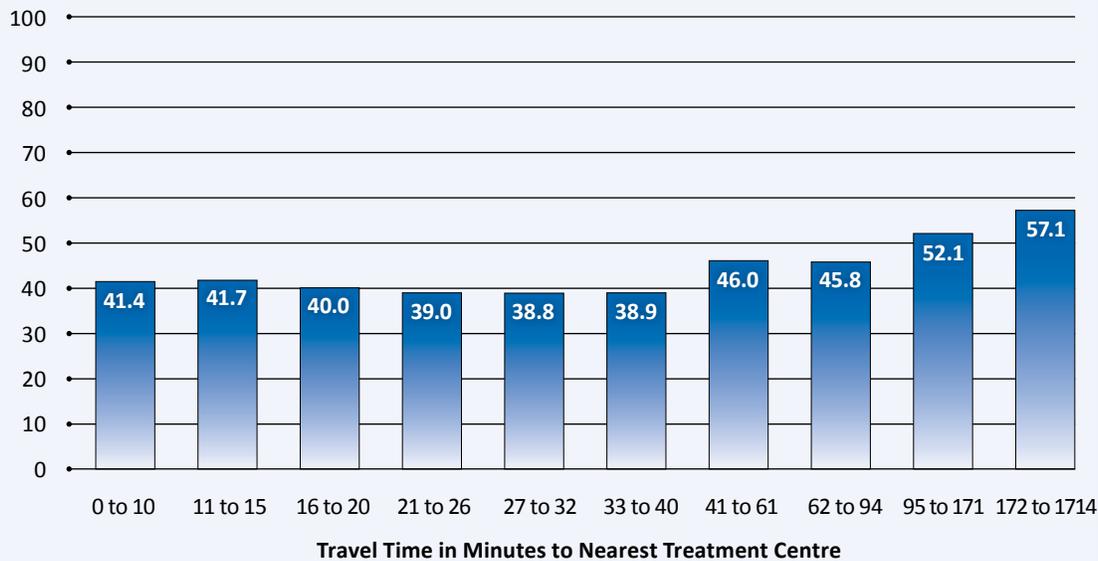
Radiation therapy is a key modality for the treatment and management of breast cancer.

Radiation therapy features prominently in the management of breast cancer. The most common use of radiation treatment in breast cancer is postoperatively (adjuvant therapy) to reduce the risk of recurrence, particularly in patients undergoing BCS. It is also used for certain patients with node-positive or locally advanced disease, irrespective of type of surgery (BCS or mastectomy). Radiation is sometimes administered preoperatively to patients with locally advanced disease who do not respond to preoperative chemotherapy. Other uses for radiation therapy in breast cancer include palliative treatment aimed at relieving pain or controlling symptoms.[53,80]

Women with early stage (Stage I or II) breast cancer who undergo BCS should have adjuvant radiation therapy to reduce the risk of recurrence unless it is contraindicated, according to evidence-based guidelines.[53,81] While adjuvant radiation therapy should be considered for most early stage patients who undergo BCS, there are no formal Canadian performance targets for post-BCS adjuvant radiation therapy use. It is difficult to set such targets because, for some patients (such as those with connective tissue disease or those who have previously received radiation to the same site), the risks associated with radiation therapy may outweigh the benefits. For these patients, mastectomy may be the better treatment option. Furthermore, some women may elect not to undergo adjuvant radiation therapy for personal reasons or because the treatment may be difficult to access (e.g., if they reside far from a treatment facility).

Nevertheless, measuring national patterns of radiation therapy use following BCS permits the identification of potential gaps in systems of care, which could be addressed through quality improvement strategies.

Reducing radiation therapy wait times for cancer patients is a national health-care priority. National wait time targets have been set and provincial initiatives to reduce wait times have been implemented.

Timely access to radiation therapy is a key component of a high-quality cancer control system. In 2004, the First Ministers committed to reducing wait time in priority areas. The following year, national benchmarks for wait times and reporting requirements were established in the identified priority areas, including cancer.[82] There are national targets for radiation therapy wait times and all provinces have implemented initiatives to measure and shorten their wait times.[83]

The relationship between radiation therapy wait times and treatment outcomes is not fully understood. According to one meta-analysis, the risk of local recurrence of breast cancer is increased when the wait time for radiation therapy is lengthy; however, the risk of metastasis is relatively small.[84] There is anecdotal evidence suggesting that getting treatment, or even simply having a treatment plan in place early in the care process, can help reduce anxiety and stress for patients and thus improve health-related quality of life.[85]

In 2011, eight of nine reporting provinces achieved the target of 90% of women treated within the national wait time benchmark (28 days from being ready to treat).

The median wait time for radiation therapy ranged from five days in Newfoundland and Labrador to 15 days in Nova Scotia (Figure 4.5). There was generally less interprovincial variation in the 90th percentile wait times, which suggests

that provinces have succeeded in reducing the proportion of patients at the high end of the wait time distribution.

Shorter wait time targets have been proposed. For example, the Canadian Association of Radiation Oncologists has set a target of 10 working days (14 calendar days) from the day of consultation or requisition to the start of therapy.[86]

FIGURE 4.5

Radiation therapy wait times for breast cancer – median and 90th percentile, by province – 2011
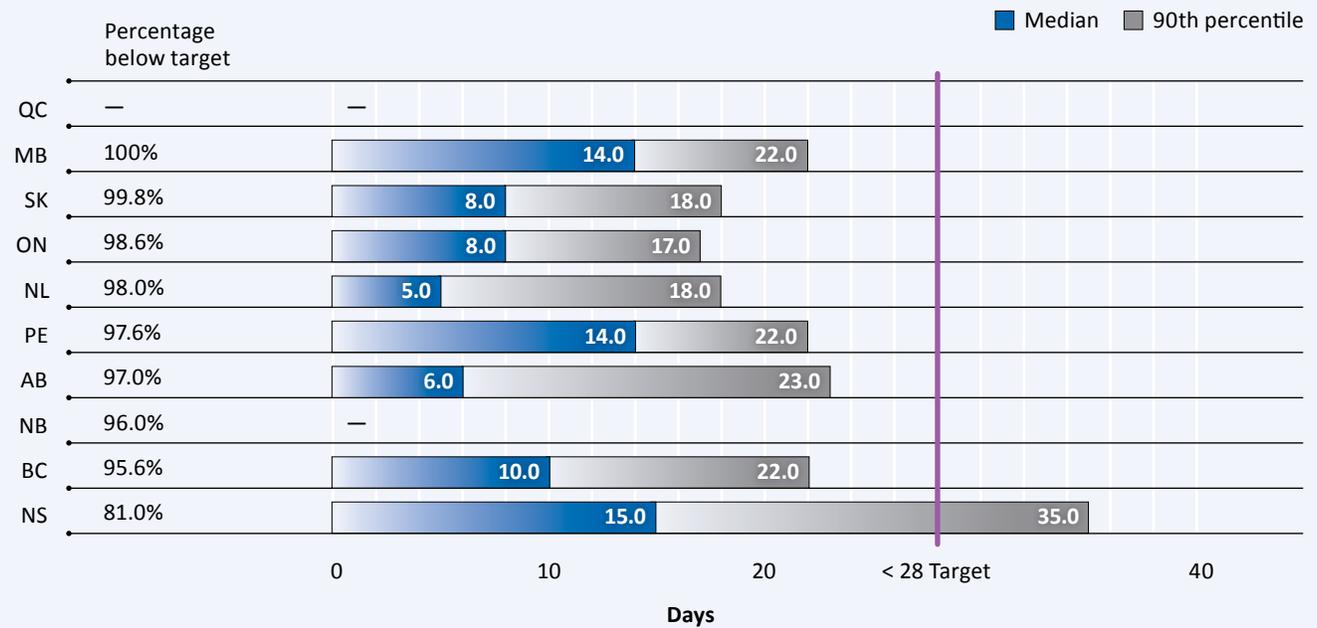
Wait time is the period from patient identified as ready to treat to start of treatment.

Note: NS implemented the collection of Ready to Treat (RTT) data in 2010. A recent audit of the processes used to generate NS Radiation Therapy wait times revealed that RTT dates are not being systematically updated in the case of planned delays. Consequently, the above estimates do not provide an entirely accurate picture of accessibility or system capacity, but somewhat overstate the length of time patients have waited for service. This effect will be most evident in the 90th percentile estimate.

"—" Data for NB are not available for the median and 90th percentile wait times. Data for QC are not available.

Data source: Provincial cancer agencies.

Sixty-two percent of women with breast cancer receive radiation therapy within two years of diagnosis, with an interprovincial range of 51% to 67%.

Of interest are overall rates of radiation therapy for women with breast cancer because these rates reflect important information on resource use relative to capacity. In 2009, the percentage of breast cancer patients treated with radiation therapy at all stages of invasive disease and for all indications within two years of diagnosis varied by province, ranging from 51% in Nova Scotia to 67% in Ontario (Figure 4.6). This variation could be due to differences in patient mix (including age and stage distribution), differences in capacity and access to radiation treatment facilities or differences in clinical practice. However, because this indicator includes patients undergoing mastectomies (who often do not undergo adjuvant radiation) and those receiving BCS (who are usually treated with adjuvant radiation), interprovincial differences in mastectomy rates would often result in interprovincial variations in radiation utilization.

62%

of women with breast cancer receive radiation therapy within two years of diagnosis, with an interprovincial range of 51% to 67%.

FIGURE 4.6

Percentage of breast cancer patients receiving radiation therapy started within 2 years of diagnosis, by province – patients diagnosed in 2009

Percent (%)
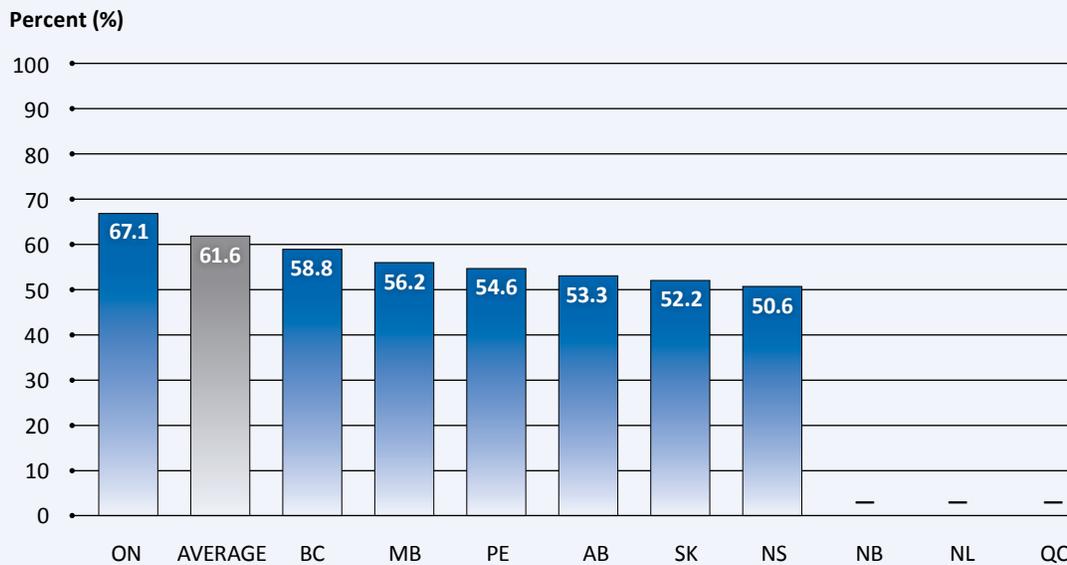
"—" Data are not available for NB, NL and QC.

Data source: Provincial cancer agencies.

This relationship is examined in Figure 4.7, which compares radiation therapy rates and BCS rates by province. As the scatter plot shows, the two rates are directly related, which would largely explain of the interprovincial variation in radiation therapy utilization. The next indicator presented focuses specifically on radiation therapy provided for women following BCS. This allows for a more meaningful comparison of evidence-based treatment patterns.

FIGURE 4.7

Percentage of breast cancer patients receiving radiation therapy vs. percentage receiving breast conserving surgery, by province – 2009 for radiation therapy, 2007 to 2009 for surgery

% Patients Receiving Breast Conserving Surgery

% Patients Receiving Radiation Therapy
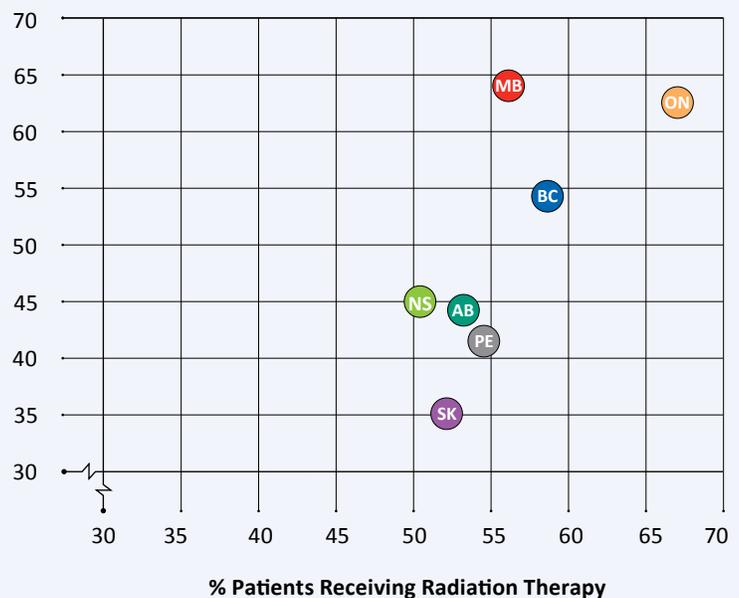
Includes radiation therapy started within two years of diagnosis for patients diagnosed in 2009. Breast conserving surgery includes procedures performed between April 2007 and March 2009.

Data sources for Breast Conserving Surgery: Hospital Morbidity Database, Canadian Institute for Health Information, National Ambulatory Care Reporting System, Canadian Institute for Health Information, Fichier des hospitalisations MED-ÉCHO, ministère de la Santé et des Services sociaux du Québec, Alberta Ambulatory Care Reporting System, Alberta Health and Wellness.

"—" Data are not available for NB, NL and QC.

Data source for Radiation Therapy: Provincial cancer agencies.

87% of women with Stage I or II breast cancer received radiation therapy following breast conserving surgery, with a provincial range of 76% to 93%.

To measure adherence to the guideline on post-BCS use of radiotherapy, information on both stage of disease and type of surgical treatment (BCS or mastectomy) are needed. Not all provinces have collected the data needed to calculate such a guideline-based metric. Figure 4.8 shows that in 2009, the use of radiation therapy in this group of women ranged from 76% in Manitoba to 93% in Newfoundland and Labrador, with an average of 87% in the six reporting provinces.

