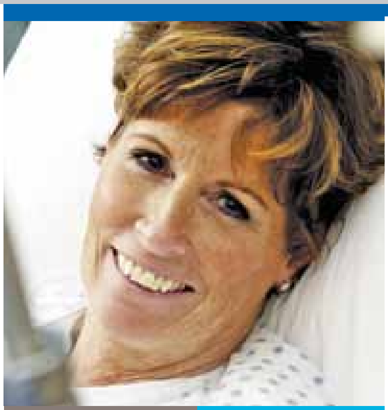
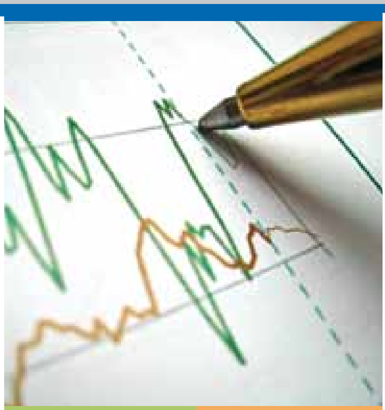
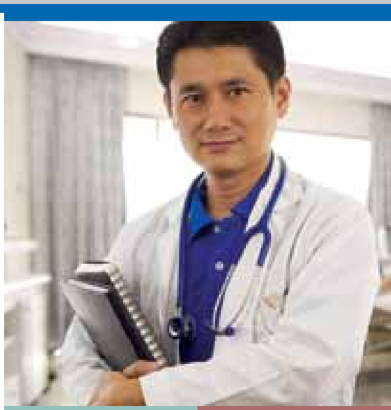
Lung Cancer in Canada: A Supplemental System Performance Report

CANADIAN **PARTNERSHIP** AGAINST **CANCER**

PARTENARIAT CANADIEN CONTRE LE **CANCER**

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Lung Cancer in Canada: A Supplemental System Performance Report

The System Performance Initiative at the Canadian Partnership Against Cancer continues to refine a set of high-level indicators that facilitate a systematic approach to measuring and reporting on cancer control in Canada. This supplemental report builds on the work of the System Performance Initiative.

In this report

Considerable advances in knowledge about prevention, diagnosis and treatment of lung cancer have been made, but it remains the leading cause of cancer death for Canadians and is the second most common cancer diagnosed in Canadian adults. Lung cancer presents a significant burden to individual Canadians affected by the disease, and it has a significant impact on the delivery of health care in Canada. These impacts are substantial, especially during treatment, and so this report is organized in a way that:

- explores the burden associated with treatment;
- looks at the risk factors for the disease;
- discusses other considerations in assessing the burden of illness; and
- examines the Canadian research environment as it relates to lung cancer.

Lung Cancer Patterns and Trends in Canada

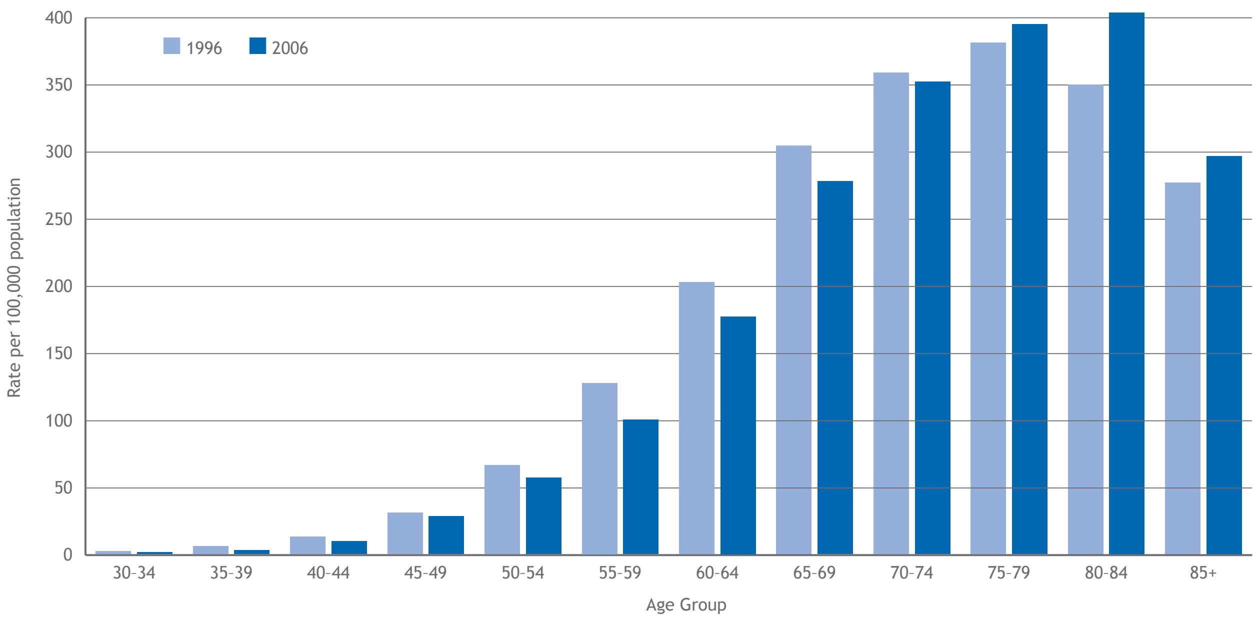
It was estimated that more than 20,000 Canadians would die from this disease in 2010, accounting for more than a quarter of all deaths from cancer across the country.[1] The total number of Canadians who will die this year as a result of lung cancer is more than the estimated number of deaths caused by prostate, breast and colorectal cancers combined.[1]

The rates for lung cancer incidence and mortality in Canada have similar patterns, and thus we have largely focused on incidence data for this report. It is estimated that in 2010 more than 24,000 Canadians were diagnosed with lung cancer, with more than half of these diagnosed in Canadians 70 years of age and older. The incidence of lung cancer increases with age, and while incidence rates are falling overall, the trend is reversed for those 75 years of age and older, where incidence rates have increased in the decade between 1996 and 2006 (Figure 1).[2]

Approximately 1.6 million new cases of lung cancer are diagnosed each year across the world, with 1.4 million deaths worldwide.[3]

Figure 1

Age-standardized incidence rates—lung cancer
BY AGE GROUP, CANADA—1996 AND 2006

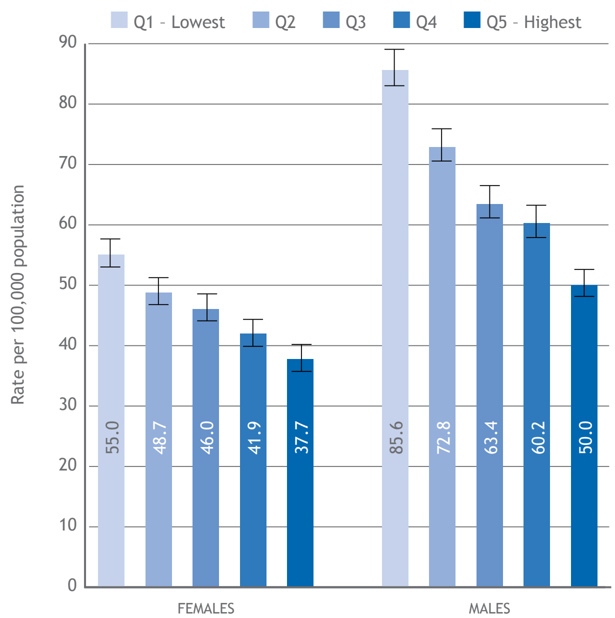


Data Source: Statistics Canada, Canadian Cancer Registry

Lung cancer incidence rates in 2006 were highest for those in the lowest-income quintile and followed a clearly decreasing trend from lowest- to highest-income quintile for both men and women (Figure 2). Incidence rates were lowest in urban areas, with higher incidence rates seen in rural and isolated areas (data not shown).[2]

