CANADIAN PARTNERSHIP AGAINST CANCER
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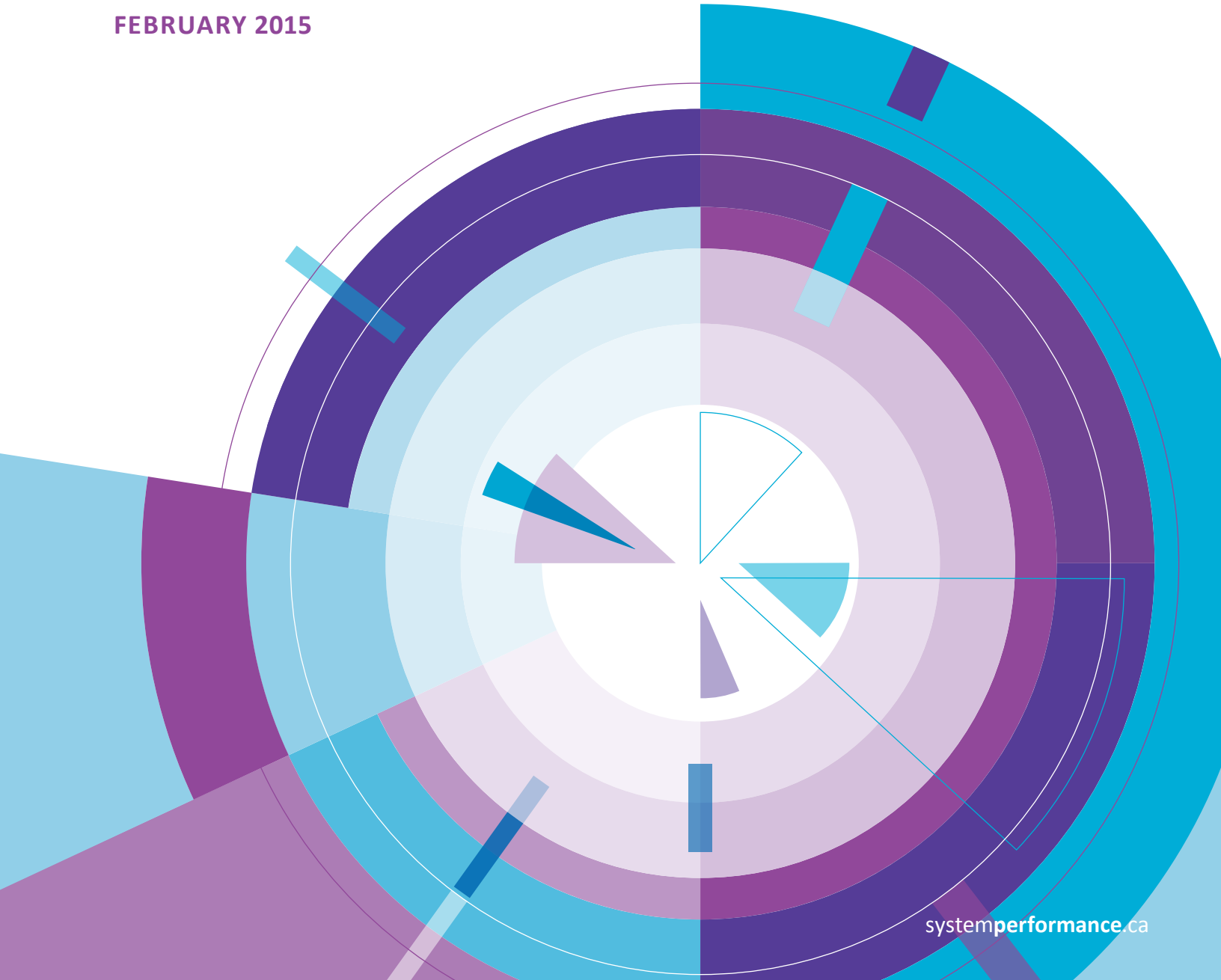
SYSTEM PERFORMANCE REPORTS

Cancer Stage in Performance Measurement: A First Look

A SYSTEM PERFORMANCE SPOTLIGHT REPORT

FEBRUARY 2015



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This document has been made possible through a financial contribution from Health Canada, through the Canadian Partnership Against Cancer. The views expressed herein represent the views of the Canadian Partnership Against Cancer.

Suggested citation:
Canadian Partnership Against Cancer. Cancer Stage in Performance Measurement: A First Look - A System Performance Spotlight Report. Toronto: The Partnership; 2015.

Downloadable at:
systemperformance.ca

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Aussi offert en français sous le titre :
Le stade du cancer dans la mesure du rendement : un premier coup d'œil
Rapport cible sur le rendement du systeme

Acknowledgments

The production of this report was made possible through the dedicated efforts of the members of the pan-Canadian Steering Committee and Technical Working Group (see member lists below) and the data collection efforts of staff from the provincial cancer registries, agencies and programs. The Canadian Partnership Against Cancer (the Partnership) would also like to acknowledge Statistics Canada, in particular the Health Statistics Division, for providing access to data used for this report.

Report production and dissemination were led by the System Performance team which includes **Dr. Heather Bryant**, Vice-President, Cancer Control; **Rami Rahal**, Director; **Jose Hernandez**, Program Manager; **Kristen DeCaria**, Specialist; **Carolyn Sandoval**, Specialist; **Jennifer Chadder**, Specialist; **Evelyne Michaels**, Lead Scientific Writer; **Beth Dunford**, Delivery Manager; **Erna Mursel**, Administrative Assistant, and **Eric Vorauer**, Student. Data extraction, analysis, and figure generation was conducted by the Analytics team which includes **Gina Lockwood**, Manager, Analytics & Surveillance, and Senior Biostatistician; **Cheryl Louzado**, Program Manager, Analytic Capacity and Coordinated Data Development Initiative; **Sharon Fung**, Program Manager, Analytics, and Biostatistician; and data analysts, **Julie Xu**, **Jin Niu** and **Jenny Liu**.

Also pivotal to the production of this report were the valuable contributions of the Diagnosis and Clinical Care program in providing content knowledge and expert input, specifically: **Dr. Geoff Porter**, Senior Scientific Lead, Diagnosis and Clinical Care; **Dr. James Brierley**, Expert Lead, Staging and Surveillance; and **Mary Argent-Katwala**, Director, Diagnosis and Clinical Care. Subject matter expertise was also provided by the members of the Pathology and Staging Expert Panels and the Collaborative Staging Working Group.

We would also like to acknowledge the Partnership's Knowledge Management team who provided knowledge transfer and exchange strategies; the Communications team who led the media and outreach engagement; the Strategy team who provided policy and government-relations advice; and the staff from the Delivery Management Office who provided project management support.

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Highlights

High quality cancer registry data are necessary to describe the burden of cancer in Canada and to evaluate collective efforts to reduce that burden at the system level.

The collection of population level cancer stage data, which describe the extent of disease and are used to inform prognosis, adds substantial value to the information that can be obtained from registries.

- For people with cancer, stage information helps their doctors identify the best treatments. It also helps clinicians predict the likely course of the cancer with greater accuracy.
- When combined with data on treatment, stage data can help track whether cancer care is being delivered according to recommended practice guidelines.
- Stage data can be used to help evaluate the quality and effectiveness of screening and early detection programs.
- Stage data are also useful for evaluating outcomes, particularly survival rates, which differ substantially by stage.
- Because the costs of managing cancer typically vary by stage, collecting and using stage data can help provincial health system leaders plan for needed health care resources.

The need for reliable pan-Canadian data on cancer stage was recognized more than 25 years ago. Data for at least 90% of Canadians diagnosed with breast, colorectal, prostate or lung cancers (2010 diagnosis year) in nine provinces are now available. This is the result of the Partnership's investment in the National Staging Initiative and the efforts of our partners in the cancer control community.