A few population-based studies published on the treatment experience in the United States and Switzerland help put these Canadian findings in context. According to a U.S. study, 94% of women aged 66 to 70 included in the study received adjuvant radiation therapy for early stage breast cancer following BCS from 2000 to 2002.[87] A national Swiss study reported an adjuvant radiation treatment rate of 92% for women under age 80 with Stage I to III breast cancer.[88] The Canadian rate reported here is slightly lower than these published results; however, the years under analysis and study methods (particularly age exclusions) differ from those in the U.S. and Swiss Studies, making precise comparisons difficult.

Early stage breast cancer patients are receiving radiation therapy in accordance with guidelines.

FIGURE 4.8

Percentage of Stage I or II breast cancer patients receiving radiation therapy following breast conserving surgery, radiation therapy started within 270 days following surgery, by province – patients diagnosed in 2009

Percent (%)

	NL	ON	AB	AVERAGE	SK	PE	MB	BC	NB	NS	QC
	93.4	88.1	87.4	86.9	86.1	84.4	76.1	—	—	—	—
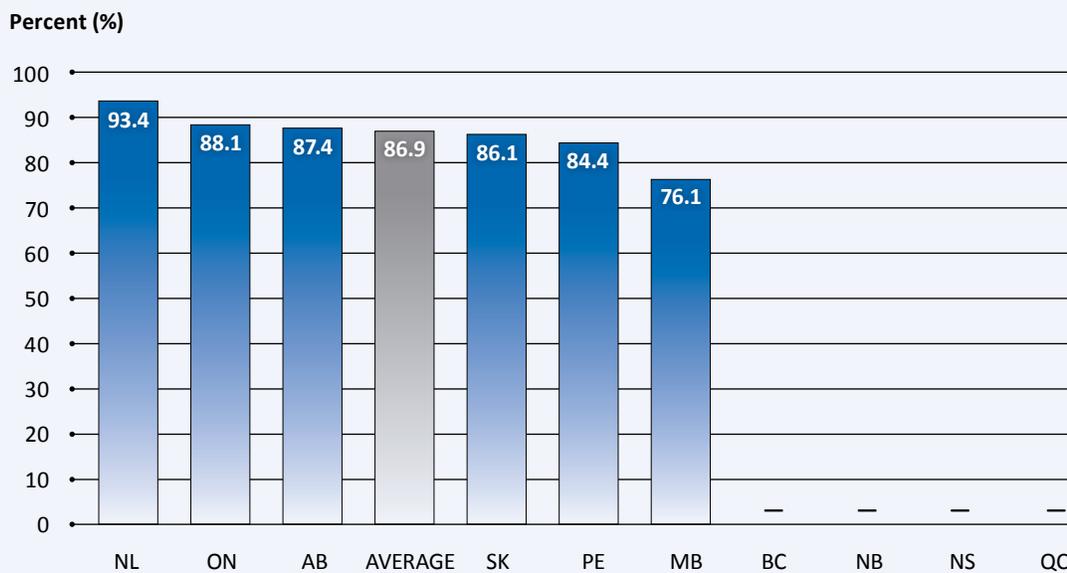
"—" Data are not available for BC, NB, NS and QC.

Data source: Provincial cancer agencies.

Some provincial increases in the use of radiation therapy from 2007 to 2009 are evident among women with Stage I and II breast cancer.

Figure 4.9 presents radiation therapy treatment rates by province for all Stage I and II breast cancer patients (irrespective of type of surgery). Although three years (2007, 2008 and 2009) of data are not sufficient to identify definitive trends, five of the seven reporting provinces

show increases in the percentage of women with early stage breast cancer receiving radiation therapy. This trend is maintained when examining only radiation rates following BCS (not shown because fewer provinces have three years of data), which suggests that it may not only reflect increases in BCS rates, but possibly increases in concordance with post-BCS adjuvant radiation guidelines.

FIGURE 4.9

Percentage of Stage I or II breast cancer patients receiving radiation therapy, started within 1 year + 270 days following diagnosis, by province – patients diagnosed in 2007, 2008 and 2009
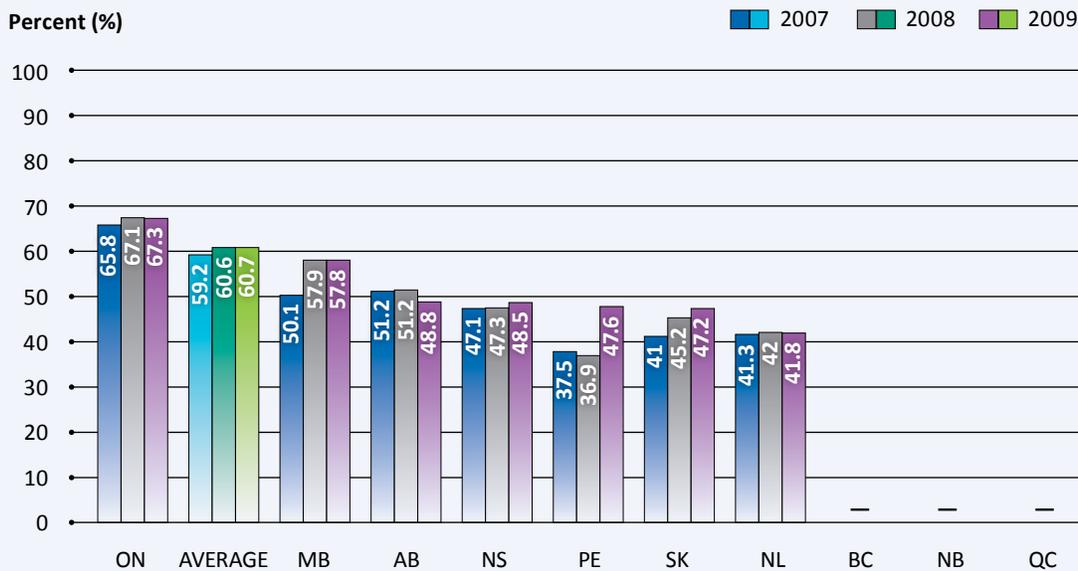
"—" Data are not available for BC, NB and QC (2007 to 2009).
Data source: Provincial cancer agencies.

The use of adjuvant radiation therapy following breast conserving surgery is lower among women aged 70 and older than among younger women.

The rate of adjuvant radiation therapy declines from an average of 90% for patients under age 70 to just above 50% for patients aged 80 and over (Figure 4.10). This general trend of decreasing treatment rates with increasing age applies to all provinces. A decline in the use of adjuvant radiation treatment, by age, following BCS has been documented extensively in the literature. For example, according to a retrospective cohort study of breast cancer incident cases from a region in England, non-standard

management of breast cancer patients increased with age. Women over age 70 were less likely to receive radiation therapy following BCS than women aged 65 to 69.[89]

Several guidelines (such as those of the National Comprehensive Cancer Network, 2011) modify their recommendation for adjuvant radiation therapy for women over 70 based on a number of clinical trials showing limited benefit in terms of survival for patients aged 70 and older who are estrogen receptor (ER) positive and clinically node negative and who receive endocrine therapy.[90] Thus, the drop in the use of radiation therapy for women over 70 may be consistent with evidence-based practice.

FIGURE 4.10

Percentage of Stage I or II breast cancer patients receiving radiation therapy following breast conserving surgery, radiation therapy started within 270 days following surgery, by age group and province – patients diagnosed in 2009
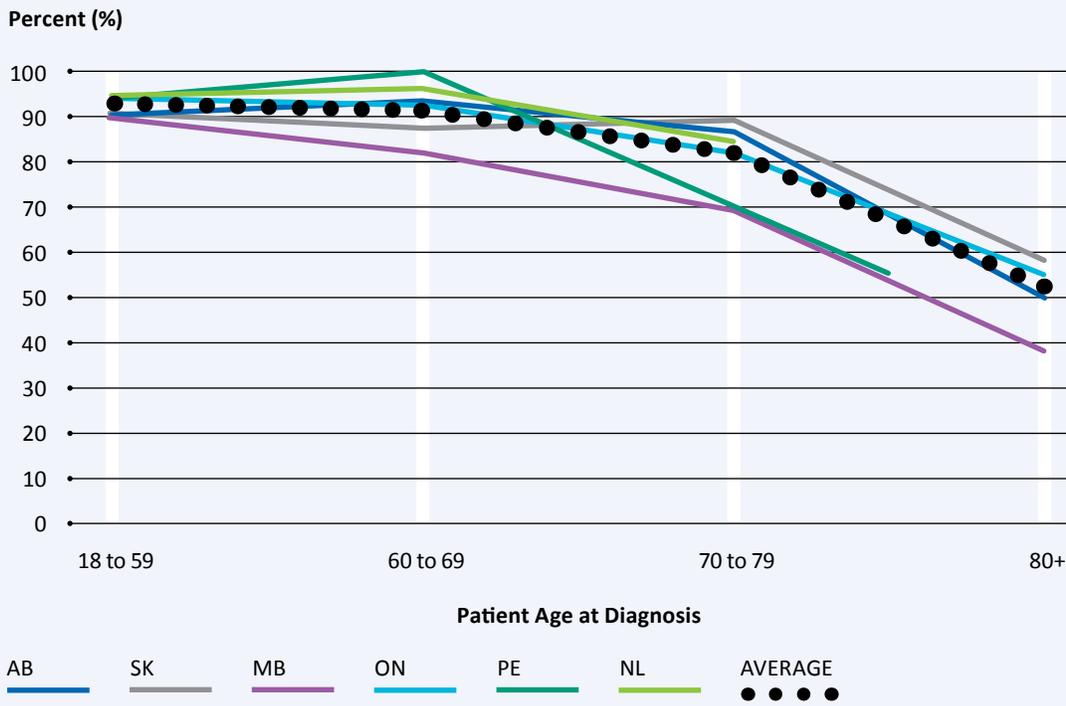
Data are not available for BC, NB, NS and QC.

PE values are combined for patients aged 70 and over for privacy considerations.

Data source: Provincial cancer agencies.

Chemotherapy in breast cancer treatment.

Chemotherapy may be used to treat all stages of breast cancer. In early stage disease with lymph node involvement, chemotherapy has been shown to be most beneficial for women with ER-negative breast cancers, although more recent research shows no difference in relative benefit from chemotherapy between ER-positive and -negative cancers.[56] Rates of recurrence and death are reduced in women with ER-positive breast cancer with adjuvant tamoxifen therapy[91] and use of adjuvant aromatase inhibitors.[92] Some women with ER-positive, node-negative breast cancer do not require chemotherapy because endocrine therapy is an effective option for them.[93] For invasive, non-metastatic breast cancer, chemotherapy is usually given as adjuvant therapy following surgery. However, in cases where the tumour is very large, neo-adjuvant chemotherapy (and hormone therapy) may help shrink the tumour prior to surgery.[94]

Breast cancer in younger women tends to be more aggressive and may respond to chemotherapy and, where indicated, hormone therapy. For women with advanced stage disease, chemotherapy is often the preferred initial treatment. Chemotherapy is not recommended for women with non-invasive, in situ cancers such as ductal carcinoma in situ (DCIS).

Where data are available, rates of chemotherapy use within one year of breast cancer diagnosis (all stages) vary from 38% to 52%.

Unlike radiation therapy, which is delivered in designated cancer centres or clinics, typically within the jurisdiction of the provincial cancer authorities, chemotherapy is delivered in a variety of settings, including community hospitals, outpatient clinics and private pharmacies (in the case of oral chemotherapy). Consequently, province-wide data on chemotherapy use are available only for provinces that track all cancer drug delivery centrally.

Among the five provinces for which province-wide data are available, rates of chemotherapy use among women newly diagnosed with invasive breast cancer in 2009 receiving chemotherapy within one year of diagnosis ranged from 38% to 52% (Figure 4.11). This variation may be due to differences in patient mix, access to services or clinical practice. Note that not all breast cancer patients are candidates for chemotherapy, so the expected rate is less than 100%. Future efforts will focus on collecting more detailed data on chemotherapy use, including treatment by stage, and also hormone therapy use as an important modality in breast cancer treatment. This will allow for more meaningful assessments of practice patterns and adherence to evidence-based guidelines.

FIGURE 4.11

Percentage of breast cancer patients receiving chemotherapy started within 1 year of diagnosis, by province – patients diagnosed in 2009

Percent (%)
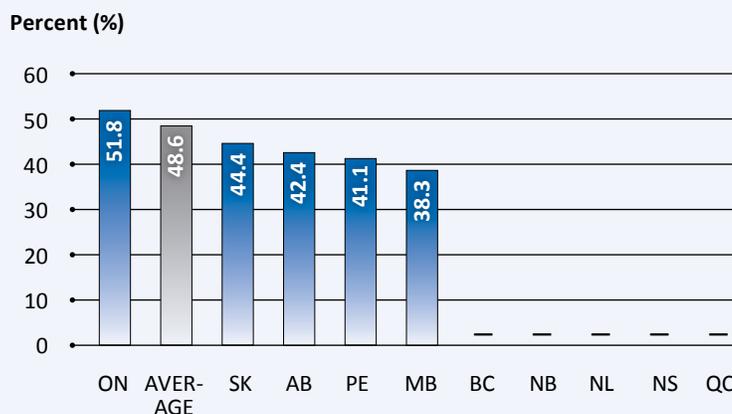
Note: Includes invasive breast cancer cases only.

"—" Data are not available for BC, NB, NL, NS and QC.

Data source: Provincial cancer agencies.

Conclusion

Breast cancer treatment is resource-intensive, complex and often multi-modal, potentially involving surgery, radiation therapy, chemotherapy, targeted therapy and endocrine therapy. Data are available on some, but not all, of the factors that influence treatment decisions and define best practices codified in evidence-based guidelines. Although not sufficiently detailed to make firm judgments about quality of care, variations in patterns of care can be examined, by jurisdiction, to inform quality improvement initiatives.

The percentage of women undergoing mastectomy varied from 26.5% in Quebec to 68.7% in Newfoundland and Labrador, while the percentage of women with early stage breast cancer receiving guideline-recommended radiation therapy ranged between 76% and 93%.

Some indicators pointed to success stories: in terms of wait times for radiation therapy in 2011, eight of nine reporting provinces had achieved the target of having 90% of women treated within the national wait time benchmark.

Chemotherapy utilization rates for breast cancer were presented for the first time in this report. Among the five provinces for which data were available, rates ranged from 38% to 52%. Chemotherapy utilization indictors will be more informative when they can be linked to evidence-based guidelines.

Breast Cancer Patient Experience, Survivorship and End-of-Life Care

SECTION FIVE

Breast Cancer Patient Experience, Survivorship and End-of-Life Care

Cancer and its treatment can take a toll on an individual's health; physical, social and occupational functioning; sense of security; and well-being.[95–97] An important measure of the quality of a cancer control system is the degree to which it provides a patient-centred perspective through which individuals are supported and cared for as they face the many challenges posed by cancer.[98]

Following diagnosis, patients and their families may need help navigating the complex cancer care system, getting information about their cancer and its treatment, and dealing with the emotional, social, spiritual and practical concerns that arise. A lack of access to information and supportive care services can add to the distress of cancer patients and compromise their ability to adjust to changes brought about by cancer.[99] Post-treatment care for cancer survivors must also be in place to meet both the medical and psychosocial long-term effects of cancer and its treatment. For those whose cancer is not treatable, or for whom the goal of treatment is no longer curative, access to comprehensive patient-centred palliative and end-of-life care is necessary.