Figure 2

Age-standardized incidence rates—lung cancer
INCOME BY SEX, CANADA—2006



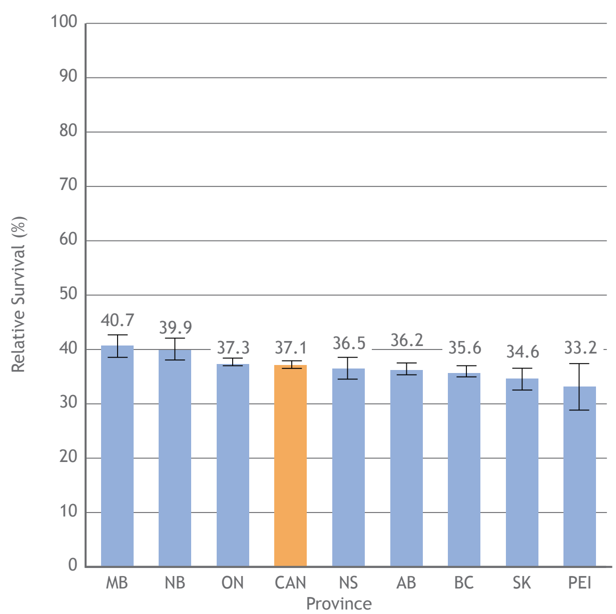
Note: 95% confidence intervals are indicated on figure
Data Source: Statistics Canada, Canadian Cancer Registry

There are differences in survival for lung cancer between and within countries, as demonstrated by a recent international study.[3] As differences between countries were identified in this international study, there are also differences in survival seen between jurisdictions within a country.

Information from the Partnership's System Performance Initiative shows that in Canada there are interprovincial variations seen in survival for people with lung cancer.[2] When both one- and five-year *relative survival** rates are considered, one-year survival for those diagnosed in 2001 to 2005 varies between 33.2% in Prince Edward Island and 40.7% in Manitoba (Figure 3), and five-year survival for those diagnosed in the same time period ranges between 11.7% in Prince Edward Island and 18.1% in Manitoba (Figure 4). It is important to note that provinces with relatively small populations, such as Prince Edward Island, have more variability in their data, as demonstrated by the wide error bars for Prince Edward Island and the narrow bars for larger provinces like Ontario and British Columbia in both Figures 3 and 4.

Figure 3

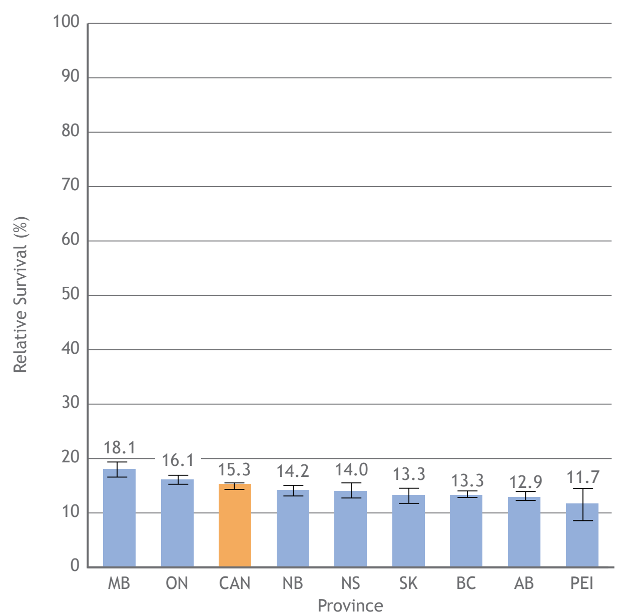
1 year relative survival (%)—lung cancer
BY PROVINCE FOR CASES DIAGNOSED IN 2001 TO 2005



Data Source: Statistics Canada, Canadian Cancer Registry

Figure 4

5 year relative survival (%)—lung cancer
BY PROVINCE FOR CASES DIAGNOSED IN 2001 TO 2005



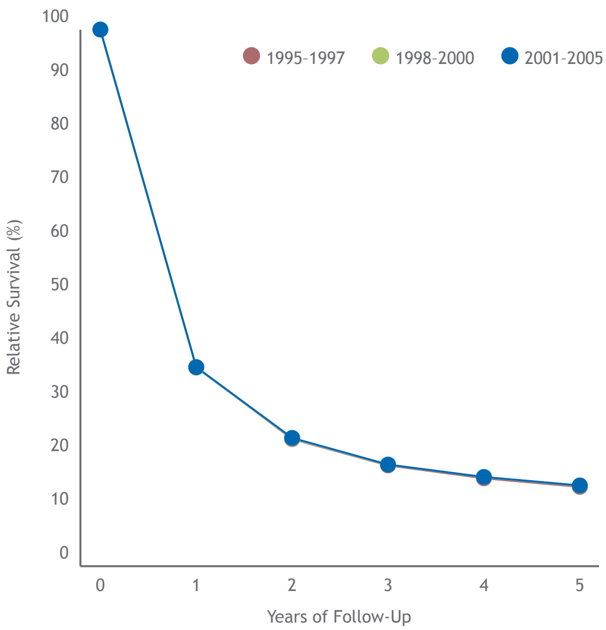
Data Source: Statistics Canada, Canadian Cancer Registry

* Relative survival is defined here as the ratio of the survival observed in patients with cancer and the survival that would have been expected if they had experienced only the all-cause death rates (background mortality) of the general population where they lived.

Five-year relative survival in Canada for those with lung cancer diagnosed between 2001 and 2005, as measured by the System Performance Initiative is 15.1% (Figure 5) with one-year survival at 37.1%.[2] The recent international study, using data from four provinces (Ontario, British Columbia, Alberta and Manitoba), showed five-year relative survival in Canada for those diagnosed with lung cancer in 2005 to 2007 to be 18.4%.[3] The difference between these two numbers (18.4% in the international study versus 15.1% in the System Performance Initiative) is likely related to several factors, including the more recent data (2005-2007 versus 2001-2005) and data from only four provinces being available in the more recent analysis.

Figure 5

Relative survival rates—lung cancer
BY DIAGNOSIS PERIOD, CANADA



Data Source: Statistics Canada, Canadian Cancer Registry
Note: Survival for the periods of 1995-1997, and 1998-2000 are not visible as they are nearly identical to 2001-2005 and the lines are superimposed

The authors of the international study concluded that there has been improvement over time in relative survival in lung cancer. The improvement seen in lung cancer survival has not been consistent across countries. Canada, Australia and the Nordic countries had the biggest improvements in five-year relative survival in the 12 years ending in 2007, with increases of 1.4% to 7.9% in these regions of the world. Potential explanatory factors for the differences were identified as later stage at diagnosis and differences in treatment, particularly in Denmark and the UK, and differences in patient age. The authors note the need for further examination of stage and treatment to explain the differences in survival and to inform the development of meaningful programs that will effect positive change.