This *Cancer Stage in Performance Measurement Spotlight Report* provides a first look at how these efforts can help us better understand cancer system performance and quality.

Key findings on cancer incidence by stage

- The majority of patients with breast cancer in Canada were diagnosed at Stage I or II, with the incidence of Stage I breast cancer up to 10 times higher than the incidence for Stage IV disease. This reflects the success of breast cancer screening and early detection efforts.
- Colorectal cancer was most commonly diagnosed at Stage III, when it is still curable. The incidence rate for Stage IV disease was similar to that for Stage I. But that pattern is expected to shift as efforts by colorectal cancer screening programs introduced several years ago begin to pay off with earlier detection and higher rates of early stage (Stage I or II) disease.
- While is likely that higher rates of prostate-specific antigen (PSA) testing leads to higher rates of early stage (Stage I and II) incidence, it is not evident from the data that higher PSA testing also results in a lower rates of later-stage (Stage III and IV) disease.

- The early detection of lung cancer remains a challenge. Recent studies and emerging guidelines have suggested that early detection using low-dose computed tomography may be effective for those at very high risk of lung cancer, but that care is needed in developing an approach to early detection. As in many other countries, the incidence rate of Stage IV lung cancer in Canadians was more than double the rates of Stage I or II disease.

Key findings on prognostic factors now available as part of stage data collection

While cancer stage is an important indicator, other factors—genetic, molecular and hormonal—that can determine prognosis and response to treatment are now routinely considered in developing treatment options. Many of these prognostic factor data elements are collected as part of the collaborative staging methodology used in nine provinces. As a result, we are now able to use these data elements to help yield a better understanding of patients' prognosis patterns and support the evaluation of overall treatment rates relative to clinical practice guidelines. These include:

- the percentage of breast cancer cases diagnosed as "triple negative"; that means the tumours tested negative for estrogen receptors (ER), progesterone receptors (PR) and human epidermal growth factor receptor 2 (HER2);
- the incidence of prostate cancer by risk groupings (low, intermediate or high); and
- the incidence of positive circumferential resection margins (i.e., containing cancer cells) following surgery to remove rectal tumours.

Why do these data matter?

For many years the idea that screening for certain common cancers would make a lasting difference in morbidity and mortality (by reducing the rate of patients diagnosed with late-stage disease) could not be demonstrated at a pan-Canadian level. Now with population-based staging becoming available for breast and colorectal cancer, we are able to report on incidence by stage at diagnosis and use this information to begin assessing the impact of population screening.

Having comprehensive information on staging and key prognostic factors will also help initiate further conversations on treatment choices and patient outcomes. This will occur through the analysis of treatment rates by stage and/or other prognostic factors such as risk category for prostate cancer and hormone receptor status in breast cancer.

And finally, we can demonstrate that the investments made in the 2008-2012 National Cancer Staging Initiative are paying off. We will continue to develop key data collection and reporting capacities that will allow us to better manage system quality and showcase advances in cancer control.

Moving forward

While great progress has been made in capturing cancer stage in provincial registry data, these are still "early days." More work is required to expand stage data collection for other cancer sites and to better understand the full potential of these data.

Meanwhile, the practice of cancer staging in Canada is about to change. The withdrawal of U.S.-based support for the collaborative staging framework starting in January 2016 means Canadian experts are now revisiting Canada's approach to collecting data on cancer stage and prognostic factors. To assist in managing this, the Canadian Council of Cancer Registries—in collaboration with the Partnership—has formed the Canadian Cancer Staging Working Group, whose role is to provide advice on a new standard for stage data collection in Canada.

Upcoming data: Two-year relative survival-by-stage

Tracking survival and related outcomes by cancer stage can provide valuable information on the effectiveness of early detection and treatment efforts. As a follow-up to this "First Look" Spotlight report on cancer staging, the Partnership has started working with provinces to collect and analyze new survival-by-stage data. The focus will be on two-year relative survival-by-stage for two of the four most common cancers affecting Canadians: lung cancer and colorectal cancer. Survival-by-stage data will be presented by province where possible and made available later in 2015.

Upcoming System Performance Reports

Later in 2015, the Partnership will be releasing two additional reports on system performance:

- *A Spotlight Report on Prostate Cancer in Canada*: This report will present a range of performance indicators of prostate cancer control including PSA testing, stage-specific incidence and patterns of care. The report will also include perspectives from prostate cancer patients and survivors on their experiences in the health care system.
- *The 2015 Cancer System Performance Report*: This report will provide the latest results for the 17 dashboard indicators as well as special features offering new content—for example, an analysis of the utilization of positron emission tomography (PET) scans in the management of lung cancer in Canada.

About the Canadian Partnership Against Cancer

The Canadian Partnership Against Cancer (the Partnership) was created in 2007 by the federal government with funding through Health Canada. Since then our primary mandate has been to help move Canada's cancer strategy into action and to help it succeed through coordinated system-level change across the full cancer care continuum—from prevention and treatment through to issues around survivorship and palliative care.

The Partnership achieves outcomes by working closely with provincial and national partners to stimulate and support the generation of knowledge about cancer and cancer control and by promoting the exchange and uptake of best practices across the country to help those most affected by cancer. The outcomes we work towards are: fewer cases of cancer, fewer Canadians dying from cancer and a better quality of life for those affected by cancer.

About the System Performance Initiative

The Partnership's **System Performance Initiative** is a national effort to identify aspects of the cancer control system that need to be measured, to define performance indicators and to collect valid and comparable data. We report findings in an integrated manner that allows for synthesis of results and interpretation of patterns to inform quality improvement strategies. This work is accomplished in close collaboration with provincial and national partners.

Findings are published in a series of reports targeted at the cancer control community, especially provincial cancer agencies, provincial departments or ministries of health, clinicians, researchers and cancer patients and their families. The performance indicators are intended to aid policy-makers, health planners, researchers and clinicians in identifying best practices and opportunities for quality improvements in cancer control across Canada.

System Performance information, including previous reports, can be accessed at systemperformance.ca.

About This Publication

About This Publication

In this report, the Canadian Partnership Against Cancer (the Partnership) is highlighting the value of stage data within the Canadian cancer control system. In Canada, the improved availability of stage data has been achieved as a result of substantial efforts by provincial cancer registries to collect and report on population-level staging data.

The pan-Canadian findings reported here are based on the most recent data collected from national and provincial sources. They relate to indicators of *stage-based incidence* and three specific *prognostic factors*: rates of triple-negative[i] cases in breast cancer; a breakdown of prostate cancer cases by risk level; and rates of positive circumferential resection margins after rectal cancer surgery.

Why report on cancer stage?

Knowing the stage of a cancer when the disease is first diagnosed has great value—for both individual patients and their clinicians. For health care professionals treating the person with cancer, information on stage helps to identify the best treatments and to more accurately predict the likely course of the disease. Patients could also benefit from understanding the stage of their disease at diagnosis and how it relates to treatment options and the potential pathways that lie ahead.

About the National Staging Initiative

The 2008-2012 National Staging Initiative, a $20 million infrastructure and technology investment of the Canadian Partnership Against Cancer, set a specific target to capture population-based, stage data for at least 90% of Canadians diagnosed with breast, colorectal, lung or prostate cancer in 2010 and beyond. These four cancers account for more than half of the cancers diagnosed in Canada.

As of the 2010 diagnosis year, nine out of 10 provinces have achieved this goal and are collecting, analyzing and sharing standardized stage data for these four most common cancers. In Quebec, work is underway to capture stage data in the forthcoming Registre québécois du cancer.

i The tumour tests negative for estrogen receptors (ER), progesterone receptors (PR) and human epidermal growth factor receptor 2 (HER2).