The cancer care community has recognized the importance of developing indicators to assess the experiences of individuals with cancer, regardless of where they receive care. There is, however, still much work to be done to collect meaningful pan-Canadian data in the important domains described above.

The first part of this section provides information on two indicators for which data are currently available: 1) the extent to which patients treated for breast cancer are screened for distress and other symptoms using standardized tools and 2) the place of death for women who die of breast cancer (i.e., in or out of hospital). The second part of this section describes other areas for which more complete national data may be available in the near future: palliative and end-of-life care, patient satisfaction, the availability of patient navigation tools and survivorship supports.

Screening for distress among women undergoing treatment for breast cancer helps to quickly identify those who need further support.

When facing a diagnosis of breast cancer, women might variously experience fear, sadness and denial.[100] Psychological distress may also accompany treatment (with its resultant side effects) and the fear of recurrence and of dying of the disease.[101]

BOX 5.1

Defining cancer-related distress

Distress among those who have cancer has been defined as "a multifactorial unpleasant emotional experience of a psychological (cognitive, behavioural, emotional), social, and/or spiritual nature that may interfere with the ability to cope effectively with cancer, its physical symptoms and its treatment. Distress extends along a continuum, ranging from common normal feelings of vulnerability, sadness, and fears to problems that can become disabling, such as depression, anxiety, panic, social isolation, and existential and spiritual crisis."[102]

Psychosocial issues and distress are generally not cancer type-specific, but they have been most extensively studied among women with breast cancer. The studies show the most distress occurs at transition points in treatment: at the time of diagnosis, while awaiting treatment, during and on completion of treatment, at follow-up visits, at recurrence and in the event of treatment failure.[103] Cancer-related distress does dissipate with time for the majority of individuals diagnosed with cancer.[96,104] For others, however, such distress may interfere substantially with comfort, quality of life and the ability to make appropriate treatment decisions and adhere to treatment.[103,105] The frequency and patterns of psychosocial distress that occur among women with breast cancer depend greatly on which concerns are included in the operational definition of distress and how it is measured. The primary goal of standardized screening for distress is to quickly identify those patients who would benefit from additional follow-up care.[106]

There are many instruments available to screen for distress and other psychosocial and physical symptoms of cancer. The most commonly used distress screening tools in Canada are the Edmonton Symptom Assessment System (ESAS) and the Canadian Problem Checklist (CPC).[105,107,108]

The ESAS allows patients to self-report the severity of psychosocial and physical problems or concerns related to cancer. The CPC captures patients' concerns or problems they experienced in the past week from a list of issues, including those in the psychosocial, practical and physical domains.

The Partnership worked with cancer agencies and treatment centres in eight provinces to implement screening for distress using the ESAS and CPC instruments and clinical practice guidelines related to distress and other symptom assessment.

Table 5.1 provides information on the extent to which provinces and their cancer agencies have implemented any standardized symptom screening tools for pain and distress. There is substantial variation across the country in the use of standardized symptom assessment tools. A few provinces have also provided the Partnership with data on uptake of distress screening among breast cancer patients. Other provinces, such as Newfoundland and Labrador, have begun using the screening tools for breast cancer patients and should be able to report on this indicator in the near future.

TABLE 5.1

Extent of usage of standardized symptom screening tools across clinics within provincial cancer agencies

Province	Province-wide implementation	Selected centres (provincially supported)	Not centrally managed – use varies by centre	Percentage of breast cancer patients seen who were screened for distress in 2012
BC	X			75% (not limited to breast)
AB		X		n/a
SK	X			n/a
MB	X			n/a
ON	X			65%
QC			X	n/a
NB			X	n/a
NS	X			n/a
PE		X		~93%
NL			X	n/a

Symptom screening tool means any instrument used to screen for distress, not necessarily ESAS or CPC.

Province-wide implementation means standardized symptom screening undertaken for at least a portion of patients at each provincial cancer centre.

Selected centres (provincially supported) means standardized symptom screening undertaken for at least a portion of patients at selected provincial cancer centres.

Not centrally managed – use varies by centre means provincially managed implementation of symptom screening does not exist; however, some centres may use a screening tool.

n/a means screening for breast cancer patients specifically has either not been rolled out or data are not available because data are not collected on this specific to cancer type.

Breast cancer place of death.

Providing the opportunity for palliative cancer patients to die in a comfortable, supportive and dignified environment is an important part of end-of-life care. Studies have found that individuals who know they will die from cancer generally prefer to die at home or in another non-hospital setting.[109] An estimated 70% of cancer deaths in Canada from 2003 to 2007 occurred in hospitals;[98] however, there was significant provincial variation in the extent of hospital deaths.[k] Among breast cancer patients, the percentage of deaths occurring in hospital during that time period is similar (data not shown). In 2009, approximately 67% of breast cancer deaths in Canada occurred in hospital (<u>Figure 5.1</u>). Variations from year to year between 2003 and 2007 are likely the result of differences in reporting practices rather than changes in patient care. The results presented here are higher than what has been reported elsewhere. Using data from 1998 to 2002, the percentage of breast cancer deaths occurring in hospital was 63% in Nova Scotia and 53% in Ontario.[110] Based on 2003/04 data from Ontario, the percentage of breast cancer deaths occurring in acute care beds was 49%.[111]

There is some evidence suggesting that cancer-related deaths are increasingly occurring out of hospital. In Nova Scotia, out-of-hospital deaths among adults dying of cancer rose from 19.8% in 1992 to 30.2% in 1997 (a 52% increase).[112] In Ontario, however, the percentage of cancer-related deaths occurring out of hospital remained relatively constant from 2000 to 2006 (56% and 55%, respectively).[113] In the United States, the percentage of cancer deaths occurring in hospital was 28% in 2007,[114] which is much lower than what was reported for Canada for that year; however, the United States has a formal palliative care program under which hospice care is covered.[115]

FIGURE 5.1

Breast cancer patient place of death, Canada – 2009

Percent (%)

13.4% Private home
11.3% Other health-care facility
8.7% Other
66.6% Hospital
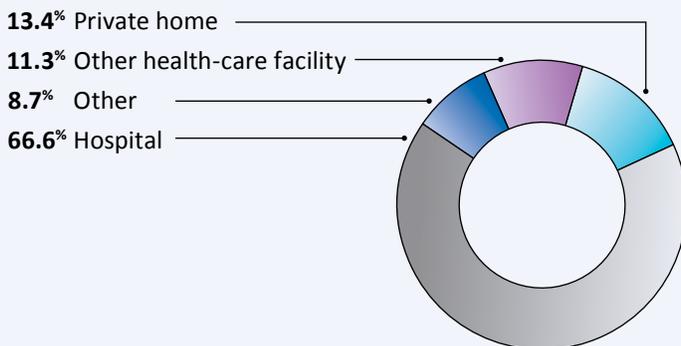
According to surveys, most patients who know they will die from cancer prefer to die at home or in another non-hospital setting.

Other includes other specified locality and unknown locality.

Data source: Statistics Canada – Vital Statistics Death Database.

k) The observed provincial variation of out-of-hospital deaths could be explained by differences in systems of institutional and home-based palliative care. Some jurisdictions, for example, may offer a more extensive system of home-based hospice services. Another explanation is an inconsistency across provinces in how hospital deaths are coded. An assumption is made that a hospital death represents an acute care stay. Some hospitals have hospital-based palliative care or hospice beds available for dying patients. If place of death is not categorized on the death certificate to distinguish between palliative care and acute care stays, a province's percentage of out-of-hospital deaths might be relatively low and misinterpreted to represent inappropriate use of in-hospital acute care beds.

Future areas for reporting

Measuring patient satisfaction.

Satisfaction with care is an important measure of patients' impressions of their experiences with the health-care system. Most provincial cancer agencies administer a patient satisfaction survey using the NRC Picker Ambulatory Oncology Patient Satisfaction Survey (AOPSS). This survey measures several aspects of care; for example, the degree to which care is co-ordinated and continuous and provides emotional support. Patient satisfaction survey results have been presented in previous System Performance reports;[98,116] however, data by cancer type were not reported. Work is underway to obtain more detailed results from patient satisfaction surveys for future reports. The Cancer System Quality Index presents AOPSS results for Ontario by cancer type, including breast.[117]

Patient navigation programs are in place in all provinces and territories.

Patient navigation refers to the proactive, practical help that specially trained professionals or volunteers offer to cancer patients and their families to assist them as they negotiate the maze of treatments, services and challenges.[118] In many provinces, patient navigation programs were first implemented for women with breast or gynecological cancers.[118] All provinces and territories have some form of patient navigation program operating either at the local, regional or provincial or territorial level. Nova Scotia and Quebec employ nurses as navigators for their provincial programs and also collect data on their systems.

The Partnership collaborated with three jurisdictions in Canada to implement and evaluate professional and patient navigation programs. There is national interest in collecting data so that indicators can be calculated to reflect the extent to which jurisdictions have implemented navigation programs for specific patient groups. The impact of these programs may then be evaluated using surveys of patient-reported outcomes and satisfaction.

Assessing survivorship needs following breast cancer is an important measure of system performance.

Survivorship, the phase most often used to define the period following active treatment, includes adjustment to "the new normal" of life, which can include dealing with economic challenges, coping with late effects and complications of treatment, surveillance for recurrence and routine follow-up care.[119] Assessing the needs of survivors and the extent to which the system is responding to those needs is an important component of system performance measurement.

Many women diagnosed with breast cancer suffer a loss of income because they cannot return to work or have to take long absences as a result of treatment.[120] According to a 2009 survey of working-age Canadian women with breast cancer, 80% experienced a significant financial impact, with an average drop of $12,000 in annual household income.[121] Among the respondents with a full- or part-time job at the time of diagnosis (73% of the sample), there was a 16% decline in the number of women with full-time jobs after treatment and 16% had their jobs terminated. Twenty percent of women who had worked at the time of diagnosis returned to work early because of financial pressures. While public health plans provide coverage for most cancer-related treatments, there are gaps in coverage that vary by jurisdiction (e.g., costs of some drugs, medical supplies and prostheses). Private insurance and charitable organizations such as the Canadian Cancer Society provide some assistance that

offsets the costs of treatment-related transportation, housing and wigs and other supplies. Despite these sources of assistance, many individuals face financial hardship following a diagnosis of cancer.

Furthermore, women have unique medical and psychosocial needs following their treatment for breast cancer. In addition to concerns about cancer recurrence and the development of a second primary cancer, women may be at risk for lymphedema, premature menopause, cardiovascular disease and other late effects of cancer and its treatment.[122] Clinical practice guidelines have been developed to meet the medical and psychosocial needs of cancer survivors.[119] A population-based study in Ontario showed that the receipt of routine follow-up care and surveillance in the five years after treatment varied substantially among breast cancer survivors.[123]

Increasingly, there have been calls to develop survivorship care plans (SCPs) that outline needed follow-up service and assign responsibility for care (to primary care or oncology);[124] there is still much discussion and research being done to develop and evaluate these plans, however. While definitive evidence of the benefits of SCPs is not yet available, a recent randomized controlled trial showed that breast cancer patients with an SCP did not show improvement in selected patient-reported outcomes, such as cancer-related distress, when compared with patients who were discharged from an oncologist to a primary-care physician.[104]

Nonetheless, the use and evaluation of SCPs continues to expand. Both survivors and providers recognize the need for appropriate transition plans that address the shift from cancer treatment to survivorship.[125] In the future, there may be opportunities to collect data to reflect the extent to which jurisdictions have implemented SCPs for specific patient groups, and better measure the benefits and outcomes of these interventions.

More palliative and end-of-life care data will improve understanding of patient needs at the end-of-life and their use of health-care resources.

Palliative care aims to improve the quality of life for individuals and families facing the terminal stage of a life-threatening illness such as cancer.[126] Managing symptoms and addressing the psychosocial and spiritual concerns of patients are central to palliative care. End-of-life care is an essential part of palliative care and is provided when cancer can no longer be treated curatively. Studies have demonstrated that in-home palliative care significantly increases patient satisfaction and also reduces the use of medical services and costs of medical care at the end of life.[115,127,128]

Population-based data on the use of hospice and palliative end-of-life care are currently not readily available in Canada. The Partnership established the Canadian Hospice Palliative End-of-Life (HPEOL) Care Surveillance Team Network in 2009 to improve the quality and use of existing data to better understand the characteristics of terminally ill cancer patients and their resource use in the final year of life.[129] Led by Drs. Francis Lau and Michael Downing, HPEOL's key objectives are to:

- Establish a methodology and design for a web-based end-of-life care surveillance system

- Publish a set of information products to describe end-of-life patients and their resource use

- Improve the quality and use of existing electronic data sources through this system to enhance end-of-life care policy planning, resource monitoring and clinical decision-making

- Engage in knowledge translation and capacity building in end-of-life cancer population surveillance

These HPEOL efforts will allow the System Performance Initiative, in future reports, to publish data on the use of hospice and palliative end-of-life care in Canada – for all cancers and for specific cancer types, including breast cancer.

Administrative data can also be used to measure some aspects of the patient experience at the end-of-life. Dr. Grunfeld and colleagues assessed the value of administrative data for measuring some aspects of the quality of end-of-life care at the provincial level in Nova Scotia and Ontario and identified seven potential quality

indicators for end-of-life care of women with breast cancer:[110]

- Interval between last chemotherapy and death
- Place of death
- Frequency of emergency department visits
- Hospital days and intensive care unit days near the end-of-life
- Continuity of care
- Time and location of care
- Adverse events

Some of these indicators have been used to assess care provided to women dying of breast cancer in 2003/04.[111]

Conclusion

While there is strong recognition of the need to better understand and enhance the cancer patient's experience in the system, there is still much work to be done to collect meaningful data for performance measurement. The Partnership recently launched a concerted effort aimed at developing indicators of patient experience and patient-reported outcomes, by

cancer type. A Patient-Reported Outcomes Measurement Steering Committee has been formed with experts from across the country to work toward this goal. Future system performance reports will include progressively more detailed indicators on patient-reported outcomes, survivorship and end-of-life care.

Breast Cancer Prevention

SECTION SIX

Breast Cancer Prevention

Many factors influence a woman's risk of breast cancer.

Prevention is a key element of cancer control. An understanding of the role of risk factors and their prevalence in the population helps to guide cancer prevention efforts. Unlike some other cancers, such as lung cancer, where the majority of cases are linked to health behaviours (such as tobacco use), many factors influence a woman's risk of breast cancer. Some of these risks are non-modifiable – for example, age and genetic makeup; several relate to reproductive and hormonal factors, while others are potentially modifiable by adjusting personal health behaviours.

