



BC Cancer Agency
CARE + RESEARCH

BC Cancer Registry 2013 Annual Report



**Special Focus:
The Future of Cancer
in British Columbia**



*Province-wide solutions.
Better health.*



Ministry of
Health Services

About the BC Cancer Agency:

The BC Cancer Agency, an agency of the Provincial Health Services Authority, provides a comprehensive cancer control program for the people of BC in partnership with regional health authorities. This includes prevention, screening and early detection programs, research and education, and care and treatment.

The Mission of the BC Cancer Agency is:

- *To reduce the incidence of cancer*
 - *To reduce the mortality rate of people with cancer*
 - *To improve the quality of life of people living with cancer*
-

This Report:

This report has been prepared by members of the BC Cancer Agency's Cancer Control Research and Cancer Surveillance & Outcomes, Population Oncology

This publication is available from the BC Cancer Agency website at:

<http://www.bccancer.bc.ca/HPI/CancerStatistics/default.htm>

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Messages

Dr. Max Coppes, President - BC Cancer Agency

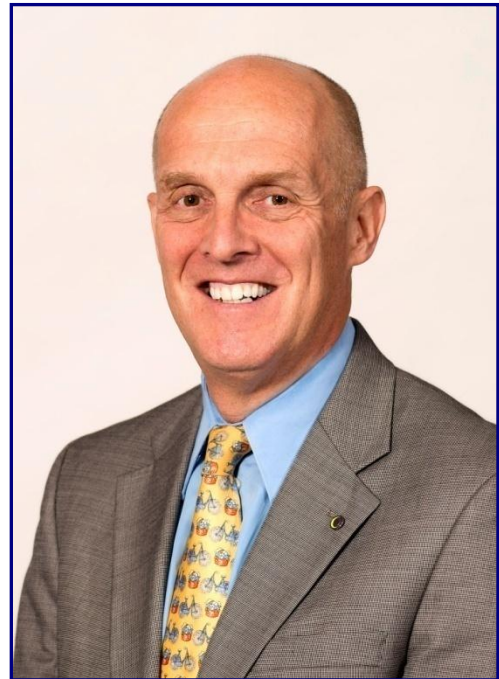
It is a pleasure to write the introduction to the 2013 BC Cancer Registry Report. This report focuses on specific issues and information related to cancer that will allow us to better understand and plan services for the future.

The source of data for this report is the BC Cancer Registry, which is a database of all new cancers diagnosed in British Columbia since 1969. Although the registry contains limited information on each individual cancer diagnosis it is an invaluable tool because it is a single province-wide database. This database provides insight into the geographic distribution of cancer and the demographics of those affected, as well as the number of types of cancer and their outcomes. The ability to link this registry to other sources of information increases its value and also supports other health systems in identifying those affected with cancer.

The special focus of this report is the future burden of cancer. Principally this is expressed in the number of new cancer cases which will be diagnosed every year.

While BC has lower rates of new cancers compared to the rest of Canada, the inevitable dynamics of a growing population and a greater proportion of older people choosing BC as home, imply that this province can expect to see a steady increase in the number of new cancer diagnoses each year. We predict that in 2027 there will be almost 35,000 new diagnoses of cancer, up 45% from the 23,829 men and women diagnosed with cancer in 2011. An increase of this magnitude is not easily accommodated given the complexity and multidisciplinary nature of cancer care today. It is important that we anticipate these increases and plan accordingly.

At this time there are six regional cancer centres operated by the BC Cancer Agency with two in Fraser Health and one in each of the other four health regions. The increase in the incidence of cancer will not be shared equally around the province although all health regions will see an increase. The Fraser Health region will see both the largest absolute and the largest proportional increase in cancer cases over the next two decades. Innovation and new practice models will be necessary to accommodate the considerable growth that we anticipate. We look forward to collaborating with our many partners to develop strategies that will allow us to care for more patients while maintaining BC's superior outcomes in cancer care.



Ryan Woods, Scientific Director - BC Cancer Registry

The BC Cancer Registry is very pleased to share with you our 2013 Annual Report. It has been some time since we have produced a report in this format and we hope you find this information of value. In future years our intent is to release an annual report that highlights some of the activities and achievements of the Registry from the past year as well as to include a special topic report utilizing Cancer Registry data; this year's report focuses on projections of future cancer cases and deaths in our province and some of the determinants of these.