Along with overall population-based estimates of cancer survival, there is a need for further information that could help to evaluate the changing risk of death in each successive year after the diagnosis of the disease. *Conditional relative survival*† at five years provides such an evaluation of a patient's changing risk over time. It quantifies the changes in a patient's profile over time with regard to the risk of dying from cancer. The improvement that has been seen over time in relative lung cancer survival is largely attributable to an increase in one-year survival. The international study authors also estimated the one-year and five-year conditional relative survival for four cancers, including lung cancer. While conditional relative survival for lung cancer is poor, particularly in relationship to some other cancers, the pooled data from the four participating provinces in Canada (Ontario, British Columbia, Alberta and Manitoba) had the best five-year survival for lung cancer of the countries examined.[3] For those diagnosed in these four provinces between 2005 and 2007, and having survived the first year after diagnosis, there was a 42.1% conditional relative five-year survival.[3] In a subsequent study specific to Canada, for almost all cancers studied, the relative probability of living an additional five years improved when analyzed at increasingly longer periods after diagnosis, indicating that prognosis improves over time.[4]

† Conditional relative survival in this context refers to relative survival at the fifth anniversary of diagnosis in patients who survived at least one year after their diagnosis. Conditional relative survival information allows comparisons while keeping to a minimum the effect of factors that mainly affect survival in the first year after diagnosis.

Treatment

The largest burden of illness for lung cancer patients, their families and the health care system occurs during the treatment phase.

Treatment for lung cancer is complex and depends on many factors including the stage of disease at diagnosis, the pathology of the tumour and any co-existing conditions the patient may have. Lung cancer can be either small cell lung cancer or non-small cell lung cancer. These two types of lung cancer behave differently and are evaluated and treated differently.

Small cell lung cancer is a more aggressive lung disease. Treatment typically involves chemotherapy and radiation.

Non-small cell lung cancer describes several different cell types including adenocarcinoma, squamous cell and large cell cancer. Surgical resection is the mainstay of treatment and is used for non-small cell lung cancers when the disease is localized.[5]

Summary of treatment recommendations for non-small cell lung cancer
National Comprehensive Cancer Network (NCCN), United States

Stage I, IIA, and II (T1-2, N1)	Surgical Resection, followed by chemotherapy for Stage II, +/- radiation therapy when determined as appropriate by a multidisciplinary evaluation (e.g. for patients with unresectable tumours, as determined by a thoracic surgeon)
Stage IIB (T3,N0), IIIA, IIIB	Surgical Resection, followed by chemotherapy for Stage IIB and IIIA. Stage IIIB patients may not be surgical candidates (assessment should be made by a thoracic surgeon). The use of radiation therapy or chemotherapy alone or in combination is based on multidisciplinary evaluation
Stage IV	Treatment choice is based on multidisciplinary evaluation and dependent on location of metastases and performance status. Cisplatin-based chemotherapy in patients with good performance status and minimal weight loss, surgical resection if solitary metastatic lesion with resectable primary tumour, as determined by a thoracic surgeon

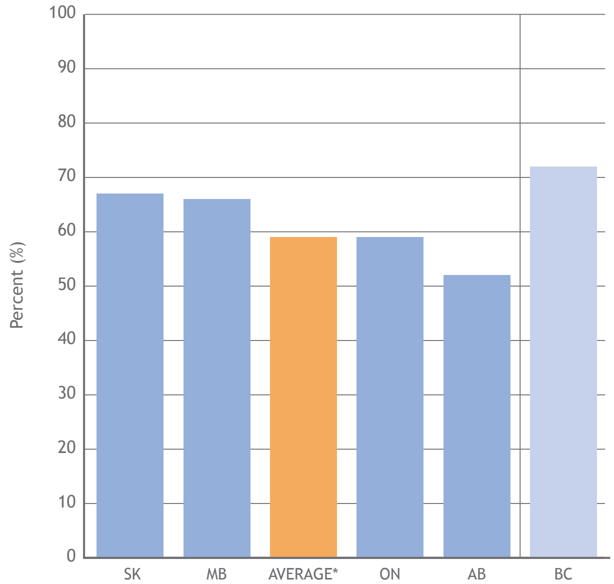
Note: Adapted from the NCCN Guidelines, Version 3.2011, Non-small cell lung cancer[5]

Currently, chemotherapy alone does not have a role in curative therapy for non-small cell lung cancer. Recent research has shown that there is a survival benefit with adjuvant chemotherapy in resected Stage IIA, IIB and IIIA non-small cell lung cancer.[6] The current guidelines of the National Comprehensive Cancer Network (NCCN) state that patients with Stage II and IIIA non-small cell lung cancer who undergo surgical resection for their disease should be offered adjuvant chemotherapy.[5] In Canada, the proportion of patients receiving treatment according to this guideline was 59.1%, based on analysis of the information from provinces that were able to supply data on this indicator (Figure 6). The proportion of patients treated according to the guideline for the four provinces reporting data consistent with the indicator requirements ranged from a high of 71.6% to a low of 51.9% (Figure 6).

Radiation therapy plays an important role in the treatment of both forms of lung cancer (small cell and non-small cell), with different objectives with varying stage of disease. It can be used alone or as part of a combination treatment with surgery and/or chemotherapy. In the treatment of Stage I and II non-small cell lung cancer, radiation therapy alone is considered only when surgical resection is not possible, usually because of limited pulmonary reserve or the presence of co-morbidities.[7] The challenge in meeting the demand for radiation

Figure 6

Percentage of Stage II and IIIA non-small cell lung cancer cases receiving chemotherapy following surgical resection
CANADA, BY PROVINCE, 2007 DIAGNOSIS



% =	66.7	65.9	59.1	58.8	51.9	71.6
N*=	27	41	479	357	54	74

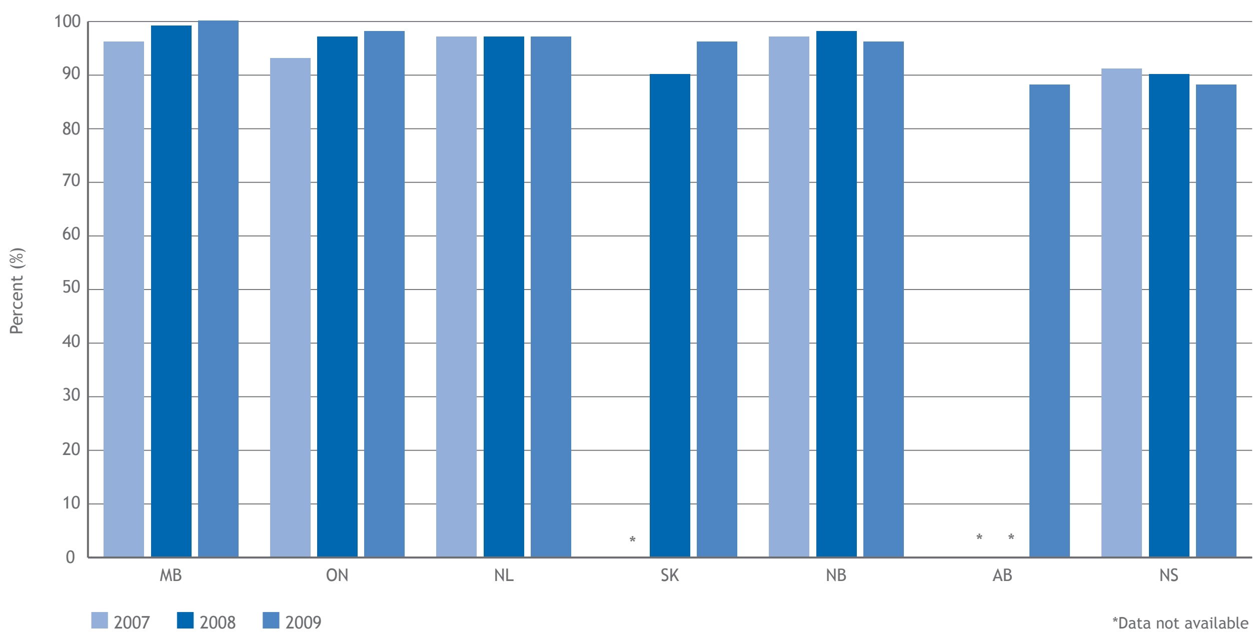
*BC data included only cases referred to the cancer centres and will therefore be spuriously high; the data were therefore not included in the "All" calculation (percent and total). Chemotherapy started within 120 days of surgical resection is included in the data displayed in this figure.
Data source: Provincial cancer agencies