A number of risk factors have been associated with breast cancer.

This section presents information on three health behaviour-related risk factors for breast cancer for which pan-Canadian data exist: overweight and obesity, physical inactivity and alcohol consumption. Recent estimates of the proportion of breast cancer incident cases that is attributable to overweight and obesity range from 3% to 23%.[130,131] The estimates for physical inactivity range from 3% to 16.5% and for alcohol consumption, from 2% to 7%. [130,131,l]

Prevalence data for these indicators of breast cancer risk are based on the Canadian Community Health Survey. The results are presented by age, geography and socio-economic status.

TABLE 6.1

Risk factors for breast cancer

Health behaviour-related factors	Reproductive and hormonal factors	Other factors
• Overweight or obesity • Physical inactivity • Alcohol consumption	• Giving birth fewer times • Later age at first full-term pregnancy • Not breastfeeding • Early age at menarche • Late menopause • Use of exogenous hormones (hormone replacement therapy [estrogen plus progestin]; oral contraceptive use [increases risk slightly])	• Age • Family history of breast cancer • BRCA1 or BRCA2 mutations • Ionizing radiation exposure • Certain benign breast conditions, such as atypical ductal hyperplasia and atypical lobular hyperplasia

Data source: Adapted from Canadian Cancer Statistics 2007 (Special Topic: Breast Cancer), page 74.

Note: Some women at high risk of breast cancer because of family history or genetic makeup may consider chemo-prevention strategies, such as tamoxifen or aromatase inhibitors (see Box 6.3).

l) Estimates of population-attributable risk will be influenced by the prevalence of personal health behaviours in that population. Therefore, studies conducted in different countries may arrive at different estimates of attributable risk.

Evidence links body weight to postmenopausal breast cancer.

Obesity and overweight, as measured by high body mass index (BMI), increases the risk of postmenopausal breast cancer.

Evidence has linked excess body weight to postmenopausal breast cancer.[132;m] For example, the Women's Health Initiative observational study of 85,917 postmenopausal women found that women with a baseline BMI of more than 31.1 were two and a half times more likely to develop breast cancer compared with women with a baseline BMI lower than 22.6.[133;n]

Obesity may increase levels of circulating sex hormones, insulin and insulin-like growth factors, which may promote the development of breast cancer.[134] The risk of postmenopausal breast cancer associated with high BMI is of concern given the increasing prevalence of overweight and obesity among women in Canada.[135] Less certain is evidence pertaining to the influence of weight loss or gain on the risk of breast cancer (see Box 6.1).

BOX 6.1

Weight loss and breast cancer risk

Although a strong body of evidence supports an association between obesity and overweight and breast cancer, less certain is whether reducing weight decreases the risk of breast cancer. There is some evidence suggesting that weight loss, particularly later in life, reduces the risk of postmenopausal breast cancer.[132,134] Furthermore, it is not known whether the risk for breast cancer associated with weight gain is independent of when in life weight gain occurs, or whether weight gain occurring during particular (susceptible) periods in life increases risk.[134]

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m) Note that among premenopausal women, some evidence suggests that being overweight protects against breast cancer; however, the evidence for this is not compelling (WCRF/AICR, 2007). Most breast cancers are diagnosed among postmenopausal women and so any protective effect of overweight among premenopausal women would not be expected to contribute significantly to a reduction in breast cancer incidence.

n) This finding was limited to women who had never taken hormone replacement therapy. The relative risk reported was found to be 2.52; 95% confidence interval = 1.62 to 3.93.

The prevalence of obesity and overweight in Canadian women remains a challenge.

In 2010, 43.7% of Canadian women aged 18 and older were classified as overweight (27.2%) or obese (16.5%). These findings are based on self-reports of height and weight to the CCHS (Figure 6.1). There is considerable variation across provinces and territories in the percentage of women classified as overweight or obese, with percentages highest in Nunavut and

New Brunswick and lowest in British Columbia and Alberta (Figure 6.1). The Nunavut estimate is to be interpreted with caution because of a small sample size. A review comparing actual (directly measured) versus self-reported height and weight to compute BMI showed that individuals tend to underestimate their weight and overestimate their height, suggesting that the percentage of women classified as overweight or obese may be higher than that reported in the CCHS.[136]

FIGURE 6.1

Percentage of women (aged 18+) classified as overweight or obese, by province/territory – CCHS 2010
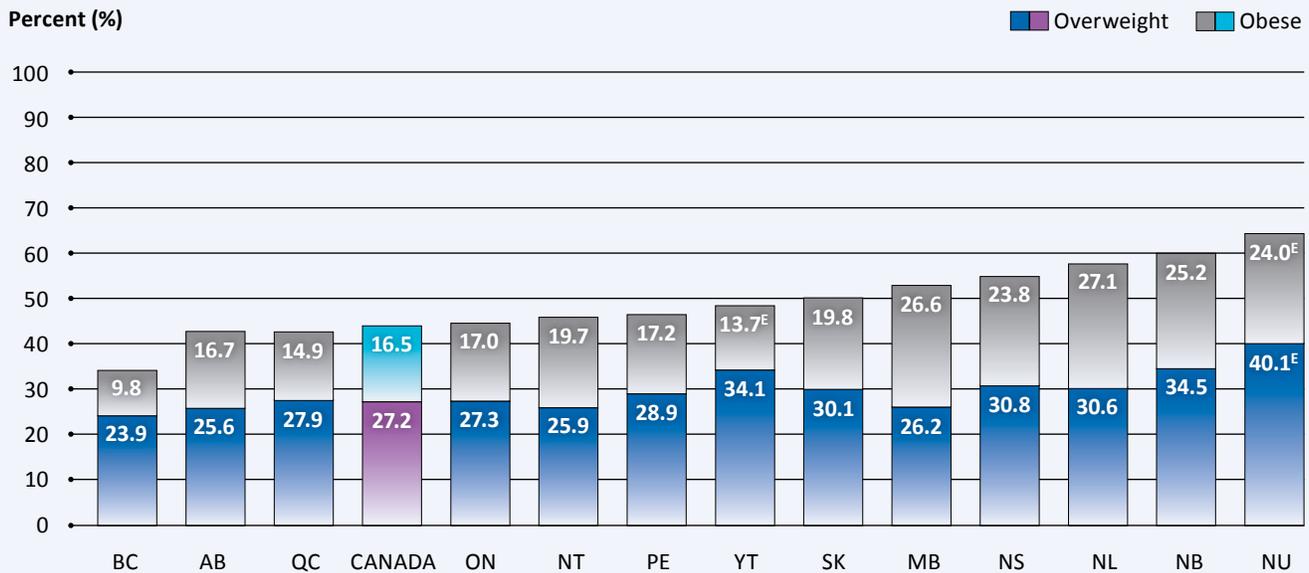
E Interpret with caution due to a large amount of variability in the estimate.

Data source: Statistics Canada, Canadian Community Health Survey.

When examined by age, the rate of overweight and obesity is much higher among women aged 50 and older (53.1%) than in younger women and girls (16.1% at ages 12 to 17; 36.1% at ages 18 to 49; data not shown).

Overweight and obesity rates among Canadian women varied significantly by income, with women in the lowest income quintile having higher rates (48.8%) than women in the highest quintile (40.3%) (Figure 6.2). A steeper gradient of difference is evident when rates are analyzed by educational attainment. Women of low educational attainment (less than secondary) were more likely to be overweight or obese (58.9%) than were women with higher educational attainment (post-secondary or graduate; 40.9%) (Figure 6.2). In terms of geography, rates of overweight and obesity tended to be lower among women living in urban areas than among residents of rural or remote areas of Canada (Figure 6.2). Socio-economic and geographic trends were similar when the analysis was limited to women aged 50 and older (data not shown).

FIGURE 6.2

Percentage of women (aged 18+) classified as overweight or obese by income quintile, household education and geography, Canada – CCHS 2010
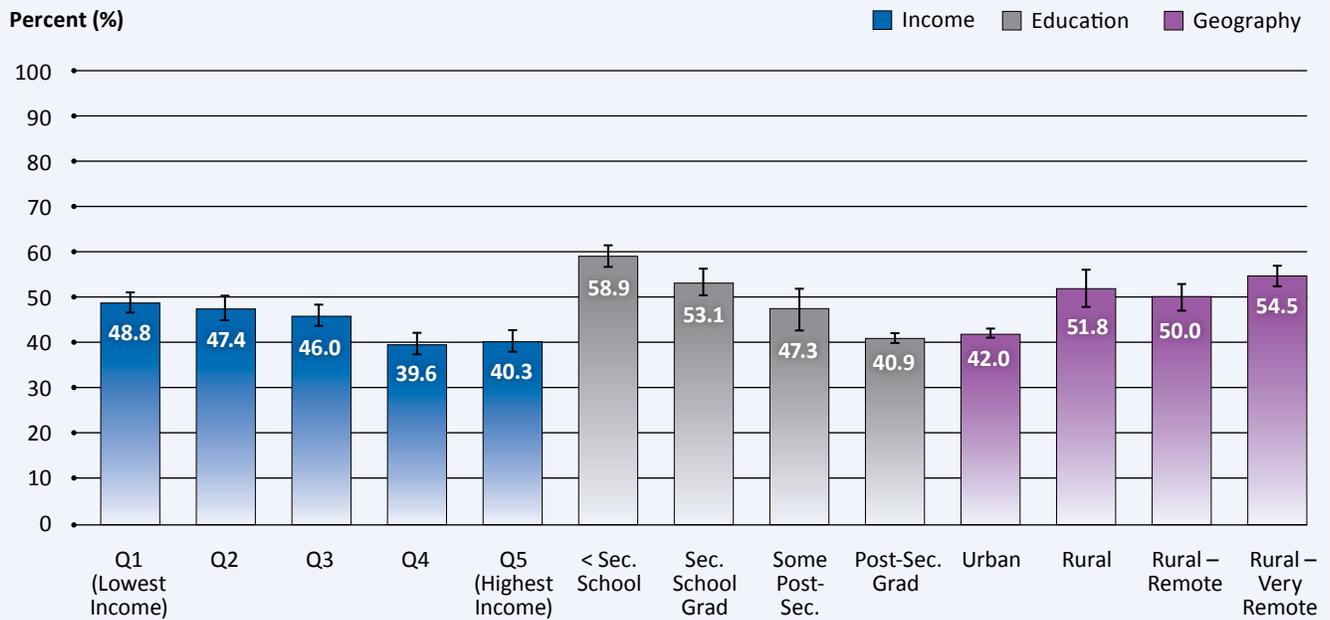
95% confidence intervals are indicated on figure.

Data source: Statistics Canada, Canadian Community Health Survey.

A guideline target is for 65% of women to be of "normal" weight by 2015.

Strategies to reduce the onset of obesity and to assist those who are overweight to lose weight have the potential to prevent or ameliorate many chronic diseases. The 2005 Pan-Canadian Healthy Living Strategy[o] set a target of increasing by 20% the proportion of Canadians at a "normal" body weight (a BMI between 18.5 and 24.9) by 2015.[137,p] According to 2003 CCHS baseline data, 54% of women reported heights and weights consistent with a normal body weight (Figure 6.3). An 11 percentage point increase in women with normal body weight from 2003 to 2015 would be needed for Canadian women aged 18 and older to meet the 65% target for normal body weight. Data from the CCHS indicate that 53% of Canadian women had a normal body weight in 2010.

Physical inactivity is a risk factor because it is linked to levels of circulating hormones and metabolic efficiency.

Physical activity decreases breast cancer risk.[132] The effect of physical activity is somewhat stronger among postmenopausal women than premenopausal women, according to studies that have examined physical activity comprehensively, including occupational, recreational and household activity.[132,138] The risk reduction is greatest for activity that is sustained over a lifetime or performed later in life; however, activity at any time of life has been shown to be beneficial. In addition, both moderate-intensity and vigorous activity decrease breast cancer risk and all types of activity are associated with risk reductions.

Generally, physical activity appears to influence breast cancer risk through several mechanisms, including the reduction of endogenous sex hormone levels, insulin resistance and inflammation, and the improvement of metabolic efficiency.[132,139-143] The risk reduction has been estimated from observational studies to be about 25% when comparing the most-active study participants to the least active. To date, no randomized controlled exercise intervention trials have been conducted to determine the exact type, amount and timing of activity that would be needed to decrease breast cancer incidence. Hence, at present, recommendations for increasing physical activity to decrease breast cancer risk need to be based on the available observational study evidence.

Both moderate-intensity and vigorous activity decrease breast cancer risk and all types of activity are associated with risk reductions.

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o) The 2005 Pan-Canadian Healthy Living Strategy focuses on preventing chronic disease and promoting good health to address common risk factors. Federal, provincial and territorial ministers of health endorsed this strategy to promote healthy living behaviours through co-ordinated and sustained action. Although the targets set as part of this strategy are not specific to cancer, they are described in this section because they pertain to obesity and overweight, physical inactivity and alcohol consumption.

p) Provincial/territorial healthy living targets can be found at http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/ipchls-spimmvs/app-ann-a-eng.php.

The rate of physical activity varies by province.

In 2010, 22.2% of Canadian women aged 18 and older reported that they were active (12.4%) or very active (9.8%) in their leisure time – that is, regularly getting 30 minutes per day of moderate to vigorous physical activity (Figure 6.3). Leisure time physical activity varies by province, with rates of being active or very active lowest in Quebec (18.1%) and highest in British Columbia (27.8%) and Yukon (34.0%). The Yukon estimate is to be interpreted with caution because of a small sample size.