Since we last released an annual report much has changed with the BC Cancer Registry. With support from the Canadian Partnership Against Cancer we successfully completed a technical migration of our data into a new registry information system. As part of this same project, we also began capturing population-level stage data for prostate, lung, breast, colorectal and cervical cancers. This has improved both the surveillance and research capabilities of the Cancer Registry.

To further facilitate health research related to cancer we participate in Population Data BC, which is a world-class health data-linkage facility. You can read more about Population Data BC and some of our other partnerships further in this report.

The BC Cancer Registry and the activities we undertake are reliant on the commitments of health care professionals around the province; I would like to express our gratitude to these many people who through their reporting efforts enable us to maintain the BC Cancer Registry. Throughout the year, we receive support and direction from our clinical partners, researchers and other colleagues across Canada and around the world. Although too many to name here, we would like to recognize all for their support and collaborative spirit. I would also like to extend my thanks to all of the staff of the BC Cancer Registry for their contributions to making 2013 a very successful year for the Cancer Registry.



BC Cancer Registry History and Overview

The BC Cancer Registry is a population-based registry of all cancers diagnosed in British Columbia residents. The purpose of a population-based cancer registry is to collect the information required to plan and evaluate cancer-control activities for an entire population (here the province of British Columbia). Additional, population-based registries serve as an important source of information for research. Research based on population registries avoids one source of potential bias due to non-representative participation and is of better quality than research that uses non-population-based sources.

Cancer registration has existed in British Columbia for many decades. As early as the 1930's, notifications of cancers diagnosed in the province were recorded by physicians using a "Report of Cancer" form; these notifications were sent to what was then the Division of Vital Statistics, who were responsible for compiling information on cancer incidence for the province. Over time this process improved to receive notifications from different reporting sources including care facilities, pathology labs and death certificates. By 1969, the BC Cancer Registry had achieved its goal of population-level coverage. The Registry was moved to the BC Cancer Agency in 1980 to support the provincial cancer-control activities under the Agency's mandate.

Today, the BC Cancer Registry receives notifications of cancer from many sources including pathology, cytology and other labs, death certificates, and admissions to cancer centres operated by the BC Cancer Agency. The Registry contains personal and demographic information, information about the specific cancer diagnosis, as well as mortality information received from the BC Vital Statistics Agency.

The BC Cancer Agency is authorized under the [BC Health Act \(Section 9\)](#) to operate the Cancer Registry and request information required for the registration of cancers. Registry data are used to generate cancer statistics that describe trends and regional differences in cancer incidence and mortality, project future service needs, and evaluate patient outcomes and the effectiveness of provincial cancer control programs. The data also support important research into the causes, prevention, screening, diagnosis and clinical management of cancer and the demand it places on the public health care system.

The BC Cancer Registry is part of larger national and international cancer registration systems. We submit data annually for the province of British Columbia to the Canadian Cancer Registry, maintained by Statistics Canada in Ottawa. It is from this national data set that reports such as the Canadian Cancer Society's [Canadian Cancer Statistics 2013](#) are produced.

The Canadian Cancer Registry provides the opportunity for inter-provincial comparisons of the rates at which different cancers are arising, as well as for projections of future cancer cases and deaths at the national level among other uses. The BC Cancer Registry also makes an annual data submission to the North American Association of Central Cancer Registries (NAACCR), which is an organization comprised of all provincial, state and regional cancer registries in Canada and the United States. Furthermore, we have been a long-standing participant in many of the collaborative projects directed by the World Health Organization's (WHO) International Agency for Research on Cancer (IARC). For more information about these collaborative projects and how the data they compile can be accessed, please see the 'Online Data Tools' section of this report.

Special Focus: The Future of Cancer in British Columbia

Introduction

As cancer is a disease that generally affects people later in life, it is expected that an aging Canadian population will mean an increase in the number of people affected by cancer. For cancer control agencies to develop strategies to meet this potential increase in demand for cancer services, estimates of the future projected size of the cancer problem are required. In public health, the term disease '*burden*' is used to mean the total impact of a disease on the population. This includes the impact of the diagnosis of disease on affected individuals and families, as well as the cost to society of managing the disease within the healthcare system and the potential loss of life and productive time associated with the illness. In this report, the term '*Cancer Burden*' refers specifically to the annual number of new cancer cases and deaths in our population.