therapy might be manifested as longer wait times for treatment, which can contribute to increased patient anxiety. In 2005, Canadian provinces and territories established a national benchmark for access to radiation therapy of four weeks from the time a patient is ready for treatment to the start of radiation therapy.[8] Since this time, all jurisdictions in Canada have implemented a mechanism to measure and reduce radiation therapy wait times.

There are variations across the country in the definition of when a patient is considered "ready to treat". As a result, data may not be directly comparable among provinces. Despite this limitation, the indicator provides an important insight into wait times across the country. Seven of the provinces submitted data for some or all of the measurement period (2007 to 2009). In 2009, the proportion of lung cancer cases treated within the four-week target varied between the provinces able to submit data on this indicator (Figure 7). Where time trend data were available, the proportion of lung cancer cases treated within the target of four weeks has improved over the measurement time for three provinces (Figure 7).

Figure 7

Percentage of cancer cases treated with radiation therapy within 4 weeks of being ready to treat—lung cancer
BY PROVINCE – 2007 TO 2009



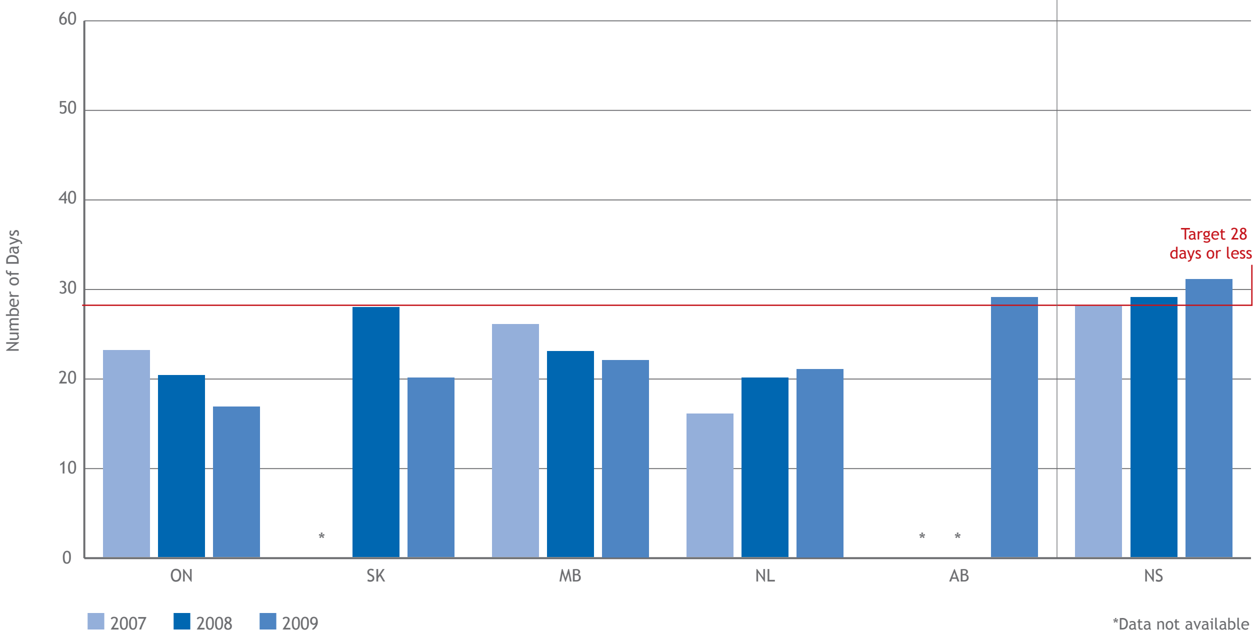
*Data not available
Data source: Provincial cancer agencies

While the previous indicator measured the percentage of lung cancer patients treated within four weeks, the following indicator measures the 90th percentile wait times in each province (Figure 8). Ninetieth percentile waiting time means 90% of the people receiving radiation treatment for lung cancer begin treatment by this time.

Comparing data collected for 2007 to 2009, the 90th percentile wait times in each province, as measured against the target of four weeks, show that three of the submitting provinces were able to demonstrate substantial improvement as evidenced by reductions in wait times over the assessed time period. The majority of submitting provinces achieved the wait times target by bringing their 90th percentile wait times to 28 days or below (Figure 8).

Figure 8

90th percentile radiation therapy wait times in days—lung cancer
BY PROVINCE—2007 TO 2009



*Data not available
Data source: Provincial cancer agencies

End-of-Life Care

End-of-life care is an important component of lung cancer care, as many will succumb to the disease within five years. The goal of end-of-life care is to improve quality of life for patients by controlling and alleviating physical, emotional and psychological concerns. As the leading cause of cancer-related death in Canada, the issue of providing accessible and effective end-of-life care is particularly important in lung cancer.

A follow-up to a Senate Committee of Canada report in 2005 found that the provision of end-of-life care in Canada was characterized by uneven access to services for Canadians.[9] The health system needs around end-of-life care for Canadians first require identification of the type of care currently received at the end of life and the extent to which it is coordinated and appropriate so that optimal services can be planned and implemented.

Diagnosis

The extent of disease at diagnosis in lung cancer is generally quite advanced. The potential impact on survival rates of earlier diagnosis at an earlier stage of disease is not yet fully understood.

The development of low-dose spiral (helical) CT has led to its evaluation as a potential lung cancer screening test. Several large randomized controlled studies are underway (the U.S. National Cancer Institute's Lung Screening Trial and the Prostate, Lung, Colorectal and Ovarian Screening Trial [PLCO]) to examine the efficacy of low-dose spiral CT scan in screening high-risk individuals for early detection of lung cancer. Outcome results from the PLCO trial[10] are pending and early results from the U.S. study show promise[11] but are not yet fully analyzed nor published at the time of this report.

The Terry Fox Research Institute and the Canadian Partnership Against Cancer fund the Early Lung Cancer Detection Study. The study uses a unique combination of a questionnaire, blood biomarkers and breathing tests to determine the potential role of these readily accessible and low-cost detection techniques for lung cancer as a first step in early detection, which may allow triaged referral of those identified as being at higher risk to spiral CT and bronchoscopy. Another objective is to determine the cost implication of implementing lung cancer screening for high-risk individuals in Canada. Study results are anticipated in 2013.

In December of 2010, the Early Lung Cancer Detection Study successfully achieved the goal of recruiting 2,500 Canadians into the study and so was closed to further recruitment. Enrolled Canadians will be followed for two years, as planned. The recent closure of the National Lung Cancer Screening Trial in the United States has accelerated the need for an interim analysis of the Canadian study data in 2011.

The Early Lung Cancer Detection Study has enabled eight centres across Canada (Figure 9) to participate in an innovative approach to identify those at highest risk of testing positive for lung cancer, which we hope will be of lasting benefit to future generations of Canadians.