FIGURE 6.3

Percentage of women (aged 18+) who report being active or very active in their leisure time, by province/territory – CCHS 2010
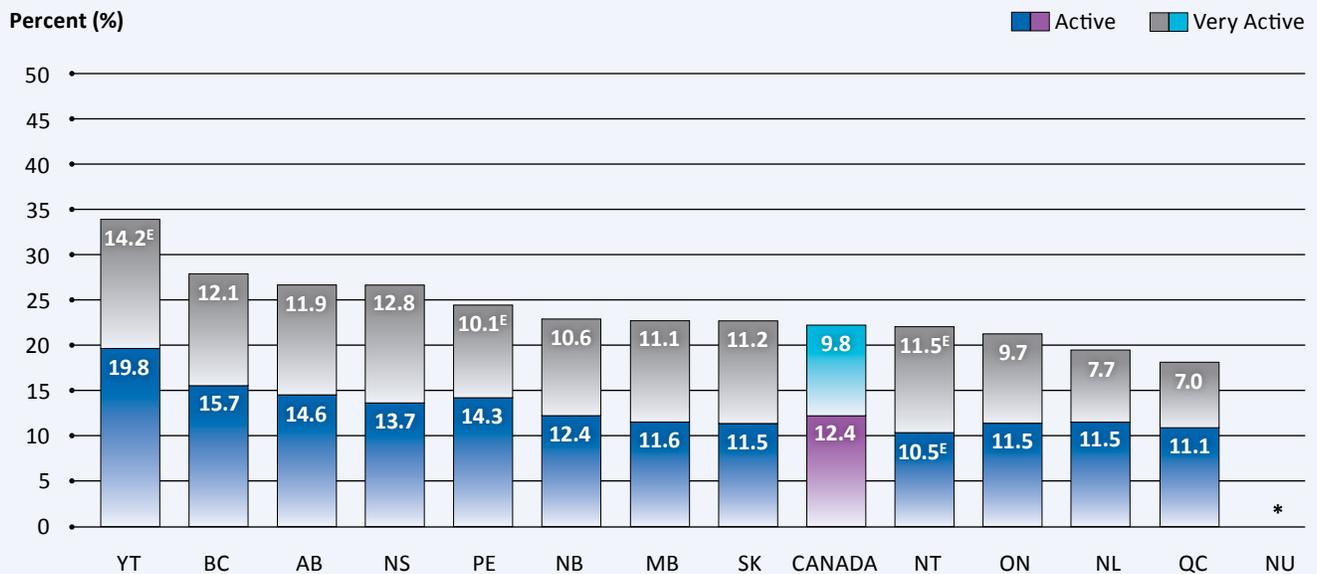
*Suppressed due to statistical unreliability caused by small numbers.

E Interpret with caution due to a large amount of variability in the estimate.

Data source: Statistics Canada, Canadian Community Health Survey.

Physical activity declines substantially with age. Girls aged 12 to 17 are the most active, with 41.0% reporting in 2010 that they were active or very active in their leisure time (Figure 6.4). Only 18.2% of women over age 50 reported this level of activity. It is apparent that leisure-time physical activity is declining at the age when the risk of breast cancer is increasing.

FIGURE 6.4

Percentage of females (aged 12+) who report being active or very active in their leisure time, by age group, Canada – CCHS 2010

Percent (%)
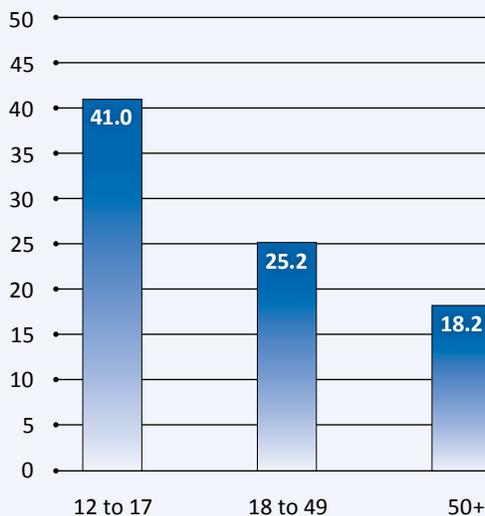
Data source: Statistics Canada, Canadian Community Health Survey.

A guideline target is for 58% of women to be at least moderately active by 2015.

Public health interventions to increase physical activity among Canadians have the potential to reduce the morbidity and mortality associated with a number of chronic diseases. The 2005 Pan-Canadian Healthy Living Strategy set a target of increasing the proportion of Canadians who participate in regular physical activity by 20% from 2005 to 2015.[136] According to 2005 CCHS baseline data reported by the Public Health Agency of Canada, 48% of women reported at least 30 minutes per day of moderate to vigorous leisure-time physical activity.[144] A 20% increase would be required to meet the target of having 58% of Canadian women participating in regular physical activity by 2015.

Alcohol consumption is linked to an increased risk of both pre- and postmenopausal breast cancer.

The link between breast cancer and alcohol consumption has been determined to be causal.[132] Alcohol consumption is associated with breast cancer in a dose-dependent fashion; that is, the risk increases in proportion to alcohol intake.[132,145] Alcohol consumption increases circulating estrogen levels, which are known to contribute to the risk for breast cancer.[145] Box 6.2 provides additional information on the relationship between level of alcohol intake and breast cancer risk.

A recent prospective study of 105,986 women examined the effect of alcohol consumption at different periods in a woman's adult life on the risk of developing breast cancer.[146] The findings indicate that cumulative alcohol intake during adulthood is associated with breast cancer risk. The study also concluded that alcohol consumption in both early adult life (at ages 18 to 40) and later life (after age 40) is strongly and independently linked to breast cancer risk.[146]

Level of alcohol intake and breast cancer risk

Available evidence does not identify a generally "safe" level of alcohol consumption below which no increased risk of cancer is evident.[132] Recent findings suggest that even light drinking is associated with increased breast cancer risk. Women consuming 12.5 g of alcohol or less per day, the equivalent of about one drink, had a small but significant relative increase (about 4%) in the risk of breast cancer compared with non-drinkers.[145]

Overall, one in four Canadian women abstains from alcohol but only one in 10 women in the highest income quintile abstains.

In 2010, almost one-quarter of Canadian women (24.1%) reported abstaining from alcohol in the past 12 months (Figure 6.5).[q] The percentage of women who reported abstaining from alcohol varied across provinces and territories, with the highest percentage of abstainers in Nunavut (31.5%) and the lowest in Quebec (17.5%).

FIGURE 6.5

Percentage of women (aged 18+) who report drinking no alcohol in previous 12 months, by province/territory – CCHS 2010

Percent (%)
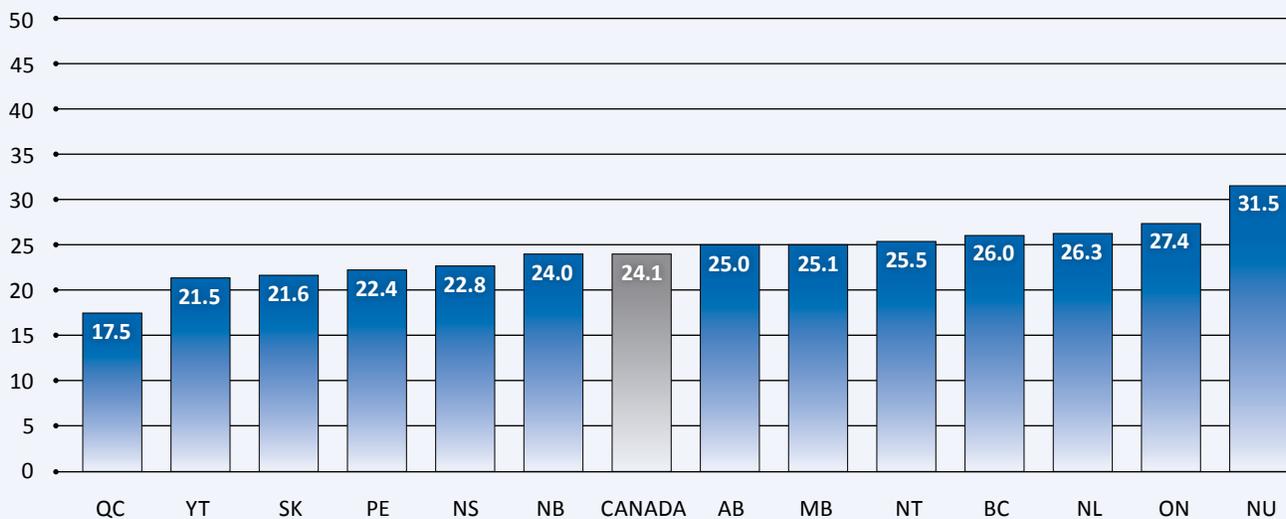
Data source: Statistics Canada, Canadian Community Health Survey.

q) Given that a safe level of alcohol consumption has not been identified, and that even light alcohol consumption has been linked to increased breast cancer risk, the percentage of Canadian women reporting no alcohol consumption (or abstinence) is presented.

Canadian women in the highest income quintile were almost four times less likely to abstain from alcohol in the previous 12 months than women in the lowest income quintile (10.1% versus 38.7%) (Figure 6.6). Women who were post-secondary graduates were less likely to

abstain from alcohol than women with only a secondary school education (20.9% versus 44.8%) (Figure 6.6). There was no distinct pattern of alcohol consumption in women of urban or rural residence (Figure 6.6).

FIGURE 6.6

Percentage of women (aged 18+) who report drinking no alcohol in previous 12 months, by income quintile, household education and geography, Canada – CCHS 2010
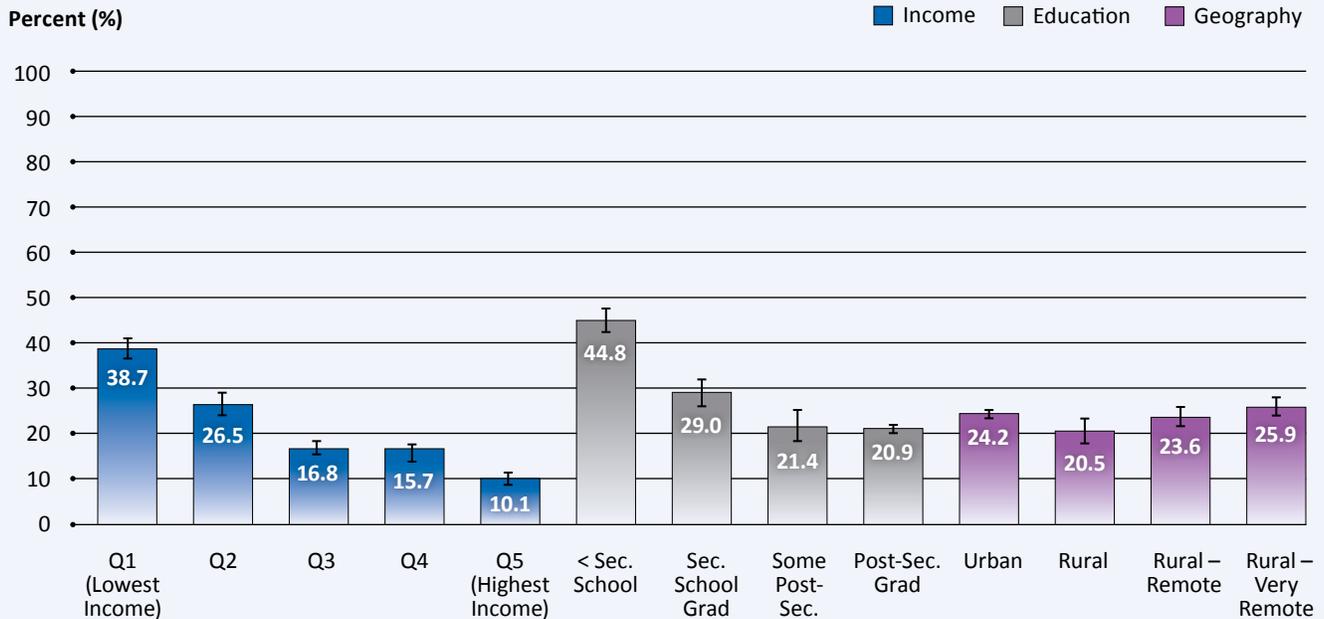
95% confidence intervals are indicated on figure.

Data source: Statistics Canada, Canadian Community Health Survey.

The low-risk guideline for cancer prevention is one drink per day.

The 2005 Pan-Canadian Healthy Living Strategy did not set targets for alcohol consumption.[137] In November 2011, the first national *Low-Risk Alcohol Drinking Guidelines* were released by the National Alcohol Strategy Advisory Committee. To reduce long-term health risks, the guidelines recommend no more than two drinks per day or 10 drinks per week for women, balanced with non-drinking days. The guidelines also highlight situations in which alcohol should be avoided altogether, such as when taking medication.[147]

To reduce the risk of cancer, the Canadian Cancer Society recommends no more than one drink per day for women.[148] Specifically regarding breast cancer, the World Cancer Research Fund (WCRF) reviewed the evidence and found convincing evidence that alcohol is a cause of both pre- and postmenopausal breast cancer. A dose-response relationship was found between alcohol intake and risk; however, no threshold of intake was identified. The organization concluded that there is no "safe" level of alcohol intake in terms of breast cancer risk. However, recognizing the potential protective effect of modest alcohol consumption against coronary heart disease, the WCRF recommends that if alcohol is consumed, consumption should be limited to no more than two drinks per day for men and no more than one drink per day for women.[132]

In 2010, 8.3% of Canadian women reported exceeding the low-risk drinking guidelines, defined here as no more than one drink per day, on average (Figure 6.7). The percentage of women who reported exceeding the low-risk drinking guidelines varied across provinces and territories, with the highest percentage in the Yukon (12.1%) and the lowest in New Brunswick (5.4%).

The World Cancer Research Fund concluded that there is no "safe" level of alcohol intake in terms of breast cancer risk.

FIGURE 6.7

Percentage of women (aged 18+) who report exceeding low-risk drinking guidelines, by province/territory – CCHS 2005
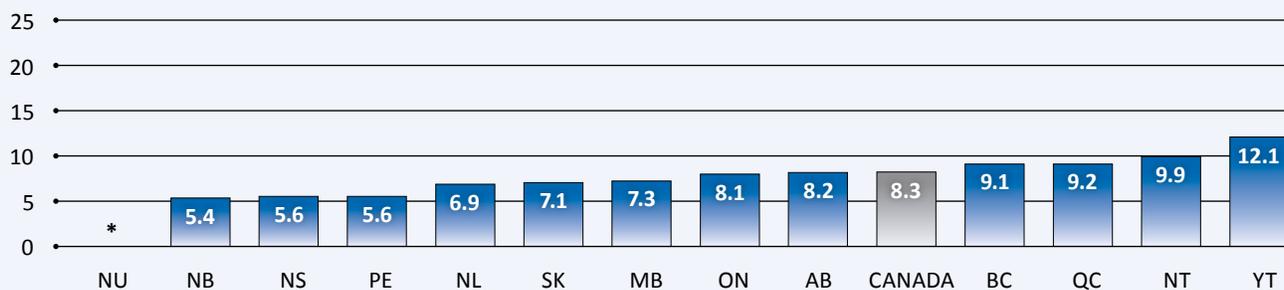
*Suppressed due to statistical unreliability caused by small numbers.

Data source: Statistics Canada, Canadian Community Health Survey.

Canadian women in the highest income quintile were more likely to exceed the low-risk drinking guidelines in the preceding week than women in the lowest income quintile (13.3% versus 5.0%) (Figure 6.8). Women who were post-secondary graduates were more likely to exceed low-risk drinking guidelines than women with only a secondary school education (9.0% versus 4.0%) (Figure 6.8). There was no distinct pattern of alcohol consumption in women of urban or rural residence when looking at low-risk drinking patterns (Figure 6.8).