Projections of future cancer incidence (new cases) and mortality (deaths) have been produced and disseminated by the BC Cancer Agency for many years. These projections have been released annually to align with projections of the BC population produced by BC Statistics. Projections have tended to focus predominantly on cancer incidence and mortality as these correspond to periods in the cancer care continuum where health service utilization is high. This report aims to describe the expected cancer burden in British Columbia over the next 15 years.

This focus report is organized into two principal sections: the main report body and an appendix of supplemental materials. The main report describes how projections of new cancer cases and deaths are made and how this information is used. This section also contains our projections for new cancer cases and deaths for the province and health regions around BC. The supplemental materials in the appendix provide some additional data to illustrate why the numbers of new cases of cancers and deaths are rising in our province. We also illustrate some of the challenges in making predictions of future cancer incidence via the example of screening for prostate cancer with PSA testing. Although the specific methodology used to derive the projections is not a focus of this report, the projection methodology has been briefly summarized as well in the report appendix.

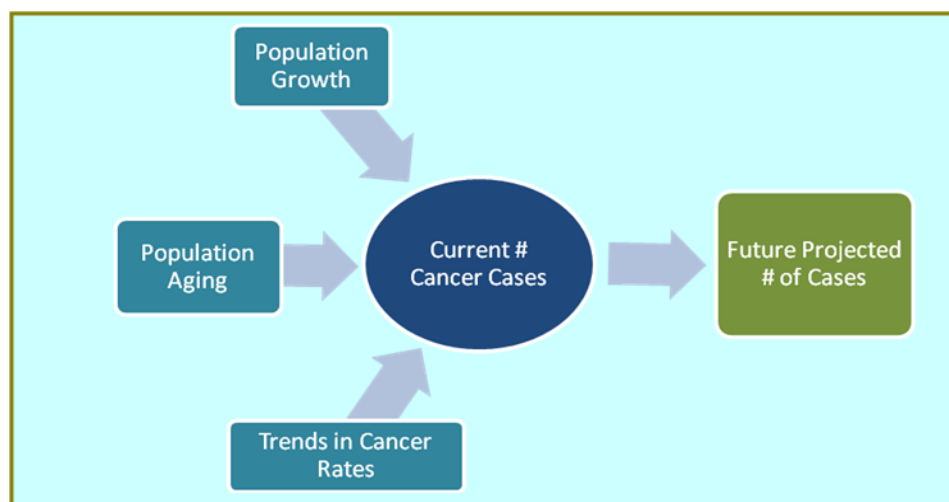
Highlights

- Over the coming 15 years, projections produced by BC statistics suggest that the population of BC is expected to grow by 20% or about 1 million residents. The number of seniors in BC (those aged 65 or older) is expected to be 72% higher in 2027 compared with 2011, which amounts to an increase of about half a million seniors.
- The growth and aging of the BC population will result in a dramatic increase in the number of new cancer diagnoses in the province. It is anticipated the number of new annual cases will grow by 45% to almost 35,000 new cancer cases in 2027.

- The increase in cases per year between 2011 and 2027 is expected to be more than 10,000. This increase is greater than the total number of cancers currently diagnosed annually in the Vancouver Coastal and Vancouver Island Health Authorities combined.
- The increase in new cancer diagnoses will not be uniform around the province. It is expected the Fraser Valley will see the most significant increase in the number of cancer cases due to the strong population growth in that region. The North will also see a large percentage increase in new cancer diagnoses due in part to the anticipated aging of the population.
- Not all cancer types will see the same percentage increase in the number of new cases over this period. Recent patterns in cancer incidence rates and the ages at which different cancers tend to arise in individuals both influence the expected percent growth in individual cancer types.

Generating Cancer Projections

Generating forecasts of new cancer cases (or deaths) requires key pieces of information and a few important assumptions. A projection of future case counts is influenced both by what is happening over time to cancer rates as well as how the BC population, and in particular the number of older individuals, is changing. One could view a projected number of cancer cases as being a summation of several determinants or “drivers” of future cancer case totals:



The top and left-most components in the above graphic (population growth and aging) generally *increase* the projected numbers of new cancer cases as a larger and older population will generally give rise to more cancers. Aging of the population in particular is an important driver of cancer incidence as cancer is a disease that arises most commonly late in life, affecting seniors more than those in other age groups. Trends in cancer rates can affect the future number of cases in either direction (decrease or increase incidence). Trends in the rates of cancers that are becoming more common in our population will tend to exacerbate the growth in the number of new cases brought on by population growth and aging. Declining cancer rates will tend to reduce the impact of population growth and aging on the future projected numbers of new cases.