Figure 9

Early lung cancer detection study recruitment sites

Incidence by Stage

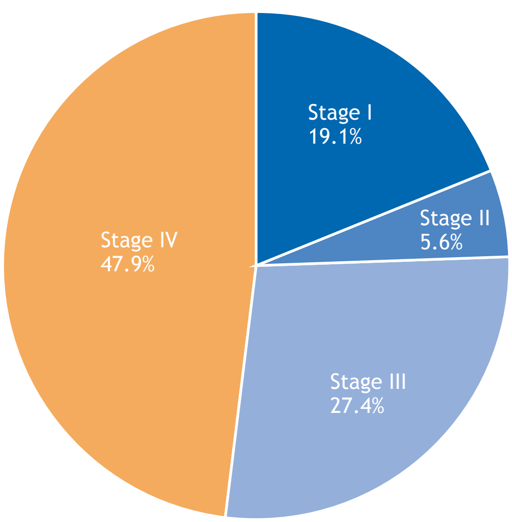
Stage at diagnosis in lung cancer, like other cancers, is an important tool to guide treatment decisions and to help to determine prognosis. The majority of lung cancers diagnosed are non-small cell lung cancers (85%)[3] and are grouped into stages by size of tumour and the extent to which there is local and/or distant spread of tumour. The stages range from 0 (in situ)[‡] to stage IV (metastatic) or alternatively are simplified into local, regional and distant categories. The other 15% are small cell lung cancers.

The majority of lung cancers are diagnosed at a relatively advanced stage, and they are associated with a poor prognosis. Analysis in the United States, using Surveillance Epidemiology and End Results (SEER) registry data demonstrated that lung cancers were diagnosed with localized, regional and distant stages in the following proportions: 16.4%, 20.3%, and 53.0% respectively. These stages had associated five-year survival rates of 48.8%, 22.8% and 3.3% respectively.[§ 12]

The collection of stage data in Canada is relatively new, and two years of recent stage data from seven Canadian provinces were analyzed. The following figure does not include "stage 0" (in situ), "not available" and "unknown" data, the proportion of which varied between the submitting provinces. The data for stage in the seven submitting provinces demonstrates a similar pattern to the SEER analysis. It shows that nearly half of those diagnosed with lung cancer were diagnosed when the disease was late stage (IV), followed by those with Stage III (27.4%) disease (Figure 10).

Figure 10

Lung cancer stage data at diagnosis, pooled for seven provinces (NS, AB, PE, SK, MB, ON, NL)
2007 to 2008



Note: Saskatchewan provided data for 2007 only. The proportions shown do not include "stage 0 (in situ)" "not available" or "unknown" stage.

[‡] Carcinoma in the stage of development when the cancer cells are still within their site of origin.

[§] There were 10.3% of cases with unknown stage at time of diagnosis, with a five-year survival for this group of 8.7%.

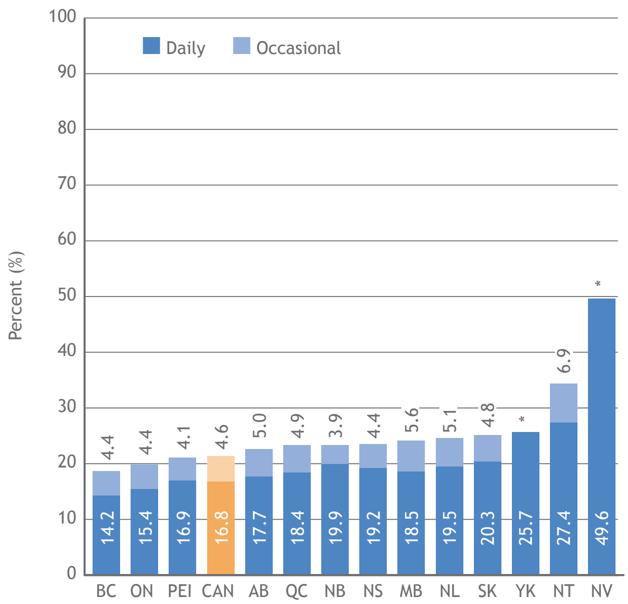
Risk Factors

Smoking accounts for 80% of the worldwide lung cancer burden in males and at least 50% of the burden in females.[13, 14] There are variations in lung cancer rates and trends across countries and between males and females within each country, and these differences largely reflect differences in the stage and degree of tobacco control.[15, 16] Reducing tobacco use is the single most important action that can be taken to prevent lung cancer, and research has shown that even a small reduction in smoking prevalence can result in significant reductions in tobacco-related mortality.[17]

Over one-fifth of Canadians still smoke, with 16.8% of Canadians declaring themselves to be daily smokers and 4.6% to be occasional smokers in 2008 (Figure 11). Over the past decade there has been an overall decline in the proportion of Canadians over age 15 who smoke (from 25% to 18%). Smoking rates have been declining for both men and women, although rates for women have levelled off (stopped declining) since 2006 (Figure 12). Despite reductions in the number of smokers in Canada, lung cancer will continue to be a concern because it takes about 20 years for the population trends in smoking-related cancers to manifest themselves. Generally, lung cancer trends for females lag behind males because females started smoking in large numbers several decades later than males.[14] In a new publication about cancer rates in the United States, the report authors find that for the first time, lung cancer death rates decreased in women during 2003 to 2007, more than ten years after the rates started to drop for men.[18] Given that the incidence of and mortality from lung cancer in males is decreasing in Canada[2], the past reductions in tobacco use among women and the trend noted in the United States, we expect to see similar decreases in lung cancer rates for female Canadians in the years to come.

Figure 11

Percentage of population aged 12 and older reporting daily or occasional smoking
BY PROVINCE/TERRITORY, CANADA 2008

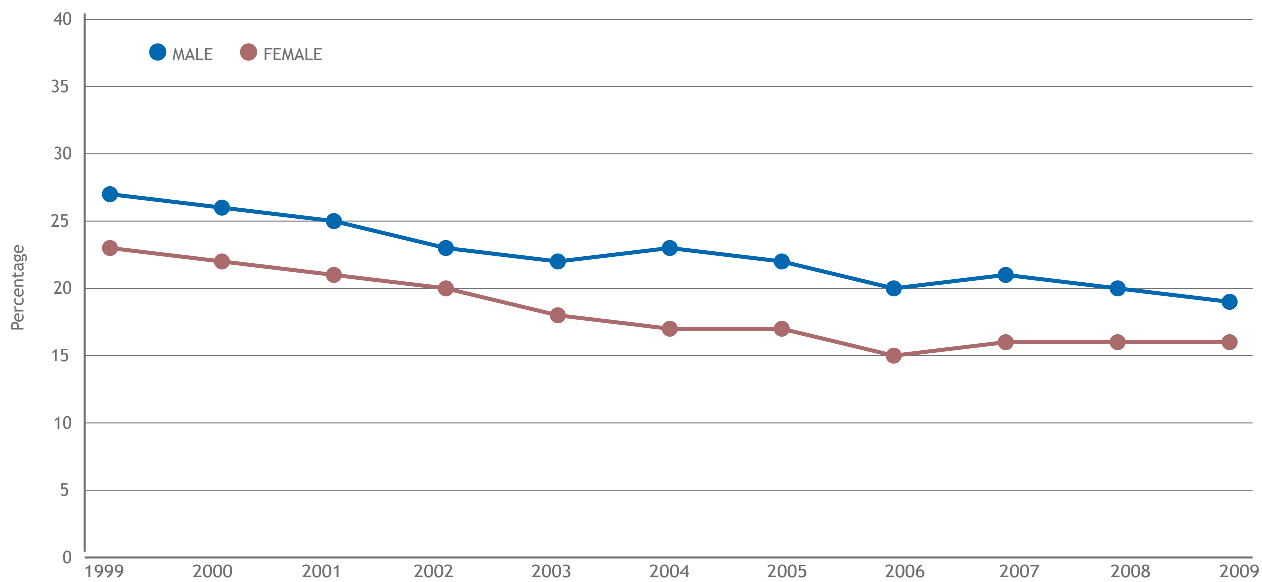


* Suppressed due to statistical unreliability caused by small numbers.
Data Source: Statistics Canada, Canadian Community Health Survey