FIGURE 6.8

Percentage of women (aged 18+) who report exceeding low-risk drinking guidelines, by income quintile, education and geography, Canada – CCHS 2005
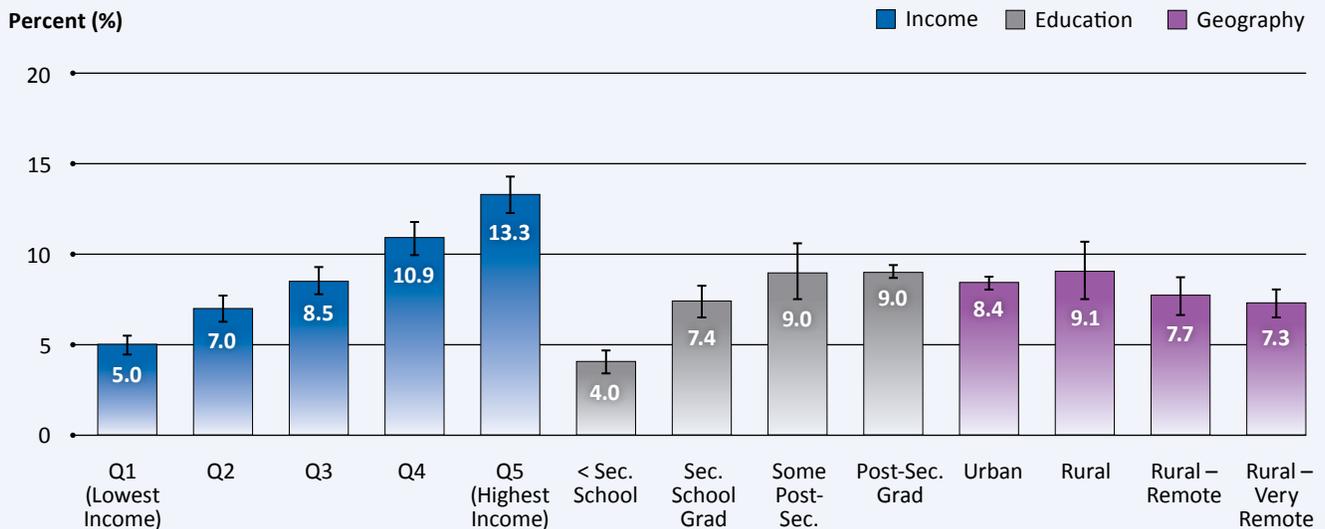
95% confidence intervals are indicated on figure.

Data source: Statistics Canada, Canadian Community Health Survey.

Chemo-prevention is an increasingly important part of the efforts to reduce the breast cancer burden.

The success of tamoxifen as an adjuvant therapy in significantly reducing cancer recurrence and the development of new primary cancers among women with breast cancer led investigators to test tamoxifen's role as a chemo-preventive agent among women with no prior history of breast cancer, but who are at increased risk for the disease. Tamoxifen is one of three drugs (the others being raloxifene and exemestane) that have been evaluated through clinical trials for their potential to prevent breast cancer.

The Canadian Task Force on Preventive Health Care recommended in 2001 that women at higher risk of breast cancer be counselled on the potential benefits and harms of taking tamoxifen for breast cancer prevention.[149] The task force noted that the cut-off point for defining high risk is arbitrary, but referenced the National Surgical Adjuvant Breast and Bowel Project P-1 Study, which included women with a five-year projected risk of at least 1.66% based on the Gail Index. Examples of high-risk

clinical situations, among others, are two first-degree relatives with breast cancer, a history of lobular carcinoma in situ or a history of atypical hyperplasia. As the risk of breast cancer increases above 5% and the benefits of chemo-prevention outweigh the harms, a woman may choose to take tamoxifen. The duration of tamoxifen use in such situations is five years, based on results from trials of tamoxifen involving women with early stage breast cancer.

While the United States, Food and Drug Administration has approved tamoxifen for primary prevention of breast cancer in the United States, the drug has not been approved for such use in Canada. Some provinces (including Ontario and British Columbia) do not have specific funding restrictions for tamoxifen, which means that physicians may prescribe it for chemo-prevention.

There are no readily available data for measuring the use of chemo-prevention for breast cancer on a pan-Canadian level. Efforts will be made to expand the availability of such data for future indicator development efforts.

BOX 6.3

More on tamoxifen and other chemo-preventive drugs

Tamoxifen is a selective estrogen receptor modulator (SERM) and can prevent estrogen receptor-positive breast cancer in women with no history of the disease, but who are at increased risk based on their family history, age and personal history (e.g., reproductive history).[150,151] A meta-analysis of five primary prevention trials demonstrated that tamoxifen use is associated with a 38% reduction in breast cancer incidence. A 48% reduction in ER-positive breast cancer was observed.[152]

Raloxifene, a newer drug than tamoxifen, is also a SERM and has been shown to be as effective as tamoxifen in reducing the incidence of breast cancer in postmenopausal women who are at increased risk. Raloxifene is associated with a lower risk of adverse events than tamoxifen, particularly uterine cancer.[153]

Exemestane, an aromatase inhibitor, has been shown to reduce the risk of ER-positive breast cancer by 65% among postmenopausal women with no previous history of breast cancer but who are at increased risk for the disease.[154]

Conclusion

Many of the risk factors associated with breast cancer, such as age and family history, are not modifiable. This section presented prevalence data on three indicators generally associated with an increased risk of breast cancer: overweight and obesity, physical inactivity and alcohol consumption. Targets have been set for these behavioural risk factors in an effort to curb cancer, heart disease, diabetes and other chronic diseases. According to survey data presented in this report, Canadian women exhibit relatively high rates of overweight, obesity and physical inactivity, especially women over age 50, when the risk of breast cancer is increasing.

It is acknowledged that the evidence available from studies conducted to date attributes only a fraction of incidence of breast cancer to overweight, obesity, alcohol consumption and physical inactivity. Nonetheless, presenting comparative prevalence rates of these risk factors within the context of a larger report on breast cancer system performance allows for an examination of relationships between these risk factors and other measures (including long-term outcomes). This section also discussed the use of tamoxifen and similar drugs as chemo-preventive agents for breast cancer. This topic will be addressed in future reports when pan-Canadian indicator data become available.

Breast Cancer Research

SECTION SEVEN

FIGURE 7.1

Distribution of disease site-specific cancer research investment (2009) and new cancer cases (2007), by disease site, Canada

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FIGURE 7.2

Ratio of patients enrolled in clinical trials to new registrations by disease site, Canada – adults seen in provincial cancer centres in 2011

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CONCLUSION

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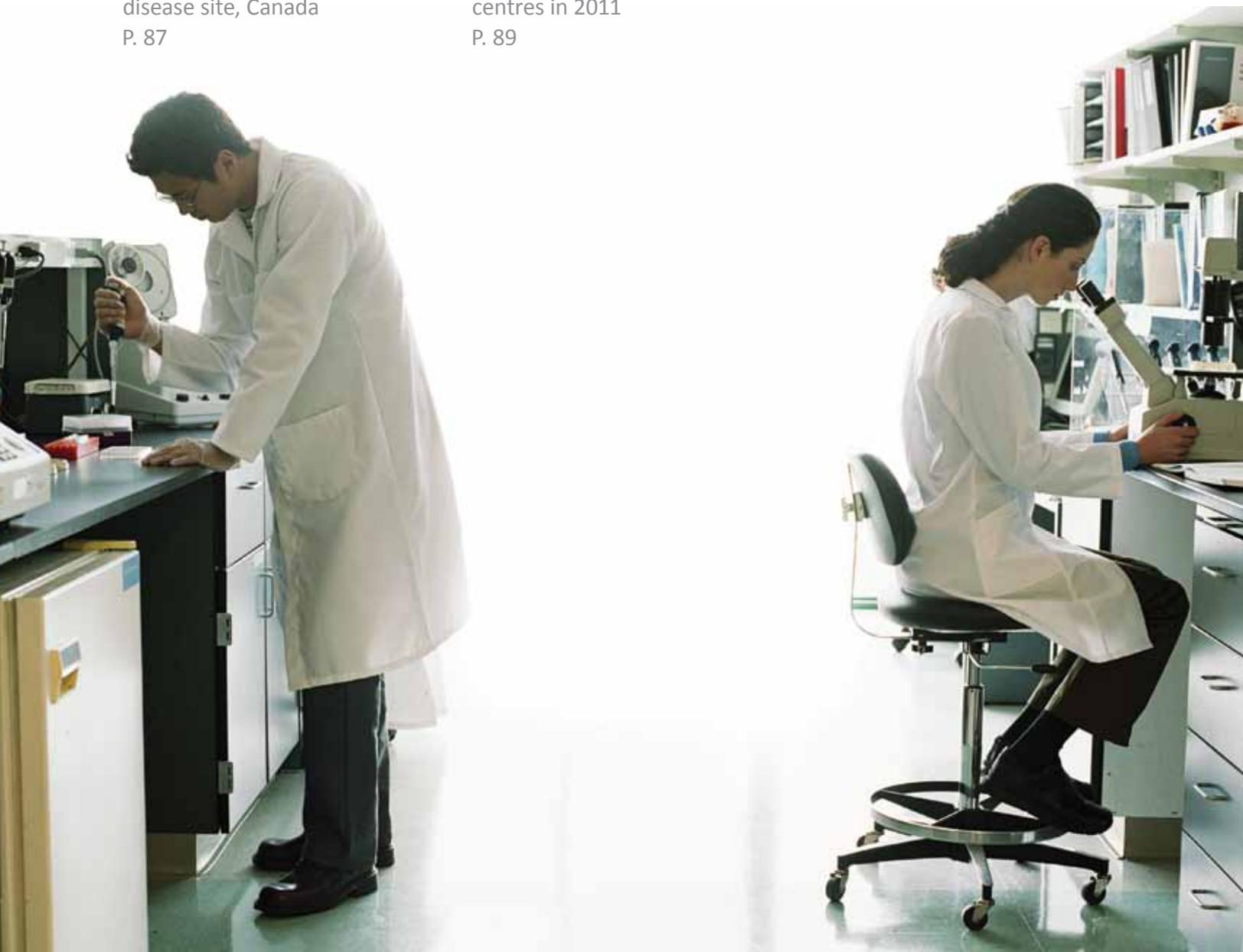
Breast Cancer Research

Canada has an active breast cancer research community. Several Canadian agencies with a research focus support breast cancer research, including:

- Canadian Cancer Society
- Canadian Institutes of Health Research
- Cancer Research Society
- Canadian Breast Cancer Foundation

In addition, other provincial agencies and hospital foundations fund and support breast cancer research.

Providing a detailed account of the activities and accomplishments of Canadian breast cancer research initiatives, including those supported by the organizations mentioned above, is beyond the scope of this report. This report focuses on presenting performance indicators where data are available (or discussing potential indicators where data are forthcoming). The ability to measure the performance and impact of cancer research activity in Canada is limited by the lack of readily available data measuring the process,

output, and outcome of clinical research activity on a pan-Canadian level.

This section presents data on two metrics that can be considered proxy system performance indicators of breast cancer research activity: the level of breast cancer research funding relative to overall cancer research funding and clinical trial accrual ratios for breast cancer relative to other cancers.

This section also reviews strategies that could be used to measure breast cancer research activity and develop indicators for inclusion in future system performance reports. These strategies depend on an expansion of data collection efforts related to research investments, investigator engagement and the relative impact of research on cancer control.

Breast cancer research in Canada receives a large share of research support relative to the burden of disease as measured by epidemiological indices.

This section discusses estimates of support for breast cancer research in 2009 based on information on research spending reported to the Canadian Cancer Research Alliance (CCRA).[r] A total of $545.5 million was provided to support cancer research in 2009 by 39 Canadian research organizations. Non-specific projects, defined as those affecting all cancer sites, received $280.1 million. Of the total, $265.4 million (48.6%) of research support was site-specific, and among this site-specific research, $74.5 million (28%) was directed specifically to breast cancer. Figure 7.1 shows that more funding went to breast cancer than to the other three major cancers (colorectal, lung and prostate) combined ($72.1 million). Other sites received $118.8 million in funding.

It is instructive to examine research support compared with burden of disease associated with certain cancers, as reflected in epidemiological measures. Figure 7.1 shows the distribution of research investment and incident cases by cancer site. Breast cancer accounts for 13% of new cancer cases and receives 28% ($74.5 million of $265.4 million) of site-specific research dollars.

Funding for breast cancer is more than commensurate with its share of the overall cancer burden as measured by incidence.

FIGURE 7.1

Distribution of disease site-specific cancer research investment (2009) and new cancer cases (2007) by disease site, Canada

**Site-Specific Research Investment (%)**

7% Colorectal
8% Lung
12.2% Prostate
28.1% Breast
44.8% Other

New Cancer Cases (%)

12.5% Colorectal
14% Lung
14.2% Prostate
13% Breast
46.4% Other
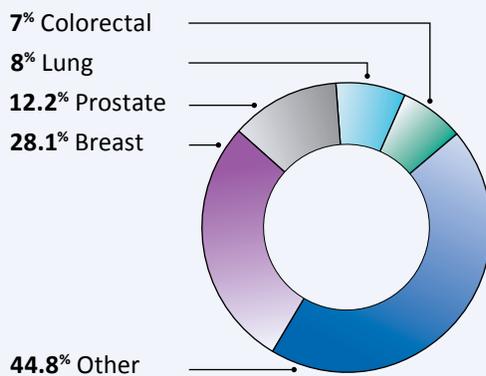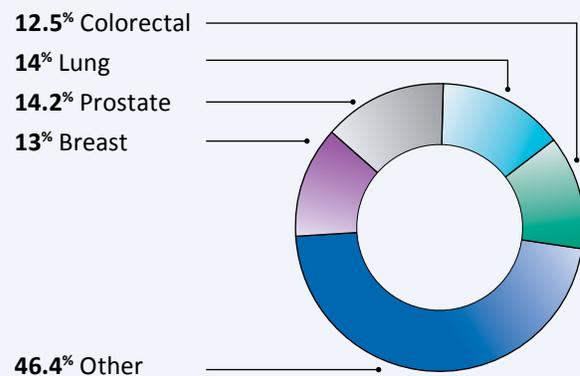
Data source for cancer research investment: Canadian Cancer Research Alliance database.

Data source for new cancer cases: CANSIM Table 103-0550 New cases for ICD-O-3 primary sites of cancer (based on the July 2010 CCR tabulation file), by age group and sex, Canada, provinces and territories, annual. Canadian Cancer Registry, 2007.

r) These estimates understate the level of research support in Canada because the CCRA does not include funding information from the BC Cancer Foundation, institution-specific foundations (e.g., hospital foundations), federal and provincial government programs for which health research comprises only a small portion of funding, or industry-sponsored research and development. Also not included is support that researchers based at Canadian institutions have received from funders outside Canada.

Breast cancer research in other countries is also well supported compared with other cancer sites. For example, the U.S. National Cancer Institute (NCI), one of many sources of such funding in the United States, allocated $625 million to breast cancer research in 2011, three times the amount allocated to lung cancer research ($296.8 million),[155] despite the higher mortality rate of lung cancer. The National Cancer Research Institute in the United Kingdom reports a similar pattern, with more funding being allocated to breast cancer than any other type of cancer (20% of site-specific cancer research funds were allocated to breast cancer in 2010).[156]

The clinical trial participation ratio is a measure of accrual rates for breast cancer relative to other tumour types.