At the broader level of the cancer control system, the availability of pan-Canadian population-based, standardized stage data, combined with other data on cancer diagnosis and treatment, is useful in several ways:

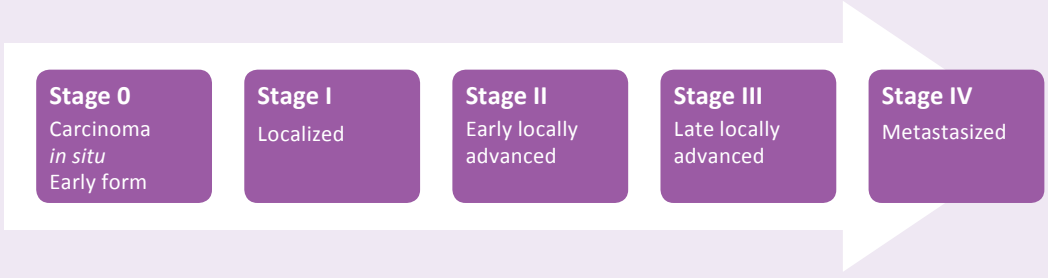
- Stage data can help those in the cancer control community better interpret long-term outcome measures such as the incidence of cancer, mortality and survival.
- When combined with data on treatment, stage data can help track whether cancer care is being delivered according to recommended practice guidelines.
- Stage data are useful in helping to evaluate the quality and effectiveness of screening and early detection efforts.
- Many cancer researchers rely on stage data to help assess the size and profile of cohorts for clinical trials and other research initiatives.
- Finally, collecting and using stage data can help provincial health system leaders plan the use of health care resources more effectively. This is because the costs of managing cancer typically vary by stage.[1,2]

How cancer progresses from stage to stage

The ability to "stage" specific cancers is based on knowledge about how cancer progresses. Cancer cells grow and divide without control or order, and they do not die when they should. As a result, they often form a mass of tissue called a tumour.

Tumours usually start out as localized growths that are limited to a specific organ or body part. But as a tumour grows, it can invade nearby tissues and organs. Cancer cells can also break away from the tumour and enter the bloodstream or the lymphatic system.

In this way, cancer cells can spread from the primary site to lymph nodes or other organs. The spread of cancer is called *metastasis*.



How the report was informed

The indicators and analyses presented in this report are the result of collaboration with partners at the national and provincial and territorial level, as well as with subject matter experts and knowledge leaders in the Partnership's Diagnosis and Clinical Care Program.

At the provincial level, the System Performance Steering Committee and Technical Working Group, each comprising locally-appointed representatives from all 10 Canadian provinces, support the work of the Partnership's System Performance Initiative and guided the planning and development of the report. This included the development of data specifications and calculation methodologies used in the collection and analysis of data, particularly for capture of stage, to ensure consistency and comparability across provinces.

At the national level, the Partnership works closely with Statistics Canada which houses and administers the Canadian Cancer Registry (CCR). The CCR is an administrative database that collects information on cancer incidence from all provincial and territorial cancer registries in Canada. CCR data were used to calculate and develop indicators on incidence by stage and related prognostic factors.

Indicators presented in this report are, for the most part, based on the 2010 diagnosis year– the first year for which nine provinces submitted population-based stage data for the four most common disease sites to the Canadian Cancer Registry. Data from 2011 and 2012 were not available at the time of publication of this report. Future system performance reports will profile more up-to-date data as Statistics Canada makes available more current updates to the national cancer registry.

How the report is organized

To set the context for the report, the *completeness of stage data collection* within each province is first presented. These data are reported as the percentage of provincial cancer incident cases for which valid data on stage at diagnosis are available.

The report then examines, for the first time, *incidence rates by stage at diagnosis* for the four most common cancers (breast, colorectal, lung and prostate). These are followed by a look into the prevalence of three key *prognostic factors*: incidence of breast cancer cases that are triple-negative, a breakdown of prostate cancer cases by risk category, and the incidence of rectal cancer cases with a positive circumferential resection margin. Prognostic factors, in addition to stage, are used to determine appropriate treatment strategies at the patient level and can yield valuable information about overall treatment patterns and patient outcomes at the population-level. Because collaborative staging includes more data points than the usual tumour-node-metastasis (TNM) anatomic-based staging system, the analysis of these three prognostic factors was possible.

For each indicator presented in this report, results are compared by province and displayed graphically in charts or tables. Supplementary information is highlighted within boxed-in text.

Indicator Results

Indicator Results

Collecting data and reporting on cancer stage

As of the 2010 diagnosis year, nine provinces reported stage data for more than 90% of cases in the four most common cancers—breast, lung, prostate and colorectal—using the collaborative stage (CS) system[ii] (see Figure 1.1 for data from the 2011 diagnosis year). This represents considerable progress since 2007, when just five provinces reported stage data for more than 90% of cases involving these cancers—as reported in the 2012 Cancer System Performance Report *from the Canadian Partnership Against Cancer (the Partnership).*

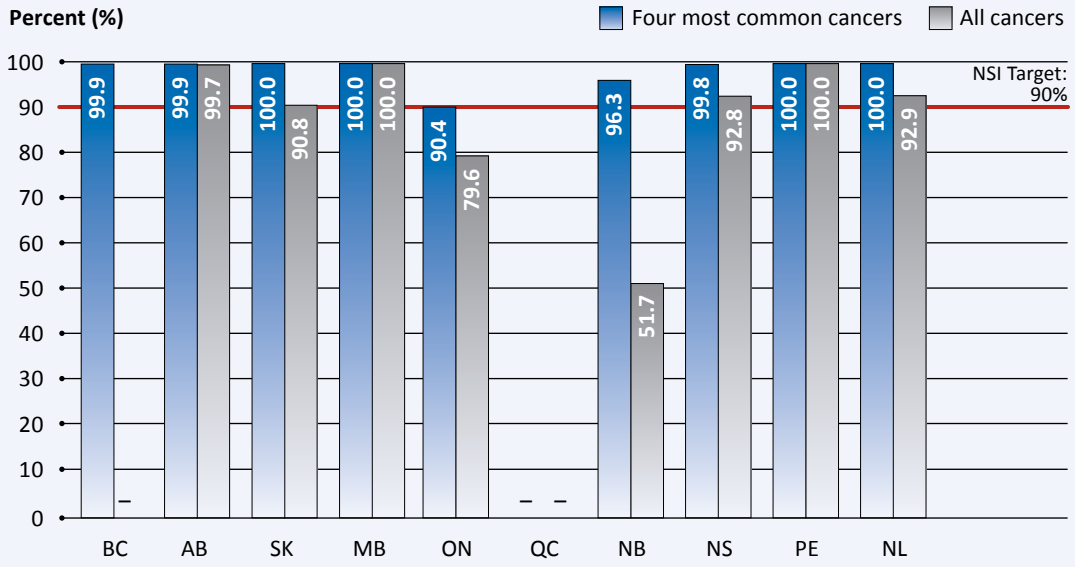
Within the CS system, a case is identified as "stage unknown" when not all the diagnostic workups necessary to determine stage are completed or when the documentation on that workup is incomplete. The percentage of cases designated as stage unknown (for breast, colorectal, lung and prostate cancers) was 6% or less for eight of the nine reporting provinces (Table 1.1). British Columbia had the highest percentages of stage unknown cases, although percentages for prostate cancer appeared to be declining (from 32.9% in 2010 to 19.7% in 2011).

The Partnership, in collaboration with jurisdictions, will continue monitoring stage data capture and stage unknown rates to ensure they are consistently available at the pan-Canadian level.

ii **Collaborative stage data collection system (CS)** Using a specific computer-based methodology, trained coders—known as certified tumour registrars—are given access to all patient charts that contain clinical findings along with any pathological test results (i.e., analysis of tumour tissue or cells). The registrar receives and reviews the data, makes coding assessments and then inputs the data into the relevant fields. A computer generates the appropriate stage but also allows the inclusion of additional prognostic factors. This information is captured and stored in provincial cancer registries.