There is strong evidence to support the benefits of smoking cessation, regardless of age when quitting. The lifetime cumulative risk of death from lung cancer gets progressively lower as the time since cessation gets longer (although it never gets quite as low as in lifelong non-smokers). The cumulative risk of death from lung cancer for men (up to age 75) who smoke is 15.9% compared to 9%, 6%, 3% and 1.7% for those who stopped smoking at 60, 50, 40 and 30 years of age.[19]

Figure 12

Percentage of current smokers, by sex, age 15+ yrs, Canadian Tobacco Use Monitoring Survey (CTUMS) Wave 1
1999 to 2009

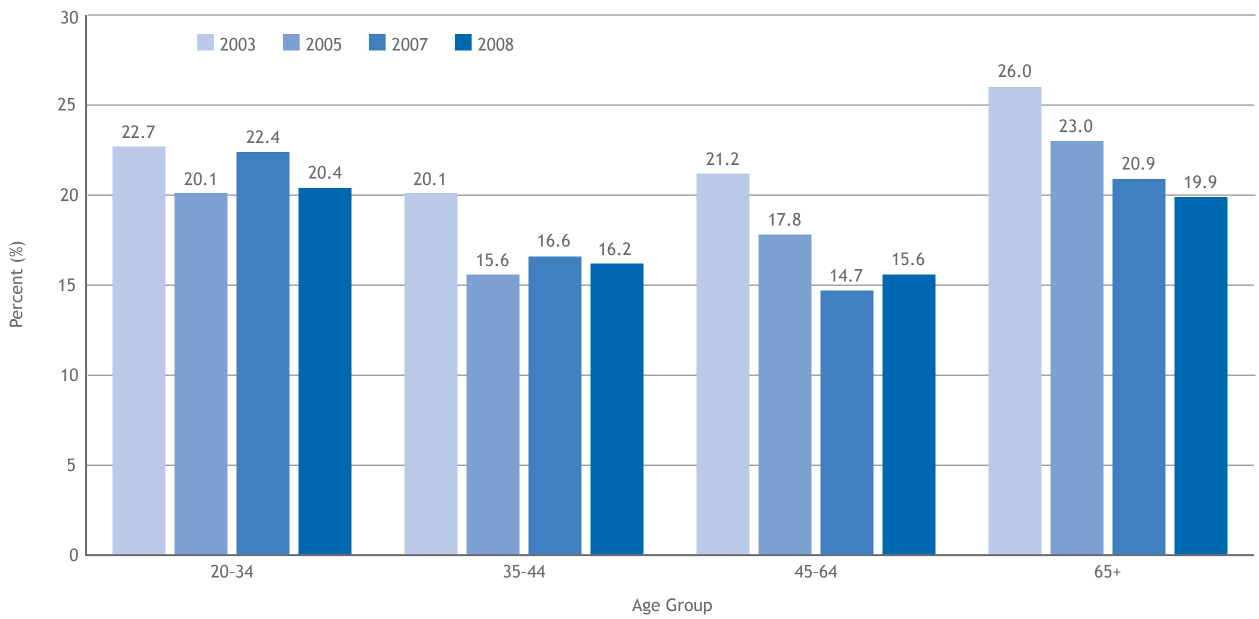


Data source: Statistics Canada, Canadian Community Health Survey

Generally, in all age groups there has been a deceleration of smoking quit rates in Canada between 2003 and 2008. This information may signal the need for more focused analysis and targeted efforts to decrease the cancer risk associated with smoking in Canada. The smoking quit rates have not been consistent for all age groups, with cessation rates among middle-aged Canadians (aged 45 to 64) having worsened in recent years (Figure 13).

Figure 13

Percent of recent smokers who have quit within the past 2 years
BY AGE GROUP, CANADA, 2003,2005, 2007 AND 2008



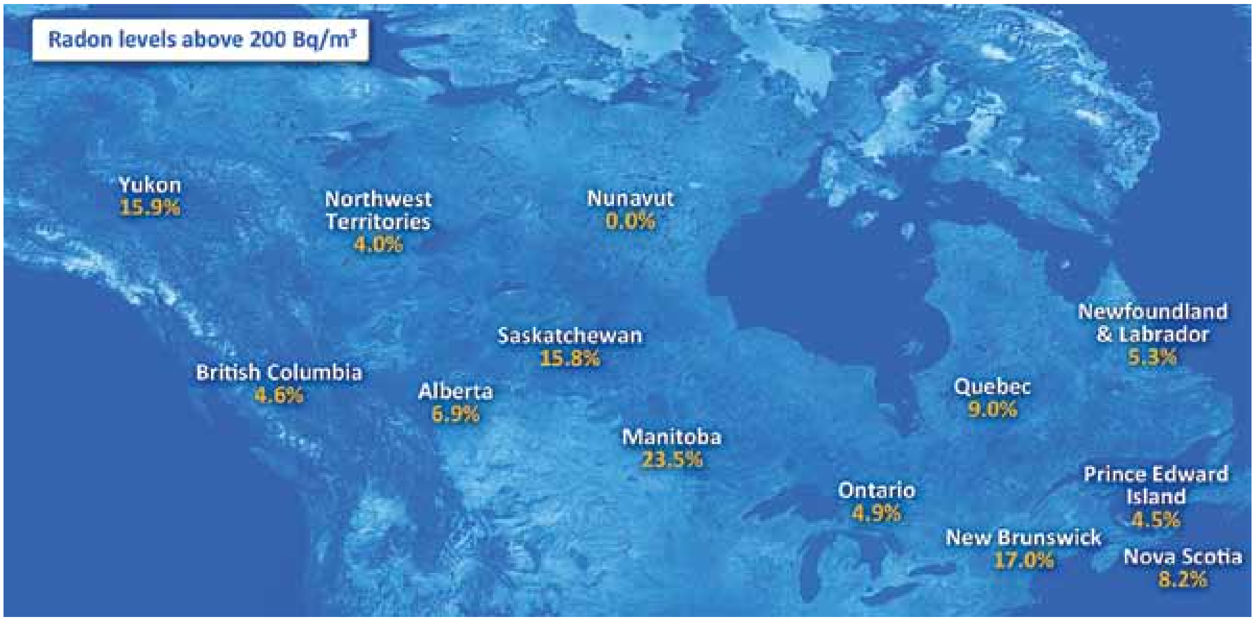
Preventing young Canadians from starting smoking will reduce the number of tobacco-related deaths in the second half of this century. Smoking cessation among current smokers, on the other hand, will have a more immediate impact in reducing tobacco-related mortality.[20] A 2001 analysis shows that a much larger decrease in tobacco-related deaths worldwide would be achieved by 2050 by reducing the number of adults who are current smokers than by preventing young adults from taking up the habit.[21] This is because most of the projected deaths from tobacco use by 2050 will occur among current smokers while the main effects of young adults not starting to smoke will occur considerably later.[21]