Cancer screening can also have a strong impact on the rates of new cancer diagnoses. Some screening tests reduce the risk of cancer by identifying early changes (before cancer is established), which can be treated so that cancer does not develop. Other tests may identify very slow growing and less aggressive cancers which may not have normally been diagnosed in the absence of screening. Soon after screening is established changes in cancer rates can occur quite quickly and projections for cancers potentially affected by screening need to be interpreted carefully; some examples of this are discussed later in this report.

A few other key points related to the generation of cancer projections for British Columbia are outlined below:

<ul style="list-style-type: none"> • The smallest level of geography for which trends in cancer rates are estimated is a regional Health Authority (HA) as trends in cancer rates at finer levels of geography are often not reliable for projection purposes. 	
<ul style="list-style-type: none"> • In extrapolating from recent trends in cancer rates, we assume that trends in risk factors or behaviors associated with developing cancer will not change dramatically. 	<ul style="list-style-type: none"> • Generally, the accuracy of projections for the most common cancers is of greatest concern as these have the greatest influence over the total projected number of cases.

Colorectal Cancer Incidence Projections for British Columbia

In 2012, the BC government announced the creation of a province-wide colorectal cancer screening program. This program, operated by the BC Cancer Agency in partnership with regional health authorities, is anticipated to have a strong impact on colorectal cancer incidence in the province. With



increasing uptake of the program within BC, one might expect an increase in cancer incidence in the short-term as screening-detectable, subclinical cases are identified in addition to those normally diagnosed in a given year; this could lead to an increase in incidence similar to that observed for prostate cancer in the early 1990's (see report appendix). However, as colon screening has the potential to prevent future cases by diagnosing lesions in their pre-cancerous states, it is likely that the long-term impact of the colon screening

program will be to reduce cancer incidence.

The effect of colorectal cancer screening is not currently captured in this report as the anticipated trends in cancer rates have not yet been established. It will be important for cancer projections to be re-evaluated on a regular basis as colorectal cancer represents the second most common cancer in men and third most common in women; thus, projections for this specific cancer have significant influence on the projections of total cancer incidence for the province.

How Far into the Future are Projections Made?

Throughout this report you will see data presented for 2011 and 2027 (and several years in between). At the time of writing this report, the most current data available for reporting within the Cancer Registry were from cases of cancer diagnosed in 2011. There is generally a lag of about 18 months between data available for analysis and real-time information as it takes time for cases to be reported to and entered in the Cancer Registry. Our approach for projections has generally been to make a projection for the current year (in this report this would be for 2013) and for each year up to 15 years after this date. Thus for this report projections are provided from 2013 up to 2027. The 15-year horizon has been chosen historically to permit medium- to long-term cancer service planning while not extrapolating too far from current trends in cancer rates.

For What Regions are Projections Prepared?

Within this report we present data for British Columbia as a whole, followed by sections that examine the projections for BC's five regional Health Authorities. The provincial projections allow one to see the total impact of cancer on the BC population and health care system while the regional projections can inform treatment and planning needs within each regional health authority.



For those interested in further regional cancer statistics an in-depth report was released by the BC Cancer Agency's Cancer Surveillance and Outcomes unit in 2012 and is available from the BC Cancer Agency website. More information on accessing additional reports of BC cancer statistics can be found later within this report.

How Cancer Projections are Used

Short-Term Projections

Short-term projections of cancer incidence and mortality are widely used in publications to provide an estimate of the current impact of cancer on our population. Projections are necessary even for present numbers of new cases and deaths as the actual numbers generally lag behind the present by four to five years at the national level.



The most prominent Canadian publication which utilizes short-term cancer projections is the [Canadian Cancer Statistics](#) annual report which provides projections of current numbers of cancer cases and deaths for all of Canada as well as for the individual provinces and territories.

Long-Term Projections

Middle- (5 years) and long-term (10-15 years) cancer projections are used by health care providers for planning purposes and can inform decisions regarding:

- Where to build future infrastructure for treatment delivery such as regional cancer centres.
- The purchase and placement of additional machines or equipment required for diagnosis and delivery of treatments.
- The types and numbers of new specialists that may be required to meet the anticipated treatment demands.