FIGURE 1.1

Percentage of incident cases for which stage data are available in provincial registries, four most common cancers and all cancers, by province, 2011 diagnosis year



Four most common cancers: breast, prostate, colorectal and lung.
"-" Data not available for BC (all cancers) and QC (four most common cancers and all cancers).
QC only began collecting data in 2013.
ON data exclude *in situ* cases.
NSI Target = target set by the National Staging Initiative.
Data source: Provincial cancer agencies

TABLE 1.1

Percentage of cases for which stage is unknown, by disease site and province, 2010 and 2011 diagnosis years

Disease site	Year	Province									
		BC	AB	SK	MB	ON	QC	NB	NS	PE	NL
Breast	**2010**	5.3	1.6	1.6	1.7	2.2	–	0.9	2.9	1.9	1.4
	2011	3.6	1.6	1.5	1.3	1.7	–	1.6	2.9	1.6	1.5
Colorectal	**2010**	13.2	4.1	2.8	3.2	2.6	–	3.6	3.4	3.8	5.8
	2011	13.9	3.4	2.9	4.3	4.3	–	4.6	3.9	4.5	3.6
Lung	**2010**	7.7	1.3	1.6	1.1	0.9	–	1.0	2.0	1.6	4.7
	2011	9.1	1.5	0.6	1.9	1.9	–	2.1	1.4	1.7	3.5
Prostate	**2010**	32.9	5.4	4.1	5.1	0.8	–	0.9	6.2	0.8	2.3
	2011	19.7	3.2	2.5	5.8	1.4	–	2.3	4.3	2.5	3.7
All other cancers	**2010**	–	–	–	–	1.7	–	–	–	–	–
	2011	–	5.6	3.8	3.6	1.7	–	–	2.5	3.4	5.0

"-" Data not available.
QC only began collecting data in 2013.
BC data include stage only for breast, colorectal, lung, prostate and cervical cancer.
ON data exclude *in situ* cases.
NB data include stage only for breast, colorectal, lung and prostate cancer.
Data source: Provincial cancer agencies

Stage-specific incidence of four cancers

Two cancers with organized screening programs: Breast and colorectal

Our first look at stage-specific incidence in this report focuses on breast and colorectal cancers. Population-based screening programs for breast cancer (such as mammography) have been in place in all provinces for at least 15 years. In contrast, the earliest provincial screening programs for colorectal cancers were launched in 2007. As of 2014, some colorectal cancer screening programs have still not been fully implemented. Given this, the impact of colorectal cancer screening on the incidence of late-stage cancers, and ultimately on reducing mortality, may not be observable for some time.

Why report *stage-specific incidence* vs. *stage distribution*?

Stage distribution is a commonly used indicator that measures the percentage of patients diagnosed at each stage of disease (I, II, III, and IV).

When screening occurs, we generally see an increase in the detection of early-stage cancers. However, screening is only effective if we also see a reduction in the *rate of late-stage cancers* (because, by finding an early cancer, we prevented its late diagnosis) and in *mortality* (because early detection and subsequent treatment were curative).

From a purely mathematical point of view, the increased number of cancers detected at an earlier stage (0-I) has the effect of reducing the percentage of cases detected at later stages (III-IV). So it would be possible to see a reduction in the *percentage* of late stage cancers, even if the screening was not effective in reducing the *rate* of late stage cancers.

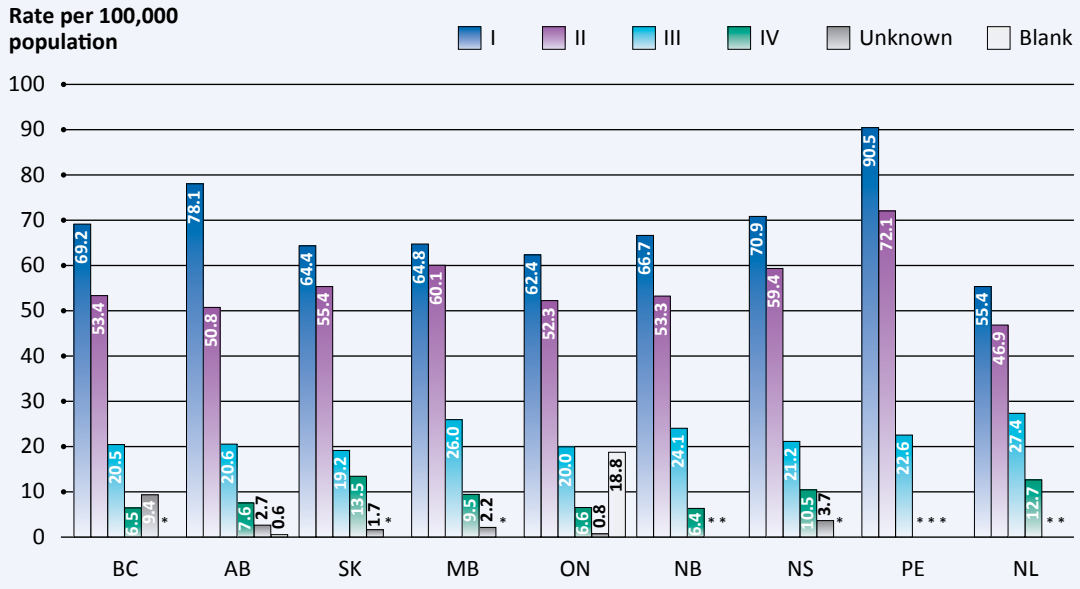
To evaluate the impact of early detection we need a measure of stage-specific incidence rates: this allows us to see the independent effects of screening on each stage at diagnosis.

Until such measures can be obtained on a broad level, using stage-specific data to assess the impact of population screening and early detection efforts will remain difficult.

STAGE-SPECIFIC INCIDENCE FOR BREAST CANCER

FIGURE 2.1

Incidence rates for breast cancer in women, by stage at diagnosis, by province, age-standardized to the 2011 population, 2010 diagnosis year



* Suppressed due to statistical unreliability caused by small numbers.
QC stage data for 2010 were not available.
Unknown = Data entered in the Collaborative Stage (CS) algorithm were not sufficient to ascertain a stage.
Blank = No staging information was entered into the patient's record.
Data source: Statistics Canada, Canadian Cancer Registry

Data from the 2010 diagnosis year show that the incidence rates for Stage I and II breast cancers were much higher compared to rates for Stage III (Figure 2.1). The age-standardized incidence rate for Stage I breast cancer was up to 10 times higher than the rate for Stage IV disease.

Interestingly, data from the U.S. show that the ratio of Stage I to Stage IV incidence for breast cancer nearly doubled from the early 1980s to the late 1990s.[3] Although this range of historical stage data is not available from Canadian sources, it is likely that similar trends would be noted here, reflecting the roll-out of organized screening programs starting in the late 1980s.

In the 2010 diagnosis year, the Stage IV breast cancer incidence ranged from 6.4 to 13.5 cases per 100,000 people in Canada (Figure 2.1).

Saskatchewan had the highest Stage IV incidence rate for breast cancer (13.5 cases per 100,000 people) and one of the lowest for Stage I breast cancers (64.4 cases per 100,000 people). The situation was reversed in British Columbia: it had one of the lowest age-standardized incidence rates for Stage IV breast cancer (6.5 cases per 100,000 people) but was also among provinces with the highest age-standardized incidence of Stage I breast cancers (69.2 cases per 100,000 people).