Other Risk Factors

While smoking is the single most important modifiable factor in the effort to reduce the incidence and mortality associated with lung cancer, other factors, predominantly environmental and occupational factors exist. Radon is cited as the second most important cause of lung cancer in much of the world, with the proportion of lung cancers attributable to radon worldwide estimated to range from 3% to 14%.[22] Radon is a naturally occurring inert radioactive gas that is found in soil and rocks and that can accumulate in buildings. It is second only to tobacco as a cause of lung cancer—causing about 10% of lung cancers, or more than 2,000 cases a year in Canada.[23, 24] The Canadian Medical Association and Canadian Lung Association have recently released an advisory to increase awareness among Canadians of the effect of radon exposure on health and to encourage Canadians to get their homes tested for radon.[25] Health Canada has provided guidance that an acceptable level of radon is 200 Bq/m^3 for indoor air.[26] A nationwide survey by Health Canada identified that the levels of radon vary considerably across and between regions, with about 7% of Canadian homes overall having elevated radon levels.[27] Subsequent data analyzed by Statistics Canada in 2010 show that the proportion of each province that does not meet the guideline of $<200\ Bq/m^3$ ranges from 0% in Nunavut to 23.5% in Manitoba (Figure 14). The proportion of higher levels of $>600\ Bq/m^3$ varies between 0% in Northwest Territories, Nunavut and Prince Edward Island to 5.3% in New Brunswick and Yukon Territory.

Figure 14

Proportion of each province/territory that has radon readings of greater than 200 Bq/m^3, Canada, 2009 to 2010



Data source: Health Canada, http://www.hc-sc.gc.ca/ewh-semt/radiation/radon/survey-sondage-eng.php

There is a cumulative effect between cigarette smoke and radon gas—at equivalent levels of radon exposure, people who smoke are at higher risk for lung cancer than non-smokers.[28] Research has shown that targeted interventions to reduce radon provide cost-effective solutions and complement existing strategies to reduce smoking.[29-31] While both smoking cessation strategies and radon reduction programs have been found to be cost effective, there is evidence that smoking cessation programs, particularly in high radon areas, have substantially greater health benefit at a lower cost than the alternative strategy of reducing radon levels in smokers' homes, while they remain smokers.[32]

Burden of Illness – Lung Cancer

The burden of illness of a disease is made up of both economic and human costs. The economic costs associated with lung cancer are made up of both direct and indirect costs. Direct costs refer to the value of goods and services for which payment was made and the resources used to treat and care for patients. These costs are directly related to the diagnosis and treatment of the illness and include hospital operating costs, chronic care, physician services, drugs, public health, other health professionals and capital expenditures on facilities and equipment. Indirect costs are defined as the value of economic output (work, productivity) that is lost because of the illness or premature death from it (estimates of the value of life lost due to premature death, i.e., mortality costs) and the value of lost activity days due to disability, i.e., morbidity costs. Human costs include the impact of the disease on the person, such as the quality of life experienced by the person who has lung cancer, as well as the human impacts on family, friends, community and society.

Human Burden of Lung Cancer—Impacts on Quality of Life

When assessing the quality of life associated with a particular disease or condition, this is defined as the "value assigned to duration of life as modified by the impairments, physical, social and psychological functional states, perceptions and opportunities that are influenced by disease, injury, treatment or policy".[33]

Patients with lung cancer commonly have a substantial symptom burden that may affect their quality of life and sense of well-being. A recent meta-analysis found that the majority (90%) of studies in lung cancer have established overall quality of life as a predictor of survival in both small cell and non–small cell patients.[34] For lung cancer patients undergoing chemotherapy, better quality of life at baseline has been associated with a better response to treatment and a lower risk of death, as well as showing that patient-reported changes in health during treatment are significant predictors of clinical outcomes.[35]

Economic Burden of Lung Cancer

The economic costs associated with cancer vary by disease trajectory, with the majority of costs occurring close to the time of diagnosis, followed by the time immediately preceding death.[1] A 2005 study in the United States showed that, not unexpectedly, lung cancer patients had significantly higher utilization of hospitalization, emergency, outpatient facilities, radiology, laboratory and pharmacy dispensed drugs than controls.[36] The main drivers of direct costs associated with lung cancer in this study were hospitalizations (49%) and office visits for treatment (35%).[36]

While current national economic burden figures associated with lung cancer are not available for Canada, research in Alberta had similar findings to the U.S. study, with 76% of direct costs for lung cancer being related to admissions to hospital and treatment.[36] The majority of overall costs associated with lung cancer occur just before, or within 3 months of diagnosis (75% for non–small cell lung cancer and 69% for small cell lung cancer) when treatments are normally initiated.[37]

A recently published analysis of the productivity costs associated with cancer mortality in the U.S. found that death from lung cancer alone accounted for more than a quarter of the total costs of this burden. The authors concluded that a reduction in lung cancer mortality would result in increased productivity and therefore would provide the greatest reduction in productivity cost burden associated with cancer.[38]

The Promise of Coordinated Action to Reduce Risk

The Partnership's Cancer Risk Management Model (www.cancerview.ca/cancerriskmanagement) provides the capability of modelling the future impact of various interventions and approaches on cancer, including lung cancer. The promise of what could be achieved 20 years from now is illustrated when smoking interventions are assessed. The lowest smoking rates in North America in 2009 were 9.8% in Utah and 12.9% in California.

The Cancer Risk Management Model shows that if Canadian smoking rates were 10% today, then by 2030 an estimated 58,000 new cases of lung cancer could be avoided (Figure 15). As well, an estimated 46,000 deaths from lung cancer could be avoided in Canada (Figure 16). When the lost income impacts to a patient that are associated with lung cancer are considered in the model, a cumulative increase of $3.2 billion in earnings would be gained with this reduction in smoking and a cumulative increase of $10.2 billion in total income that would be realized.

Figure 15

Projections of new cases of lung cancer with status quo versus reduced smoking rate to 10%, Canada