Projected Cancer Incidence and Mortality

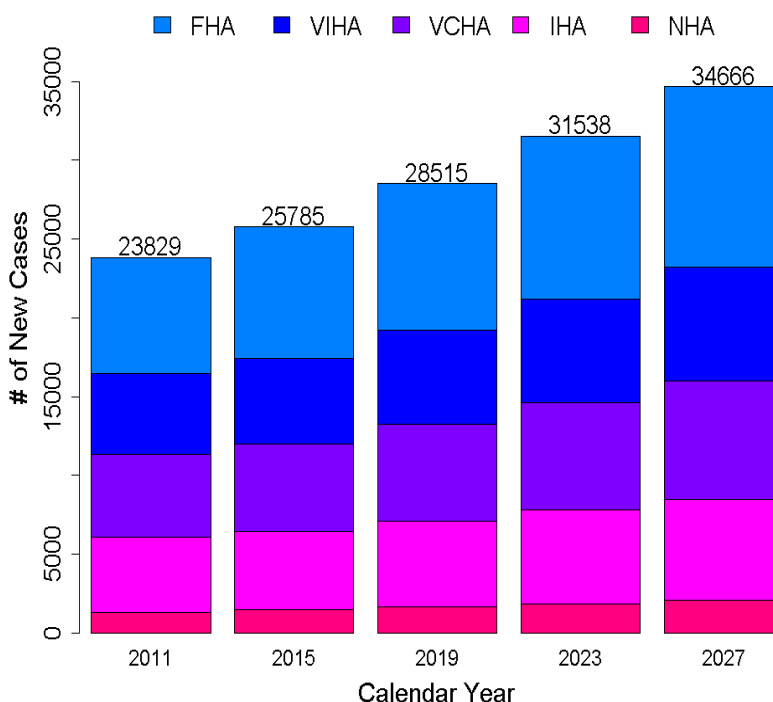
British Columbia

New Cases of Cancer

The annual number of new cases of cancer in British Columbia is growing steadily; in recent years, the number of new cases has grown by more than 500 cases each year. This increasing trend in the number of new cases diagnosed annually is expected to accelerate over the coming 15 years (Figure 1). In 2011, there were 23,829 new cases of cancer diagnosed in the province (Table 1); this total is projected to increase by more than 45% to 34,666 new cases in 2027.

- The overall increase in new cancer cases is expected to be roughly equal between men (+47%) and women (+43%), however the projected increase for some specific cancers does vary by sex.

Figure 1: Actual and Projected Total New Cancer Diagnoses by Health Authority, 2011-2027 (Actual = 2011)



- In 2011, breast cancer was the most common cancer diagnosed both in females and overall with 3,453 new cases; breast cancer is expected to remain the most commonly diagnosed cancer in females with 4,659 projected new cases for 2027.
- Prostate cancer is the only cancer projected to eclipse breast cancer in 2027 with 4,939 expected new cases; this represents a 45% increase from the 3,397 cases diagnosed in 2011. Prostate cancer has however proven difficult to predict in past years and some caution should be exercised in interpreting these projections.

- New cases of melanoma are expected to increase quite dramatically over the next 15 years to more than 2,100 cases in 2027. This is driven by both the projected population changes and by increases in incidence rates in both men and women in BC. Melanoma is one of the few cancers where incidence rates have been increasing recently in both males and females (see report appendix).
- Lung cancer was among the most commonly diagnosed cancers in 2011 (2,842 total new cases) and is expected to continue to represent a significant portion of the cancer burden in 2027 with 3,664 new cases. By 2027 the projected number of female lung cancer cases is expected to be about 350 cases higher than the number in men. Historically in BC, the number of lung cancers diagnosed in men has always been higher than the number diagnosed in women. Our projection that we will see more lung cancers in women in the coming years compared to men is due to differences in trends in rates between men and women associated with past smoking patterns.