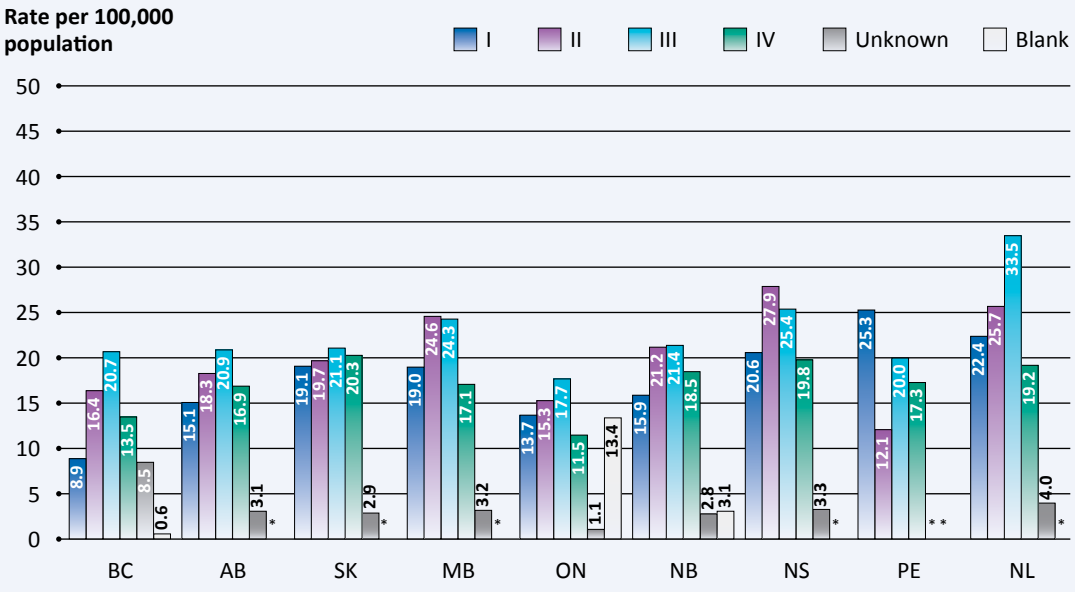
While the relationship between provincial screening rates and the patterns of stage-specific incidence reported here does not necessarily represent cause-and-effect, over time such comparisons can help inform the evaluation of screening and early detection efforts in breast cancer.

For example, data from the 2012 Canadian Community Health Survey—as reported in the Partnership's *2014 Cancer System Performance Report*—showed the percentage of women (aged 50-69) stating that they had received a screening mammogram in the previous two years. The number was 63% in Saskatchewan, which according to this report had the highest age-standardized incidence of Stage IV breast cancer. In British Columbia the screening rate was 70%; the current report shows that this province had one of the lowest age-standardized incidence rates of Stage IV breast cancer among reporting provinces.

STAGE-SPECIFIC INCIDENCE FOR COLORECTAL CANCER

FIGURE 2.2

Incidence rates for colorectal cancer, by stage at diagnosis, by province, age-standardized to the 2011 population, 2010 diagnosis year



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Unknown = Data entered in the Collaborative Stage (CS) algorithm were not sufficient to ascertain a stage.
Blank = No staging information was entered into the patient's record.
Data source: Statistics Canada, Canadian Cancer Registry

Colorectal cancer is most commonly diagnosed at Stage III when it is still curable through surgery and chemotherapy, but also when the chance of recurrence after treatment is higher than it is for cancers diagnosed at an earlier stage.[4] Data from the 2010 diagnosis year show that the incidence rates for colorectal cancer were more evenly distributed by stage at diagnosis compared to rates for breast cancer (Figure 2.2).

Given the recent implementation of population-based screening for colorectal cancer, the differences among the nine reporting provinces in stage-specific incidence patterns shown here represent more of a baseline measure (i.e., a starting point for comparisons). That baseline varied substantially across provinces: the lowest age-standardized incidence rate of Stage IV colorectal cancer occurred in Ontario (11.5 cases per 100,000 people) while the highest rate was seen in Saskatchewan (20.3 cases per 100,000 people).

The roll-out of colorectal screening programs began in Ontario, Manitoba and Alberta in 2007 and 2008. Screening rates across Canada in 2008 ranged from 16.2% of the population aged 50-74 years in Quebec to 46.6% in Manitoba; Ontario followed closely at 44.7%. By 2012, all provinces reported an increase in screening rates which ranged from 28.3% to 59.2% of the eligible population.[5] This variation likely reflects different stages of screening program roll-out in the provinces.

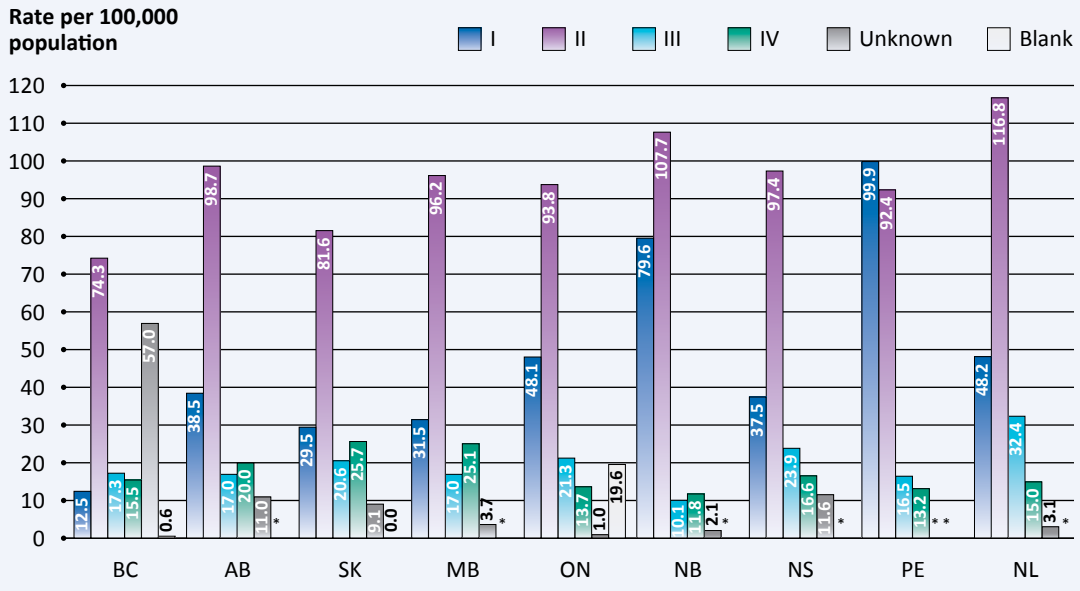
Data show that the incidence of early-stage colorectal cancer (Stage I) ranged from 25.3 cases per 100,000 people in Prince Edward Island to 8.9 cases per 100,000 people in British Columbia. When comparing different provinces' incidence rates by stage for colorectal cancer, it is important to keep in mind that there are inter-provincial variations in overall incidence of the disease. For example, while the Atlantic provinces had the highest age-standardized incidence rate of early-stage colorectal cancer, they also had the highest overall incidence rates of the disease.

In the next 10 to 15 years, when colorectal screening programs are more mature, we expect to see the patterns of colorectal cancer stage-specific incidence shift—that is, we will see more early-stage and fewer late-stage cancers. Also, because colorectal cancer screening actually can detect and remove many pre-cancerous lesions, we hope to see a reduction in overall incidence rates.

STAGE-SPECIFIC INCIDENCE FOR PROSTATE CANCER

FIGURE 2.3

Incidence rates for prostate cancer, by stage at diagnosis, by province, age-standardized to the 2011 population, 2010 diagnosis year



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QC stage data for 2010 were not available.
Unknown = Data entered in the Collaborative Stage (CS) algorithm were not sufficient to ascertain a stage.
Blank = No staging information was entered into the patient's record.
Data source: Statistics Canada, Canadian Cancer Registry; Provincial cancer agencies (BC and SK).

Unlike the situation for breast and colorectal cancers, organized population-based screening for prostate cancer is not currently recommended in Canada. This is because evidence suggests that the potential benefits do not outweigh the potential harms.

However, prostate-specific antigen (PSA) testing is commonly ordered by physicians for patients across the country, although the extent of its use varies by province. This variation is partially due to differences in provincial policies and practices (e.g., some provinces fund any PSA test ordered by a physician, while others do not).