Participation in Phase I to IV clinical trials makes substantial contributions to the discovery of novel treatments and offers data on the comparative effectiveness of therapeutic options. The results of clinical trials allow clinicians to confidently incorporate new and more effective therapies into their practices and to stop practices that offer less benefit or greater toxicity. Patients treated at centres with active clinical trial programs tend to have better outcomes than those who are treated in other centres.

This outcome advantage is likely due to closer adherence to evidence-based guidelines at centres actively engaged in clinical research.[157,158]

The number of clinical trials and rates of participation in clinical trials have been declining in Canada over the past 10 years.[159] Several factors may explain this trend, including the following:

- Increasing costs for conducting clinical trials
- Challenges in patient recruitment and registration
- Complexities in regulatory and ethical oversight
- The emergence of more competitive markets for conducting trials
- Declines in institutional support for trials, especially those originating in the academic sector

Canada is not alone in facing these challenges. Other countries, such as the United Kingdom, have experienced similar issues. Governments there have made significant investments to increase public access to clinical trials information and to enhance recruitment to trials and other patient-centred research.[160]

Comparing the percentage of patients enrolled in clinical trials across the country could highlight opportunities to enhance efforts to encourage clinical trial participation. Given current data limitations, a proxy measure is used to estimate this percentage: the ratio of patient registrations

in clinical trials to new patient registrations in cancer centres. As Figure 7.2 illustrates, the ratio of adult patients enrolled in trials to new cancer centre registrations (for provinces submitting data) in 2011 was 0.071 (7.1%) for breast cancer. This compares with a ratio of 0.030 (3.0%) for lung cancer, 0.033 (3.3%) for colorectal cancer and 0.079 (7.9%) for prostate cancer. The ratio of adult clinical trial participants to new cancer centre patient registrants for all invasive cancers was 0.053 (5.3%).

Targets for optimal participation rates are not widely agreed upon. Some patients are not eligible to participate in available clinical trials because clinical trials often have strict enrolment criteria (e.g., there may be demographic, tumour and clinical status eligibility criteria). Some, however, have suggested a target of 10% or more patients enrolled in trials as an achievable and meaningful goal.[158, 159]

FIGURE 7.2

Ratio of patients enrolled in clinical trials to new registrations by disease site, Canada – adults seen in provincial cancer centres in 2011

Proportion
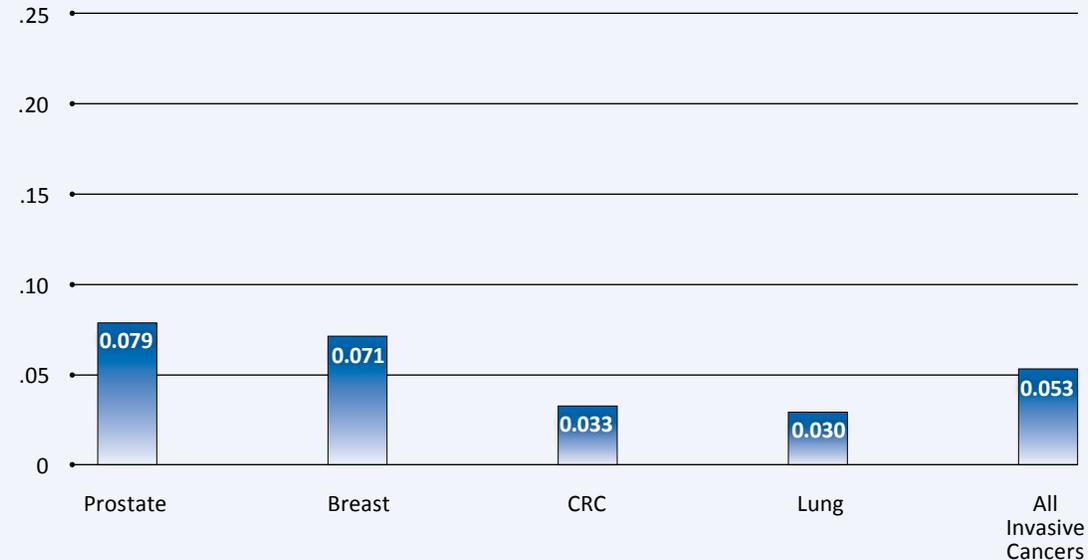
This is a proxy measure for clinical trial participation.

Includes all cancer clinical trials (all phases and intervention types) registered in 2011 and all patients seen for the first time by cancer centres in 2011.

Average of provinces that submitted comparable data (disease site breakdown includes AB, BC, MB, NB, NS and SK; All invasive cancers includes AB, BC, MB, NB, NS, PE and SK).

Data source: Provincial cancer agencies.

Previous Partnership system performance reports have presented data on clinical trial enrolment by province. Data were not available from the provincial cancer agencies by cancer site for this report. The Partnership's System Performance Initiative will review measures of clinical trial enrolment to establish a measure that is comparable across provinces and that could be used to set performance targets. The goal is to provide clinical trial enrolment by cancer site. Such data have been assembled elsewhere.[161] The literature suggests that there are barriers to trial enrolment among breast cancer patients[162] and generally by cancer site and stage.[163]

Measures of research activity may be refined for future system performance reports to reflect research inputs (e.g., clinician engagement), outputs (e.g., publications) and areas that have been identified as priorities for the research community.

Several strategies to measure Canadian research activity are being explored for future Partnership system performance reporting:

- A measure of the number of clinicians involved in cancer research generally, and in site-specific cancer research specifically, has been used as an indicator of the levels of research activity in several studies.[155,164] Such an approach could be possible through an expansion of the survey data provided by the Canadian Cancer Research Alliance through the Canadian Cancer

Research Survey to specify which investigators are involved in breast cancer research predominantly and to provide comprehensive data on investigators whose research is supported through the private sector and through some government organizations.

- Having information on research funding by domain, type of grant and research priority is instructive (e.g., research into biology of breast cancer, prevention, early detection, treatment, etc.). For example, it would be particularly informative to monitor the extent to which the 17 priorities for breast cancer research developed by researchers and funders and published as the National Breast Cancer Research Framework are being addressed;[165] see Appendix V). The CCRA and the Ontario Institute for Cancer Research (OICR) have reported on the breakdown of research investment and/or projects by cancer control domain, cancer type, and project type.[164,166]

- The number of publications in journals stemming from funded research has been examined generally and by journal impact factor.[164,167] Canada has contributed significantly to accelerating the international body of published evidence on breast cancer and was ranked among the top 10 countries in terms of bibliographic research yield.[167] Measuring this as a system performance indicator, while an important metric of research activity, is not possible with current data available to the Partnership (either through the CCRA or provincial cancer agencies).

Conclusion

Investments in breast cancer research have led to breakthroughs across the cancer control continuum, from basic cancer biology to cancer survivorship. In 2009, Canadian researchers benefited from the disbursement of $545.5 million in support of cancer research from 39 funding agencies. This estimate does not include all sources of support; for example, some federal, provincial, private and international (e.g., U.S. National Cancer Institute) investments are not included. While incident cases of breast cancer represented 13% of all cancer cases in 2007, breast cancer-specific research investments represented 28% of site-specific cancer research support in 2009 ($74.5 million of $265.4 million). The relatively high level of support for breast cancer research in Canada parallels observations from the United States and the United Kingdom.

Priorities for breast cancer research have been established by and for the Canadian research community and more refined measures of research activity could be developed in the future to gauge the extent to which research investments are targeting prioritized areas. The clinical trial participation rate for breast cancer is higher than for colorectal and lung cancers, but lower than for prostate cancer, despite the substantially higher research investment. This suggests differences in the use of research investments (e.g., proportion dedicated to clinical trials) between breast cancer and other types of cancer.

Plans are underway to develop other methods of measuring research activity and impact. For example, more precise measures of clinical trial enrolment in Canada would provide information on research engagement and patient access to new cancer therapies.

Conclusions

Significant advances in cancer control have led to a reduction in breast cancer mortality in Canada. Increased rates of screening leading to earlier detection, refinements in diagnosis and more effective targeted treatments have all contributed to this trend. Nevertheless, the breast cancer burden remains heavy for Canadian women, with more than 5,000 deaths from this disease each year.

This report presents a comprehensive overview of what is known about the performance of breast cancer control efforts across Canada, from prevention and screening, through diagnosis and treatment, to patient-reported outcomes and end-of-life care. Indicators of research activity and epidemiological measures of the outcomes of cancer control are also presented.

The objective of this report, and others in the Partnership's system performance report series, is to shed light on opportunities for system-wide improvement. The scope of these potential improvements is broad, from enhancements in standardized measurement and data collection to refinements in cancer control strategies and increased concordance of clinical practice patterns to evidence-based guidelines. Ultimately, the goal is to prevent cancer and, when it occurs, to ensure that Canadians are well supported and experience optimal quality care.

Some of the notable findings of this report are summarized below:

- **Screening:** In most provinces and territories, more than 70% of women in the target age group (age 50 to 69) report receiving mammograms. Screening rates are, however, lower among women living in the poorest neighbourhoods. A substantial proportion of women outside the target age group are being screened, which has implications for resource use and system capacity.

- **Diagnosis:** Wait times to resolve abnormal mammogram results remain a challenge: none of the provinces submitting 2010 data achieved targets set for wait times. The good news is that with the recent acquisition of population-based staging information from nine provinces, more than 80% of women diagnosed with breast cancer in 2010 had early stage disease and only 5% of women had metastatic breast cancer.

- **Treatment:** As is consistent with clinical practice guidelines, 87% of women undergoing breast conserving surgery (BCS) were subsequently treated with radiation therapy. This rate, as measured in the five provinces submitting data, improved over the three-year period from 2007 to 2009. The use of radiation following BCS varied by province. The percentage of women with invasive breast cancer undergoing mastectomy ranges from 27% to 69% even though BCS is the recommended treatment for many women. The percentage of women with breast cancer receiving chemotherapy in the year following diagnosis is available for certain provinces and is reported as a first step toward guideline concordance measurement.

- **Patient Experience and End-of-Life Care:** There are relatively few indicators available to evaluate the experience of Canadians with cancer. While standardized symptom assessment tools are used in many provinces, few report on their use among women with breast cancer. In terms of end-of-life care, the percentage of breast cancer patients dying at home in Canada appears low compared with those patients in the United States.

- **Prevention:** Canadian women continue to exhibit relatively high rates of overweight, obesity, and physical inactivity, especially women over age 50, when the risk of breast cancer is increasing.

While chemo-prevention is an increasingly important modality in breast cancer control, the data currently available do not allow for pan-Canadian measurement.

- **Research:** Investment in breast cancer research appears to be relatively robust. While breast cancer represents only 13% of all new cancer cases, it receives 28% of site-specific research funding. Clinical trial participation rates for breast cancer patients are higher than the average rate for all cancers.

Efforts to substantially expand measurement of the performance of the Canadian cancer control system are underway through partnerships with national entities – for example, the Canadian Institute for Health Information, Statistics Canada, the Canadian Cancer Society and the Public Health Agency of Canada. Provincial and territorial partners, including the provincial cancer authorities, are also actively engaged in this work, which involves the development of measures and reporting mechanisms to accurately capture aspects of the cancer control system that convey its performance. Plans are to expand the scope of performance measurement into new domains, including system efficiency, patient safety and patient-reported outcomes, and to improve the ability to monitor the experiences of vulnerable populations such as those living in rural and remote communities (including First Nations, Inuit and Métis peoples), low-income Canadians, new immigrants and other groups with special needs.

Initiatives undertaken at both the national and provincial or territorial levels will allow the Partnership to augment its indicator portfolio and strengthen the reporting of significant achievements in cancer control, as well as provide opportunities for system improvement.

"Analysis and comparison are the midwives of improvement."

Roy Romanow, Linda Silas, and Steven Lewis from The Globe and Mail *(January 16, 2012)*

Appendix I

Members of the System Performance Steering Committee and Technical Working Group

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Appendix II

Attributes of provincial and territorial breast screening programs

Province	Name	Start date	Program practices for women by age group		
			Age group	Accept	Recall
AB	Alberta Breast Cancer Screening Program	1990	40 – 49	Yes	Annual
			50 – 69	Yes	Biennial
			70 – 74	Yes	Biennial
			75+	Yes	None
BC	Screening Mammography Program of British Columbia	1988	< 40	With physician referral	None
			40 – 49	Yes	Annual
			50 – 69	Yes	Biennial
			70 – 79	Yes	Biennial
			80+	With physician referral	None
MB	BreastCheck	1995	40 – 49	On mobile unit with physician referral	Biennial
			50 – 69	Yes	Biennial
			70 – 74	Yes	Biennial
			75+	Yes	None
NB	Breast Cancer Screening Program	1995	40 – 49	With physician referral	None
			50 – 69	Yes	Biennial
			70+	With physician referral	None
NL	Breast Screening Program for Newfoundland and Labrador	1996	40 – 49	No	N/A
			50 – 69	Yes	Biennial
			70+	If previously enrolled in program	None
NS	Nova Scotia Breast Screening Program	1991	40 – 49	Yes	Annual
			50 – 69	Yes	Biennial
			70+	Yes	None

Province	Name	Start date	Program practices for women by age group		
			Age group	Accept	Recall
NT	Northwest Territories Breast Screening Program	2003	40 – 49	Yes	Annual
			50 – 69	Yes	Biennial
			70+	Yes	Biennial
NU	No organized screening program. Screening is provided opportunistically.				
ON	Ontario Breast Screening Program	1990	40 – 49	No	N/A
			50 – 69	Yes	Biennial
			70 – 74	Yes	Biennial
			75+	Yes	None
PE	PEI Breast Screening Program	1998	40 – 49	Yes	Annual
			50 – 69	Yes	Biennial
			70 – 74	Yes	Biennial
			75+	If previously enrolled in program	None
QC	Quebec Breast Screening Program	1998	35 – 49	With physician referral*	None
			50 – 69	Yes	Biennial
			70+	With physician referral*	None
SK	Screening Program for Breast Cancer	1990	40 – 49	No†	N/A
			50 – 69	Yes	Biennial
			70 – 74	Yes	Biennial
			75+	Yes	None
YT	Yukon Mammography Program	1990	40 – 49	Yes	None
			50 – 69	Yes	Biennial
			70+	Yes	None

*If done at a program screening centre, but this is not officially considered within the program.

†Accepts women at age 49 on the mobile unit if they will be 50 in that calendar year.