Table 1: Actual and Projected Numbers of New Cancer Cases for 2011 and 2027

Cancer	Actual		Projected		% Change
	2011		2027		
All Cancers (total)	23,829		34,666		+45 %
Males (total)	12,526		18,411		+47 %
Females (total)	11,303		16,255		+44 %
Selected Sites	Males	Females	Males	Females	% Change
Breast (female)	-	3,453	-	4,659	+35 %
Colorectal	1,636	1,310	2,299	1,695	+36 %
Gastrointestinal (other)	972	571	1,431	677	+37 %
Lung	1,460	1,382	1,656	2,008	+29 %
Lymphoma/Leukemia	977	753	1,382	1,028	+39 %
Melanoma	531	470	1,107	1,030	+113 %
Prostate	3,397	-	4,939	-	+45 %
All Other Cancers	3,572	3,364	5,597	5,158	+55 %
<i>Gastrointestinal (other)</i> = Liver, Pancreas, Stomach and Esophagus					

Cancer Deaths

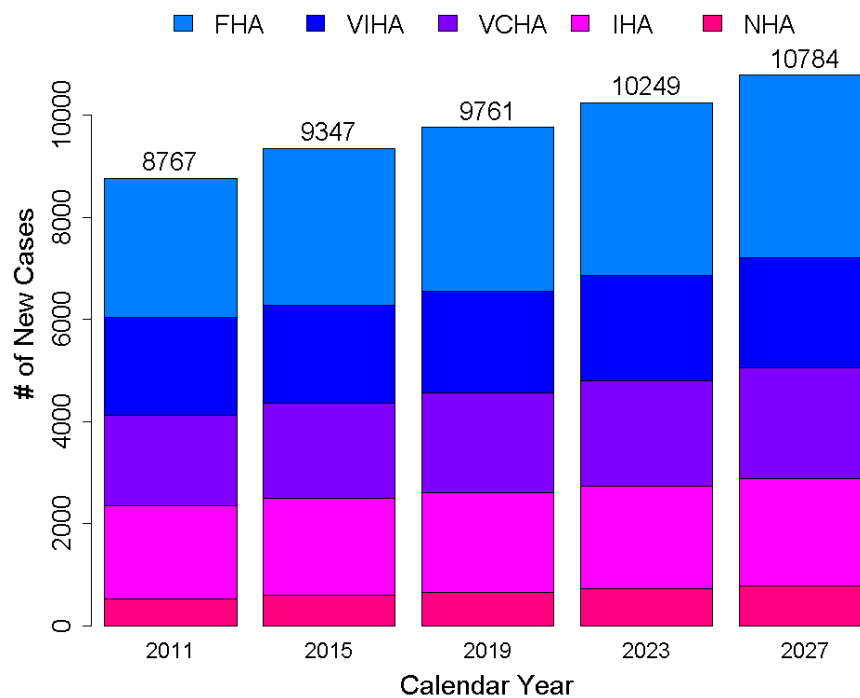
In 2027 a significant number of British Columbians are expected to die of cancer; the number of cancer deaths in the province is expected to exceed 10,000 per year by about 2021, rising to 10,784 in 2027 (Figure 2). This represents an increase of approximately 23% in deaths from cancer between 2011 and 2027.

- Breast, prostate, and pancreatic cancers will continue to be significant sources of cancer mortality accounting for more than 15% of total cancer mortality in 2027.
- As in 2011, lung cancer is expected to account for the greatest number of cancer deaths in 2027 with almost 2,700 British Columbians projected to die of this cancer (Table 2); it is also expected to be the most common cancer death for both men and women. In 2027, approximately 1 in 5 cancer deaths in men will be due to lung cancer; in females this number is expected to be almost 1 in 3.

Table 2: Actual and Projected Numbers of Cancer Deaths, 2011 and 2027

Cancer	Actual		Projected		% Change
	2011		2027		
All Cancers (total)	8,767		10,784		+23 %
Males (total)	4,677		5,892		+26 %
Females (total)	4,090		4,892		+20 %
Selected Sites	Males	Females	Males	Females	% Change
Breast (female)	-	576	-	509	- 12 %
Colorectal	583	486	700	621	+24 %
Lung	1,167	1,052	1,179	1,519	+22 %
Lymphoma/Leukemia	366	271	474	352	+30 %
Pancreas	289	239	454	224	+28 %
Prostate	510	-	595	-	+17 %

Figure 2: Actual and Projected Total Cancer Deaths by Health Authority, 2011-2027 (Actual = 2011)



Fraser Health

Our projections suggest that in 2027 one in three new cancers diagnosed within the province will be diagnosed within Fraser Health (FHA). The number of new cases expected within FHA in 2027 is about 50% greater than the number expected for the next largest Health Authority (Vancouver Coastal Health).