Figure 2.3 shows the incidence of prostate cancer by stage and by province for the 2010 diagnosis year. The incidence of *stage unknown* prostate cancers was particularly high in British Columbia (57.0 cases per 100,000 people). The stage unknown incidence was much lower—1.0 to 11.6 cases per 100,000 people—in other provinces.

When we restrict the comparison to provinces with a low proportion of *stage unknown* cases, New Brunswick and Prince Edward Island show the lowest age-standardized incidence rate of late-stage prostate cancer; Saskatchewan and Manitoba show the highest. The incidence rate of Stage IV disease ranged from 11.8 cases per 100,000 people in New Brunswick to 25.7 cases per 100,000 people in Saskatchewan.

The evidence on PSA testing

The 2014 report of the Canadian Task Force on Preventative Health Care does not recommend the use of population-wide prostate-specific antigen (PSA) testing. This is due to insufficient evidence on the test's effectiveness and on its potential for causing overall harm.[6]

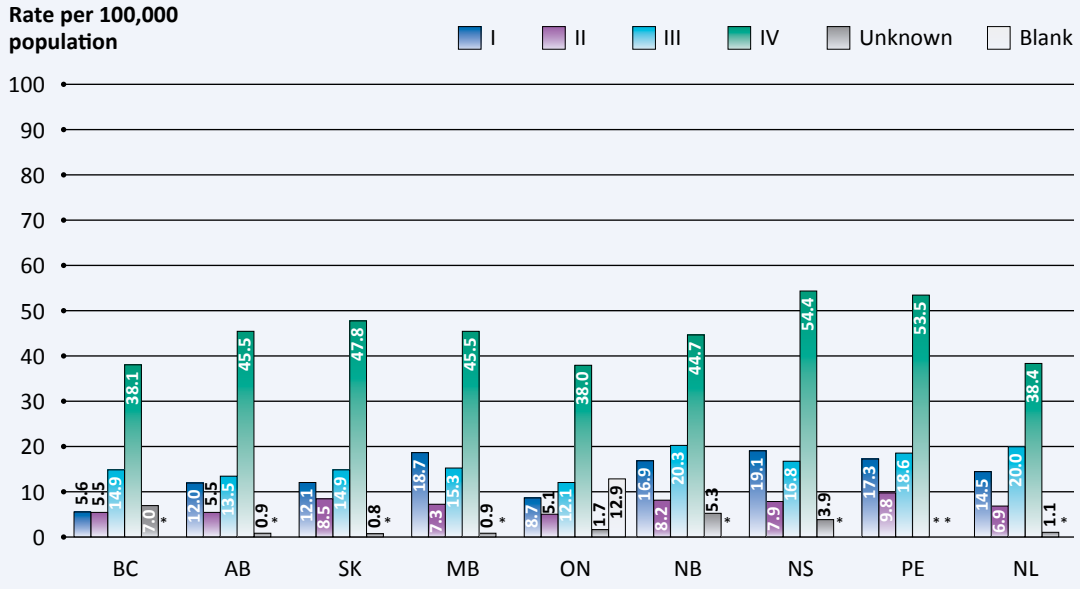
The harms of PSA testing include false-positive results, unnecessary biopsies, over-diagnosis of latent or early-stage prostate cancers that are unlikely to cause harm, and subsequent unnecessary treatment which could lead to increased rates of impotence, incontinence and decreases in quality of life.[6]

The Prostate, Lung, Colorectal, and Ovarian (PLCO) Cancer Screening Trial, a large randomized control trial in the United States, found that PSA screening had no effect on prostate cancer mortality.[7]

STAGE-SPECIFIC INCIDENCE FOR LUNG CANCER

FIGURE 2.4

Incidence rates for lung cancer, by stage at diagnosis, by province, age-standardized to the 2011 population, 2010 diagnosis year



* Suppressed due to statistical unreliability caused by small numbers.
QC stage data for 2010 were not available.
Unknown = Data entered in the Collaborative Stage (CS) algorithm were not sufficient to ascertain a stage.
Blank = No staging information was entered into the patient's record.
Data source: Statistics Canada, Canadian Cancer Registry

Because lung cancers rarely cause symptoms before progressing to a late stage, most early detection is incidental—for example, a lung cancer is identified on a computed tomography (CT) scan ordered for some other unrelated health problem. In Canada as elsewhere, most lung cancers are diagnosed when they are already at Stage IV.[5] No organized population screening programs aimed at the early detection of lung cancer currently exist. However, early detection using low-dose CT scans for patients at a high risk of developing lung cancer is now being seriously considered by many jurisdictions, including those in Canada.[8]

Figure 2.4 shows the incidence rates of lung cancer by stage and by province in the 2010 diagnosis year. Stage IV incidence rates ranged from 38.0 to 54.4 cases per 100,000 people. The rates of early stage (Stage I) disease were much lower, ranging from 5.6 to 19.1 cases per 100,000 people.

Differences among provinces reflect variations in overall lung cancer incidence that are largely driven by differences in smoking rates. The Atlantic provinces had proportionately higher incidence rates of late stage lung cancer, but it is important to note that they also had higher overall incidence rates of the disease. This higher incidence is likely a result of higher smoking rates in these provinces.

Beyond stage: Other prognostic factors

While cancer stage is an important indicator of a patient's disease, other factors that determine prognosis and response to treatment are now routinely considered in developing treatment options. This is because knowledge about many other aspects of cancer—genetic, molecular, hormonal—has increased dramatically over the past 20 years.

Data on several of these prognostic factors have been routinely collected as part of the collaborative stage data collection system now used in Canada. These include biomarkers such as human epidermal growth factor receptor 2 (HER2) in breast tumours and levels of prostate-specific antigens (PSA) found in men with prostate cancer. The presence of these biomarkers may help predict patients' response to different treatments and to understand the likely course of their disease.

i. Percentage of invasive breast cancer cases that are triple negative (ER, PR and HER2-negative)

Studies suggest that between 15-20% of all breast tumours are *triple-negative*–that is, they do not meet the criteria for positive expression of estrogen receptors (ER), progesterone receptors (PR) and human epidermal growth factor receptor 2 (HER2).

Evidence suggests that patients with triple-negative tumours have a worse prognosis. They are also more likely to be offered chemotherapy because evidence shows they do not benefit from drugs targeting HER2 such as trastuzumab (Herceptin) or from hormonal therapies that are most effective in the setting of ER and/or PR positivity.[9] For these reasons, triple-negative status has been linked to a disproportionate number of deaths among women with breast cancer, particularly younger women.[10]

Breast cancer tumour biomarkers

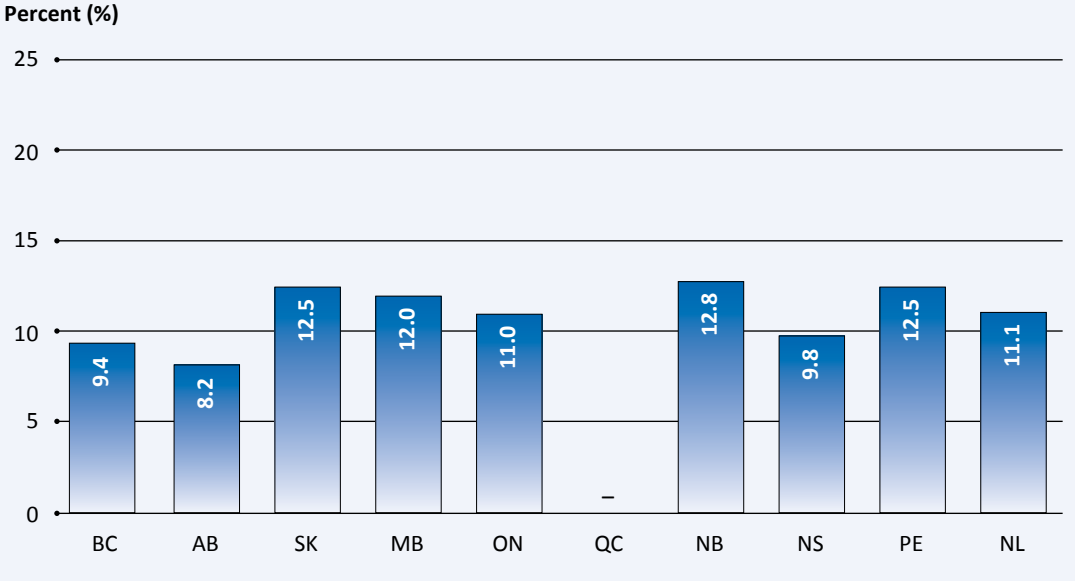
Most breast cancer cells have specific receptors for hormones or growth factors on their surface that are essential for their growth. These receptors can be used as targets for drugs known to inhibit tumour growth. Knowing that specific tumour markers are present can be useful in selecting appropriate drug therapy.