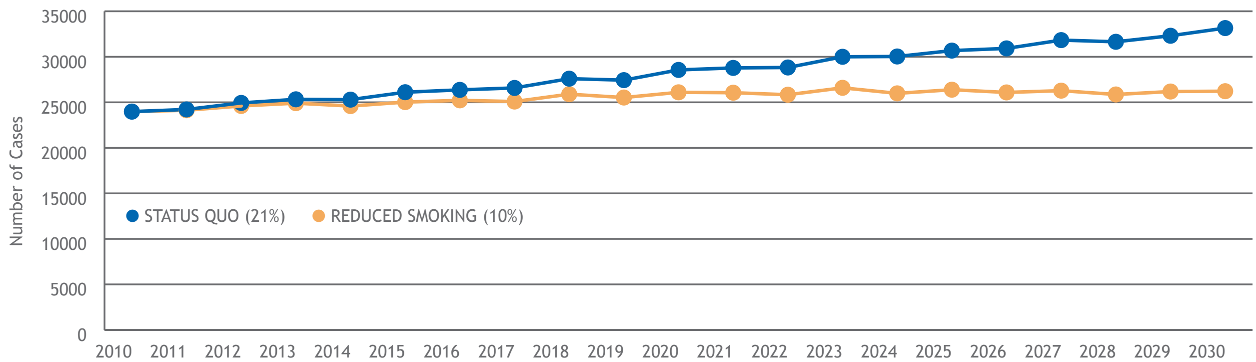
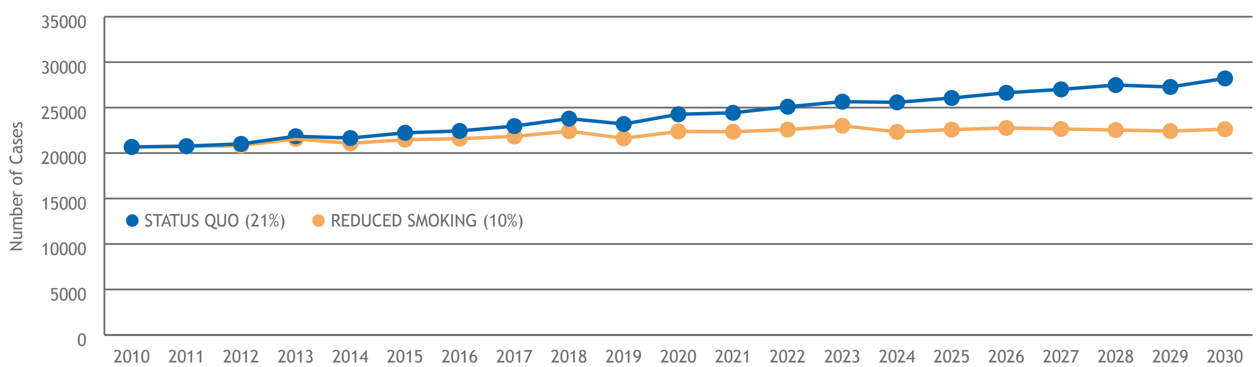


Figure 16

Projections of lung cancer-related deaths with status quo versus reduced smoking rate to 10%, Canada



Research and Future Directions

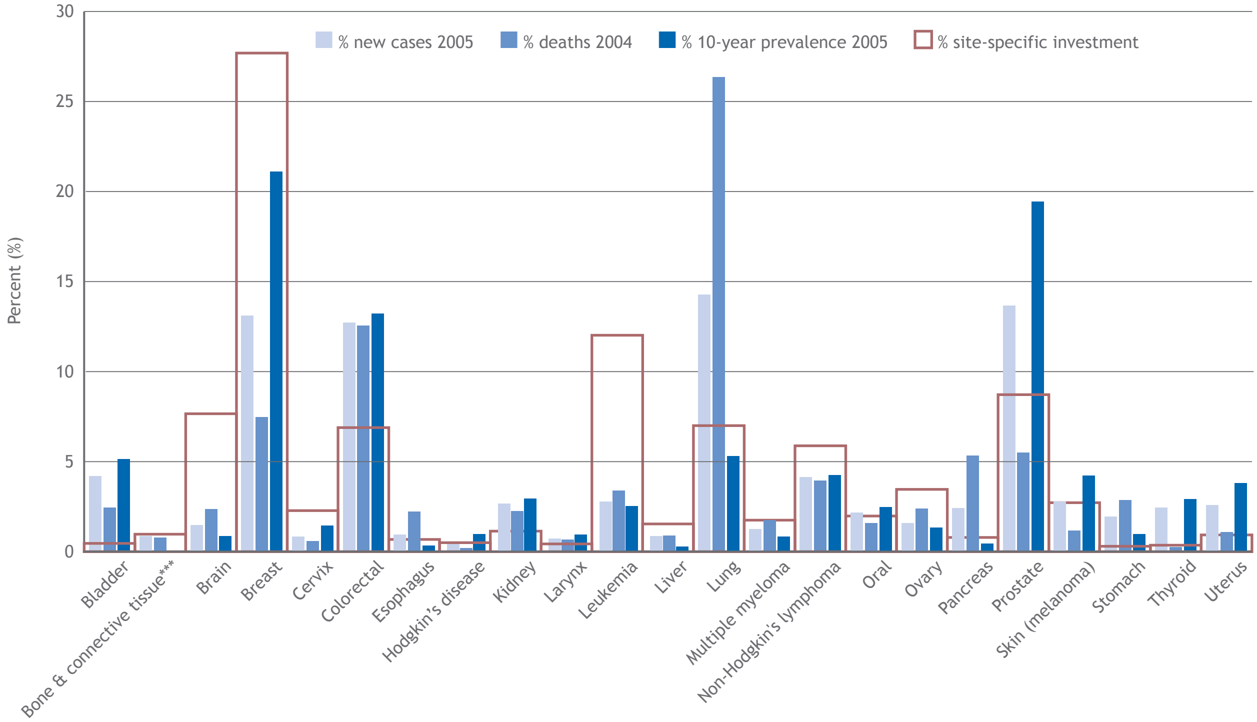
Clinical trials are integral to the evaluation of safety and efficacy of emerging cancer treatments and protocols. Participation of patients in the clinical trials that are required to appropriately assess emerging screening, diagnosis and treatment modalities remains a gap in Canada, with fewer than 5% of patients diagnosed with cancer participating in clinical trials.[39] In 2007, $11,932,536 was spent on lung cancer research (where at least half of the research project must be relevant to lung cancer) in Canada.[40] The cancer research funds allocated to lung cancer represented 2.96% of the total cancer research spend in 2007 ($402,448,190).[40]

Since new cancer cases and cancer deaths provide proxy measures of the burden of the disease, this information can provide valuable information when looked at in conjunction with investment in lung cancer research. Figure 17 compares the distribution of tumour site-specific investment in research with the distribution of new cancer cases, ten-year prevalence and cancer deaths. The proportional research investments for brain cancer, breast and leukemia are considerably higher than the percentage of new cases, ten-year prevalence or deaths, while lung cancer investment is lower. These data strongly suggest that the research investment in lung cancer has been disproportionately low relative to its disease burden (Figure 17).

Figure 17

Distribution of 2007 Site-Specific Cancer Research Investment

BY NEW CANCER CASES IN 2005*, CANCER DEATHS IN 2004* AND TEN-YEAR PREVALENCE RATES**



*Source: Canadian Cancer Society's Steering Committee. Canadian Cancer Statistics 2009. Toronto: Canadian Cancer Society, 2009.

**Source: Ellison, LF & Wilkins, K. (2009). Cancer prevalence in the Canadian population. Health Reports, 20(1):7-19. Ottawa: Statistics Canada. Cat No 82-003-XPE. Available at http://www.statcan.gc.ca/pub/82-003-x/2009001/article/10800-eng.pdf.

***Source: Prevalence data were not available for bone and connective tissue cancers.

Conclusions – Take-Away Messages

Both the quality of life burden of lung cancer on individual Canadians and their families and the economic burden of lung cancer on the health system are significant. Looking to the future, greater focus on targeted prevention activities as well as new strategies for treatment (that ensure appropriate care, reduce delays in treatment and minimize hospitalizations) have the potential to offset some of the economic burden associated with the disease as well as improve the quality of life and overall survival for Canadians with lung cancer.

Improving the research investment in lung cancer, which has been disproportionately low relative to its disease burden, will represent important progress in Canada. Given the substantial burden of illness associated with lung cancer and the high productivity losses associated with premature mortality due to lung cancer, increased research investments in lung cancer offer considerable potential for improvements, as does addressing possible barriers to patient participation in clinical trials.

While survival from lung cancer is problematic worldwide, Canada is performing well in terms of conditional relative survival as compared to other countries examined. However, continued efforts to strengthen smoking cessation and prevention and to report on system performance in treatment of lung cancer will be essential to maximize impact on reducing disease burden from lung cancer.

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