Table 3: Number of New Cancer Cases by Cancer Site for Fraser Health, 2011-2027

Cancer	2011	2027	% Change
All Cancers (total)	7,141	11,480	+61 %
Males (total)	3,664	5,949	+62 %
Females (total)	3,477	5,531	+59 %
Selected Sites	2011	2027	% Change
Breast (female)	1,069	1,588	+49 %
Colorectal	886	1,387	+57 %
Gastrointestinal (other)	484	781	+61 %
Lung	877	1,081	+23 %
Lymphoma/Leukemia	542	847	+56 %
Melanoma	240	662	+176 %
Prostate	968	1,561	+61 %
All Other Cancers	2,075	3,573	+72 %
<i>Gastrointestinal (other) = Liver, Pancreas, Stomach and Esophagus</i>			

Figure 3: Number of New Cancer Cases for Fraser Health, 2011-2027

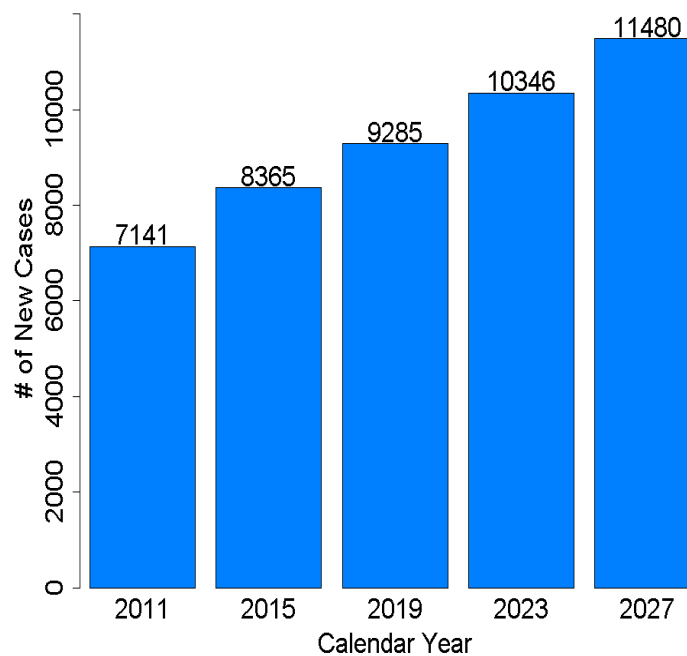


Figure 4: New Cancer Cases in 2027 by Health Service Delivery Area – Fraser Health

The percentage atop the bars in the figure below represents the percentage of all new cases of cancer diagnosed in the Fraser Health in the year indicated that were diagnosed within the respective Health Service Delivery Area