The most commonly used biomarkers for predicting the response to treatment are **estrogen receptors (ER)** and **progesterone receptors (PR)**. Another useful tumour marker in the management of breast cancer is a protein called **human epidermal growth factor receptor 2 (HER2).** Breast cancer cells making an excess of HER2 tend to be more aggressive if not treated with anti-HER2 adjuvant agents and/or less responsive to hormone treatment.

Figure 3.1 shows that the percentage of breast cancers diagnosed as triple-negative fell within a relatively narrow range (from 8.2% in Alberta to 12.8% in New Brunswick). These Canadian results fall within the range of data from the U.S. A recent analysis of the SEER (Surveillance Epidemiology and End Results) database for 2010 reported that 12.2% of breast cancers in American women were triple-negative for ER, PR and HER2 markers.[11] These U.S. data also showed that the proportion of cases with triple-negative disease was twice as high in black women (22.5%) as it was in white women (10.7%). This points to a possible ethnic group/genetic susceptibility to this type of breast cancer. While this might also apply to the Canadian setting, no demographic data (such as race or ethnicity) are routinely reported for cancer patients in Canada. Provincial variations shown here may be reflective of ethnicity along with other factors that need to be considered when interpreting results.

FIGURE 3.1

Percentage of invasive breast cancer cases (women aged ≥ 20) diagnosed as triple negative (ER, PR, HER2), by province, 2010 diagnosis year



"-" Data not available.

Data source: Statistics Canada, Canadian Cancer Registry

ii. Breakdown of non-metastatic prostate cancer cases by risk category

In prostate cancer, the classical stage characteristics tell only a part of the story about the patient's disease and the appropriateness of various treatments. Several other prognostic or predictive factors are now routinely considered in the prognosis and treatment planning of prostate cancers.

At a consensus meeting in 2000, the Genitourinary Radiation Oncologists of Canada (GUROC) reached agreement on a set of definitions for localized prostate cancer risk groupings; localized tumours are those that have not spread beyond the prostate gland. These groupings, designated as *low*, *intermediate* and *high*, are based on the patient's biopsy Gleason score, blood levels of prostate-specific antigen (PSA) and clinical T stage.[12]

Prostate cancer risk groupings

Low-risk

Must have *all* the following:

- PSA ≤10 ng/mL
- Gleason Score ≤6
- Stage T1-T2A

Intermediate-risk

Must have *all* of the following (if *not* low-risk):

- PSA ≤20 ng/mL
- Gleason score <8
- Stage T1/T2

High-risk

Must have *any* of the following:

- PSA >20 ng/mL
- Gleason Score ≥8
- Stage ≥T3

Prognostic factors for prostate cancer

Gleason Score

This score reflects the grade of the tumour—specifically how cells removed via biopsy look under a microscope. A score of between 2 and 6 suggests a low-grade prostate cancer which is likely to grow very slowly. A score of 7 is considered an intermediate-grade tumour that will grow at a moderate rate. A score of 8 to 10 indicates a high-grade cancer that is likely to grow more quickly.

Prostate-Specific Antigen (PSA)

PSA is a protein produced within the prostate gland and secreted into the seminal fluid. A high PSA reading may indicate the presence of early cancer, but it can also lead to unnecessary tests and treatment. This is why doctors consider the patient's other risk factors before recommending a specific treatment or other approach.

Clinical T Stage

Clinical T stage findings are based on digital rectal examination and/or on transrectal ultrasound testing (which may involve microscopic analysis of tissue). Clinical T staging also helps determine whether or not the patient is a good candidate for specific treatments such as radical prostatectomy (surgical removal of the prostate gland), external beam radiation therapy, brachytherapy, cryosurgery and/or hormonal therapy prior to treatment.

Figure 3.2 shows that the breakdown of non-metastatic prostate cancer cases by risk category varied substantially by province. The percentages ranged from 15.5% to 47.8% for those in the low-risk category; from 30.4% to 52.5% for those determined to be at intermediate risk; and from 13.0% to 35.1% for those in the high-risk category.

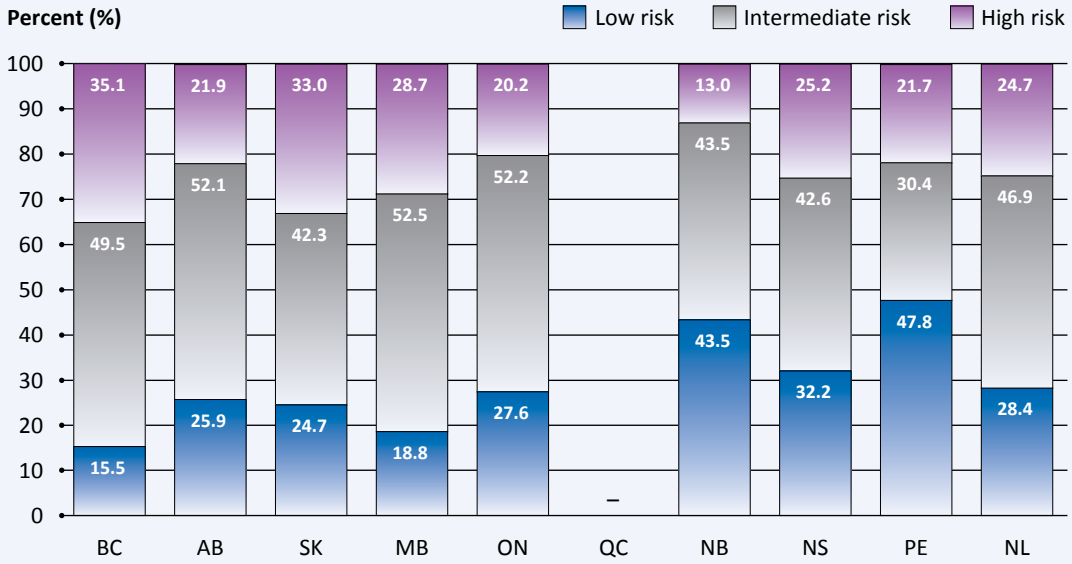
It is possible that some of this variability reflects differences in pathology practice and/or data capture and reporting. But it is also possible that higher PSA test rates in certain provinces contribute to a higher proportion of patients deemed to be in the low-risk category.

For comparison, a U.S. study of more than 200,000 men with prostate cancer reported the risk breakdown as follows: 29% of men were determined to be low-risk, 49% were intermediate-risk, and 22% were considered high-risk.[13] These breakdowns are comparable to those from Alberta and Ontario (British Columbia's distribution is difficult to interpret because of the high rate of *stage unknown*).

In the upcoming system performance spotlight report on prostate cancer in Canada, we will present indicators that measure patterns of care by prostate cancer risk category (and by age group). These data will highlight how current approaches to managing prostate cancer vary by the patient's risk category.

FIGURE 3.2

Distribution of non-metastatic prostate cancer cases (men aged ≥ 20) by risk category, by province, 2010 diagnosis year



"-" Data not available.