Appendix III

Stage distribution (%), excluding stage not available, by province and diagnosis year

Year	Province	0	I	IIA	IIB	IIIA	IIIB	IIIC	NOS	IV	Unknown	Total
2009	**Overall**	**12.6**	**37.8**	**20.9**	**9**	**6.2**	**2.1**	**3**	**0.2**	**5.4**	**2.9**	**100**
	AB	12.7	37.9	20.3	9.8	6.6	*	2.6	*	5.6	2.4	100
	MB	13.2	37.9	23	8.7	4.6	1.7	3.7	0	5	2.2	100
	NB	12.6	38.8	20	7.2	6.5	1.8	2.3	0	5.7	5.1	100
	NL	10.8	34.8	26	9.1	7.9	2.6	*	0	5.6	*	100
	NS	13.4	41.2	20	8	4.7	*	2.6	*	4.3	3.3	100
	PE	15.2	33	16.1	7.1	8	*	*	0	8.9	*	100
	SK	10.7	35	20.3	9.7	7.3	2.7	4.2	0.6	5.8	3.7	100
2010	**Overall**	**12.9**	**38.2**	**20**	**9.6**	**6.3**	**2.2**	**3**	**0.1**	**4.5**	**3.3**	**100**
	AB	13	40.2	19.9	9.4	5.7	*	2.8	*	4.3	2.6	100
	BC	13.4	37.7	19.4	9.3	6	1.8	3	0.1	3.7	5.6	100
	MB	10.9	35.4	22.4	10.3	8.4	1.9	3.7	*	5.2	*	100
	NB	14.5	38.3	19.9	9.1	6.1	4.3	3.1	*	*	*	100
	NL	16.5	33.5	17.4	10	7.7	*	4.4	0	7	*	100
	NS	11.7	39.3	19.6	10.8	5.6	2.5	*	*	5.4	2.5	100
	PE	13.8	40.9	22	10.7	5.7	*	*	0	*	*	100
	SK	10.6	37.4	21.2	9.8	6.7	2.2	2.7	*	7.5	*	100

*Data suppressed due to small numbers.

ON is excluded because in situ is not reported.

Stage 0 includes both behaviour code 2 (in situ) and behaviour code 3 (malignant).

NOS includes IINOS and IIINOS.

Appendix IV

Description of staging data collection methodologies.

The most commonly used staging methodology is the one jointly developed and maintained by the Union for International Cancer Control (UICC) and the American Joint Committee on Cancer (AJCC). It is known as TNM: T describes the primary tumour characteristics, N describes the regional lymph node involvement and M describes the presence of distant metastases.[168] TNM methodology is used to assign cases to a clinical and pathological stage, which then maps to an overall stage ranging from 0 (non-invasive) to IV (metastatic), often with sub-stage designations (e.g., IIA, IIIC) reflecting the extent of disease within a particular stage.

Collaborative staging is a standardized method for coding a comprehensive set of data elements to accurately characterize cancer stage. These data elements are abstracted from patient charts and records by trained registrars. Based on these collaborative stage data elements, cancer cases can be assigned to a UICC/AJCC stage (or other staging system as required). Certain site-specific factors have been incorporated into the collaborative staging method to capture information that may be relevant to a particular cancer site. For example, for breast cancer, collaborative stage coding includes recording the number of identified positive ipsilateral axillary lymph nodes.

The Canadian Partnership Against Cancer has provided funding and support for the implementation of collaborative staging in all provinces. The goal of this effort is for each province to collect collaborative stage data for at least 90% of incident cases for the four most common cancers (breast, colorectal, lung and prostate).

Appendix V

Research priorities identified by the Canadian Breast Cancer Research Alliance

Category	Research priority	
Biology	1. Genetics	The genetic and epigenetic basis of breast cancer development
	2. Initiation	Deciphering the molecular pathways implicated in breast cancer initiation
	3. Metastasis	Understanding the cause of metastatic breast cancer and identifying new avenues for interventions
Etiology	4. Breast Cancer Risk	The influence of lifestyle and environmental factors on the risk of developing breast cancer
	5. Breast Cancer Causes I	The genetic and hormonal causes of breast cancer
	6. Breast Cancer Causes II	Understanding the interplay of multi-causal factors: genetics and environment
Prevention	7. Prevention (Interventions)	Interventions to study the influence of lifestyle and environmental factors on the risk of developing breast cancer
Early detection, diagnosis and prognosis	8. Detection	Better approaches to early detection and diagnosis
	9. Biomarkers I	Development and evaluation of new biomarkers (including biomarkers for diagnosis) and the optimization of treatments for individual patients
	10. Biomarkers II	Clinical setting/clinical trials to assess clinical sensitivity and specificity of new biomarkers
Treatment	11. New Treatments	Discovery and development of new treatments for breast cancer
	12. Clinical Trials	Clinical trials of promising new therapies

Category	Research priority	
Cancer control, survivorship and outcomes research	13. Survivorship and Quality of Life Interventions	Psychosocial and survivorship interventions
	14. Health-Care Issues	Analysis of the financial and health-care delivery concerns facing breast cancer patients across the cancer care continuum
	15. Knowledge Translation and Best Practices	Interventions to improve knowledge translation and disseminate best practices in breast cancer across the cancer care continuum
	16. Link with Clinical Data	Developing mechanisms to link clinical trial data with administrative health databases for studies on long-term outcomes and late effects
Scientific model systems	17. Animal Models	Developing new animal and cellular models to study response to therapeutics and mimic human breast cancer development

Data source: Canadian Breast Cancer Research Alliance, 2009

Glossary of Terms

Adverse event

An unexpected medical problem that may happen during treatment with a drug or other therapy. Adverse events do not have to be caused by the drug or therapy, and they may be mild, moderate or severe.[169]

Age-standardized incidence rate

The number of cases per population, expressed per 100,000 people, that would occur if the population had the same age distribution as a standard reference population.[170]

Age-standardized mortality rate

The number of deaths that would occur in a particular area if it had the same age distribution as a standard reference population, expressed per 100,000 people.[170]

Aromatase inhibitor

A drug that prevents the formation of a female hormone called estradiol. It does so by interfering with an aromatase enzyme. These drugs are used as hormone therapy in postmenopausal women who have hormone-dependent breast cancer.[169]

Attributable risk

The proportion of disease that can be attributed to an exposure to risk that persons in a population have experienced. A general term that is usually more precisely defined by epidemiologists in one of several ways, the most widely used specific term is population attributable risk, which is the incidence rate of a condition in a specified population that is associated with or attributable to exposure to a specific risk.[170]

Biopsy

The removal of cells or tissues for examination by a pathologist. The pathologist may study the tissue under a microscope or perform other tests on the cells or tissue. There are many different types of biopsy procedures. The most common types are 1) incisional biopsy, in which only a sample of tissue is removed; 2) excisional biopsy, in which an entire lump or suspicious area is removed; and 3) needle biopsy, in which a sample of tissue or fluid is removed with a needle. When a wide needle is used, the procedure is called a core biopsy. When a thin needle is used, the procedure is called a fine-needle aspiration biopsy.[169]

BMI

Body mass index, a measure of a person's body weight-to-height ratio, calculated by dividing body weight in kilograms by the square of the height in metres. Canadian adults are considered overweight if their BMI is between 25 and 29.9 and obese if their BMI is 30 or more.[171]

Bone scan

A technique for creating images of bones on a computer screen or on film. To do so, a small amount of radioactive material is injected into a blood vessel; it travels through the bloodstream and eventually collects in the bones and is detected by a scanner.[169]

BRCA mutation

A gene on certain chromosomes that normally suppresses cell growth. People who have certain mutations in these genes have a higher-than-normal risk of breast, ovarian, prostate and other types of cancer.[169]

Breast reconstruction

A surgical procedure to rebuild the shape of the breast after a mastectomy.[169]

Cancer control

An integrated and co-ordinated approach that involves a range of activities (primary prevention, early detection, treatment, rehabilitation and palliation) with the aim of reducing the incidence and mortality of cancer and enhancing the quality of life of those affected by cancer.[172]

Chemo-prevention

The use of drugs, vitamins or other agents to try to reduce the risk of cancer or to delay its development or recurrence.[169]

Chemotherapy

A form of cancer treatment that involves the use of drugs to kill cancer cells.[169]

Coefficient of variation

A measure of the relative variation of distribution independent of the units of measurement. It is defined as the ratio of the standard deviation to the mean.[170]

Clinical trial

Also referred to as a therapeutic trial or clinical study, this is a specific type of study that involves administering a test regimen to human subjects so that the efficacy and safety of the regimen can be evaluated. There are several phases of clinical trials. This report refers to Phase IV trials, which are trials conducted after a regimen has been approved for distribution or marketing by a national regulatory authority in order to assess a specific treatment effect (short or long term) and to establish the incidence of adverse events.[169,170]

Collagen vascular disease

An auto-immune disorder in which the body's immune system attacks collagen, a tough fibre-like tissue in tendons, joints and connective tissue.[173]

Confidence interval

A range of values for a variable of interest constructed so that this range has a specified (for instance, 95%) probability of including the true value of the variable.[170]

Contraindication

A symptom or medical condition that makes a particular treatment or procedure inadvisable because a person is likely to have a bad reaction.[169]

CT scan

Computed tomography scan, also called a computerized tomography or computerized axial tomography (CAT) scan, this is a series of detailed pictures of areas inside the body taken from different angles. The pictures are created by a computer linked to an x-ray machine.[169]

Ductal hyperplasia

A benign condition that increases the risk of breast cancer in which there are more cells than normal in the lining of breast ducts, and the cells look abnormal under a microscope.[169]

E

Coefficient of variation is between 16.6% and 33.3%, meaning that there is a large amount of relative variation. This has been calculated in this report only for indicators that are based on record-level data.

Endocrine therapy

Also called hormone therapy, this treatment adds, blocks or removes hormones to or from the body. For certain conditions, hormones are given to adjust low hormone levels. To slow or stop the growth of certain cancers, synthetic hormones or other drugs may be given to block the body's natural hormones. Sometimes endocrine therapy may involve surgery needed to remove the gland that makes a certain hormone.[169]

Hormone replacement therapy (HRT)

Also referred to as menopausal hormone therapy, this treatment involves giving hormones (estrogen, progesterone or both) to women after menopause to replace the hormones no longer produced by the ovaries.[169]

Hormone therapy

See endocrine therapy.

Immigrant status

Refers to whether or not the person is a landed immigrant in Canada. Landed immigrants have been granted the right to live in Canada permanently by immigration authorities. For this report, landed immigrants were categorized on the basis of how long they have lived in Canada (10 years or less or more than 10 years since immigration). Non-immigrants are those born in Canada or who were Canadian citizens by birth.

In situ carcinoma

Also called Stage 0 disease, this refers to a group of abnormal cells that remain in the place where they first formed and have not spread. These cells may become cancerous and spread into nearby normal tissue.[174]

Invasive breast cancer

Cancer that has spread from where it started in the breast into surrounding tissue. Invasive breast cancer can spread to other parts of the body through the blood and lymph systems.[174]

Ipsilateral

Occurring on the same side of the body as another structure or point.[169]

Journal impact factor

A quantitative evaluation of the importance of a scientific journal. It measures the frequency with which the average article in a journal has been cited in a particular period.[175]

Lobular hyperplasia

A benign condition that increases the risk of breast cancer, in which there are more cells than normal in the breast lobules and the cells look abnormal under a microscope.[169]

Magnetic resonance imaging (MRI)

A procedure used to create detailed pictures of areas inside the body, especially soft tissue and organs. Radio waves and a powerful magnet linked to a computer are used to create these pictures, which can show the difference between normal and diseased tissue.[169]

Mammography

The use of film or a computer to create an x-ray picture of the breast to screen for or diagnose breast cancer.[169]

Margin

The edge or border of the tissue removed in cancer surgery. Negative or clean margins refer to when the pathologist finds no cancer cells at the edge of the tissue, suggesting that all the cancer has been removed. Positive or involved margins refer to when the pathologist finds cancer cells at the edge of the tissue, suggesting that not all the cancer has been removed.[169]

Metastatic breast cancer

Cancer that originated in the breast and has spread to other organ systems in the body.[169]

Multi-centric disease

Discontinuous tumour presence in multiple breast quadrants.[169]

Neighbourhood income quintile

A relative measure of a respondent's household income relative to the household incomes of all other respondents. The measure is a ratio of the total household income to the low-income cutoff (this varies according to the size of the household and the community where the household is located). After calculating the ratio between the household income and its corresponding low-income cutoff, the ratios are standardized across all regions of Canada, ordered from lowest to highest and then divided into five equal groups (quintiles).

PET scan

Positron emission tomography scan, a procedure in which a small amount of radioactive glucose (sugar) is injected into a vein and a scanner is used to make detailed, computerized pictures of areas inside the body where the glucose is used. Because cancer cells often use more glucose than normal cells, the pictures can be used to find cancer cells in the body.[169]

Physical activity

Any bodily movement produced by skeletal muscles that requires energy expenditure. In this report, physical activity levels were quantitatively determined based on the CCHS using daily energy expenditure calculated for each leisure physical activity and measured in kilocalories per day. The daily energy expenditure values from each activity are added up, resulting in an overall daily energy expenditure value for leisure-time physical activity.

Radiation therapy

Also called irradiation and radiotherapy, it is the use of high-energy radiation from x-rays, gamma rays, neutrons, protons or other sources to kill cancer cells and shrink tumours. Radiation may come from a machine outside the body (external-beam radiation therapy) or it may come from radioactive material placed in the body near cancer cells (internal radiation therapy). Systemic radiation therapy uses a radioactive substance, such as a radio-labelled monoclonal antibody, that travels in the blood to tissues throughout the body.[169]

Recurrence

Cancer that has come back, usually after a period during which the cancer could not be detected. The cancer may come back to the same place as the original (primary) tumour or in another place in the body.[169]

Relative survival

The ratio of observed survival for a group of individuals, typically those diagnosed with a specified disease, to the expected survival for members of the general population that have the same main factors affecting survival (such as age, sex and place of residence) as the individuals with the disease.[170]

Rural area

A geographic area having a population of less than 10,000 and a proportion of the population that commutes to an urban area of up to 49%.

Small sample size (small numbers)

A subset of a population under study that is considered too small to analyze because the data are unstable. In this report, any sample of fewer than five individuals or cases is considered too small to report on.

Socio-economic status

Refers to characteristics of the environments (economic, social and physical) in which individuals live and work, as well as their demographic and genetic characteristics.[176]

Stage unknown

The situation in which there is not enough information to determine a cancer's stage.[174]

Targeted therapy

A type of treatment that identifies and attacks specific cancer cells using drugs or other substances, such as monoclonal antibodies.[169]

Travel time

The geographic proximity of care providers relative to patient travel considering both distance in kilometers and travel time.[177] For this report, travel time to the nearest radiation treatment centre was calculated on the basis of geographic mapping techniques.

Ultrasound

Also called ultrasonography, a procedure in which high-energy sound waves are bounced off internal tissues or organs and make echoes. The echo patterns are shown on the screen of an ultrasound machine, forming a picture of body tissues called a sonogram.[169]

Urban area

A geographic area having a population concentration of 10,000 or more and adjacent areas with 50% or more of the population who commute to the urban core.

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