Data source: Statistics Canada, Canadian Cancer Registry

iii. Positive Circumferential Resection Margin (CRM) rates for invasive rectal cancer

Surgery is the primary treatment for patients with rectal cancer. During rectal cancer resection procedures, the surgeon will try to remove the entire tumour and some normal tissue surrounding it (called "the margin").

A *negative margin* means that when this tissue is examined by a pathologist, it is free of any cancer cells. This increases the chances that the entire tumour has been removed. A *positive margin* means cancer cells can be seen at the edge of the surgical specimen; this suggests malignant cells may have been left behind. A positive margin is defined as an area of normal tissue that is less than 1 mm from the edge of the original tumour.

Among the types of margins studied in rectal cancer—proximal, distal and circumferential (also called radial)—the circumferential margin (CRM) is considered to be the most important.

For the past 20 years, CRM findings have been used to aid in predicting how well someone with rectal cancer will do after surgery. For example, is the tumour likely to reoccur? This is a particular challenge when it comes to removing rectal cancers which are located in a very narrow anatomical area. For this reason, the CRM may also be used as an indicator of quality of surgery being done for rectal cancers.

Changes in surgical techniques in rectal cancer, specifically the use of total mesorectal excision combined with the use of pre-operative radiotherapy to shrink tumours, have led to a marked reduction in positive margins. This in turn has reduced the rates of rectal cancer recurrence.[14]

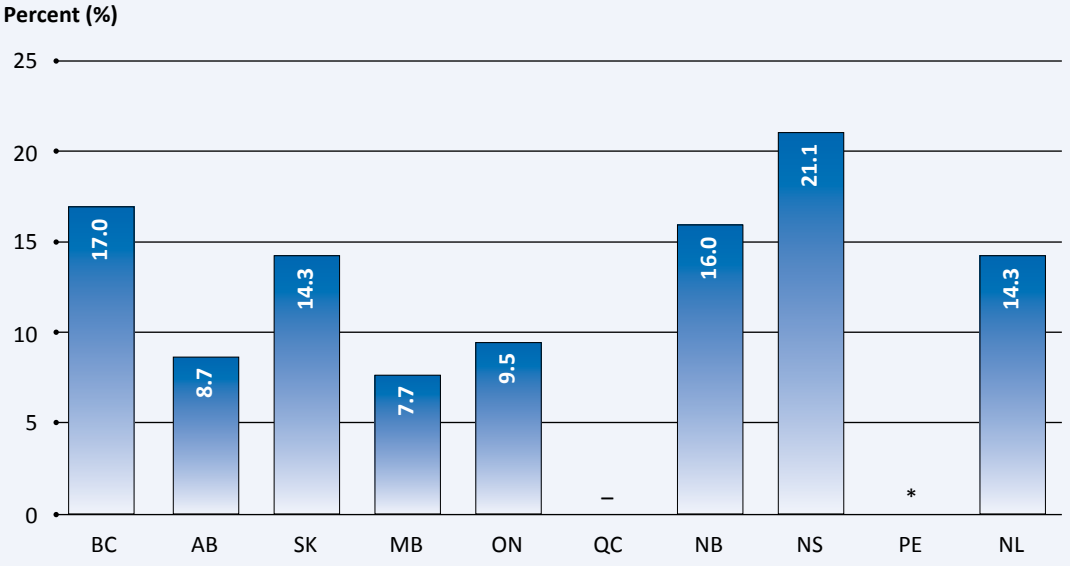
Figure 3.3 shows that the percentage of rectal cancer cases with a positive CRM ranged from a low of 7.7% in Manitoba to a high of 21.1% in Nova Scotia. This wide range persists even when the analysis is limited to the larger provinces with higher volumes of surgery. For example, the rate of positive margins was nearly twice as high in British Columbia (17.0%) as it was in Alberta (8.7%).

Similar variability is reflected in the results of other population-based studies from the U.S. where positive circumferential margin rates ranged from 8% to 22%.[14]

As additional years of staging data become available, it may be possible to determine whether this kind of inter-provincial variation reflects a general instability in the data used for the indicators or whether it reflects actual differences in surgical practice between provinces.

FIGURE 3.3

Percentage of invasive rectal cancer resections (patients aged ≥ 20) with a positive circumferential margin, by province, 2010 diagnosis year



* Suppressed due to statistical unreliability caused by small numbers.
"-" Data not available.
Positive Circumferential Margin (CRM) is a resection margin less than 1mm from the edge of the original tumour.
Data source: Statistics Canada, Canadian Cancer Registry

Moving Forward

As mentioned earlier in this report, the National Cancer Staging Initiative has brought us close to having complete population-based stage data collection for the four most common cancers affecting Canadians. But the practice of collaborative cancer staging in Canada is about to change.

In August of 2013, the major U.S. cancer registry data collection standard setters[iii] announced they would no longer support the collaborative staging framework for cases diagnosed after January 1, 2016. The main reasons cited for this change were costs and the complexity of maintaining such an algorithm-based system—especially with the increasing demand for collection of "prognostic variables"—factors that lie outside the standard "tumour-node-metastasis" (TNM) anatomic-based system.

The withdrawal of American-based support for the collaborative staging framework means Canadian experts are now revisiting Canada's approach to collecting data on cancer stage and other prognostic factors. If TNM is the data standard moving forward, the major question that emerges is defining what level of TNM granularity and other data, including for the prognostic factors examined in this report, should be collected regionally and nationally.

To help implement and manage this change, the Canadian Cancer Staging Working Group (a collaboration of the Canadian Council of Cancer Registries and Canadian Partnership Against Cancer) is providing advice on a new stage data collection standard for Canada. This group will help guide the transition from collaborative staging to a system that is less resource intensive but still allows for the collection of the most useful data elements on staging and prognosis.

Synoptic pathology reporting: Adding value to staging data

Early on in our mandate, the Partnership recognized that having complete, comprehensive and timely pathology reporting is important to effective cancer control. In 2008, the National Staging Initiative was established and went on to successfully implement a system for *synoptic pathology* reporting in Ontario and New Brunswick. A similar system was already in place in Prince Edward Island.

iii U.S. Centers for Disease Control and Prevention and its National Program of Cancer Registries; the U.S. National Cancer Institute and its SEER Program; and the Commission on Cancer.

Synoptic pathology reporting uses an electronic format that allows for the standardized collection, transmission, storage, retrieval and sharing of data between clinical information systems. Important diagnostic and prognostic factors are laid out in a structured list or table rather than being expressed in unstructured text format. This improves communication among health care providers, makes treatment decisions easier and allows us to compare the performance of different pathologists. The approach also enables us to look at the distribution of tumour characteristics across populations.

With the support of the Partnership, British Columbia, Alberta, Manitoba and Nova Scotia began implementing electronic synoptic pathology reporting. New Brunswick has extended its use across the province. Prince Edward Island has focused on setting up a new registry system and interfaces in order to obtain data electronically.

This expansion reflects investments by the provinces, Canada Health Infoway and the Partnership.[15] Data from synoptic pathology will augment staging and prognostic information collected in registries and will allow for more meaningful analysis of diagnostic information, including the identification of best practices to support pan-Canadian quality improvements.

Future System Performance reports

Upcoming and future system performance reports will continue to include indicators and related analyses that rely heavily on high-quality staging and prognostic data collected by the provincial cancer registries.

- These include the 17 dashboard indicators that form the foundation for the annual Cancer System Performance Reports, starting with the 2015 edition to be released later this year.
- The Spotlight report series will also continue to feature stage and prognostic factor-based indicators. This includes the upcoming spotlight report on prostate cancer in Canada, which will present treatment patterns by risk category.
- Later in 2015, the Partnership will publish new data on survival-by-stage for lung and colorectal cancers.

We believe this work underlines the importance having of high-quality registry data that includes information on stage and prognostic factors. Such information enables us to accurately measure and assess the cancer control system and to inform improvements in quality across Canada.

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