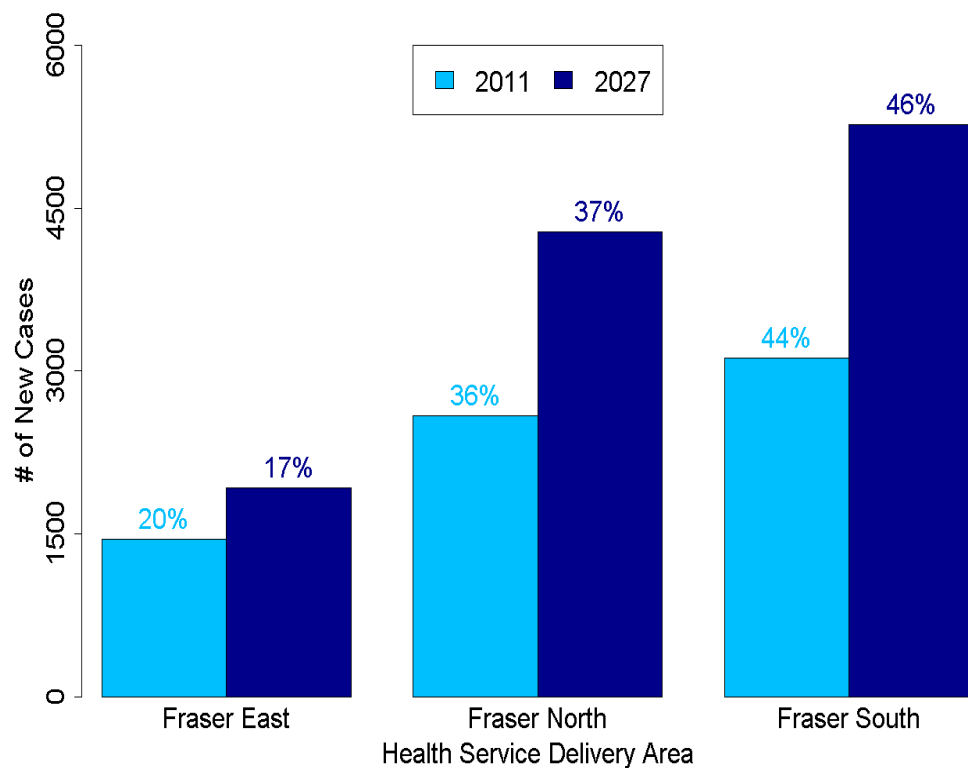


Table 4: Number of Cancer Deaths by Cancer Site for Fraser Health, 2011-2027

Cancer	2011	2027	% Change
All Cancers (total)	2,719	3,565	+31 %
Males (total)	1,407	1,937	+38 %
Females (total)	1,312	1,629	+24 %
Selected Sites	2011	2027	% Change
Breast (female)	172	180	+5 %
Colorectal	322	454	+41 %
Lung	676	809	+20 %
Lymphoma/Leukemia	198	289	+46 %
Pancreas	153	226	+48 %
Prostate	158	205	+30 %

Interior Health

Interior Health is expected to have the second smallest number of new cancer cases among the five regional Health Authorities in 2027. This region is expected to have 6,420 new cases of cancer diagnosed in 2027 which represents an increase of 39% from the number diagnosed in 2011.

Table 5: Number of New Cancer Cases by Cancer Site for Interior Health, 2011-2027

Cancer	2011	2027	% Change
All Cancers (total)	4,609	6,420	+39 %
Males (total)	2,438	3,379	+39 %
Females (total)	2,171	3,041	+40 %
Selected Sites	2011	2027	% Change
Breast (female)	681	820	+20 %
Colorectal	535	713	+33 %
Gastrointestinal (other)	276	327	+18 %
Lung	629	787	+25 %
Lymphoma/Leukemia	344	490	+42 %
Melanoma	210	429	+104 %
Prostate	672	842	+25 %
All Other Cancers	1,262	2,012	+60 %
<i>Gastrointestinal (other)</i> = Liver, Pancreas, Stomach and Esophagus			

Figure 5: Number of New Cancer Cases for Interior Health, 2011-2027

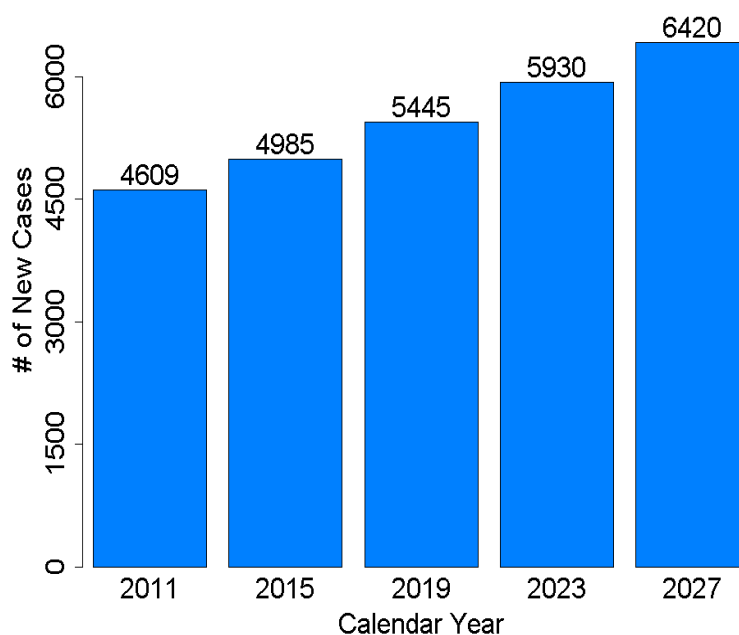


Figure 6: New Cancer Cases in 2011 and 2027 by Health Service Delivery Area – Interior Health

The percentage atop the bars in the figure below represents the percentage of all new cases of cancer diagnosed in the Interior Health in the year indicated that were diagnosed within the respective Health Service Delivery Area

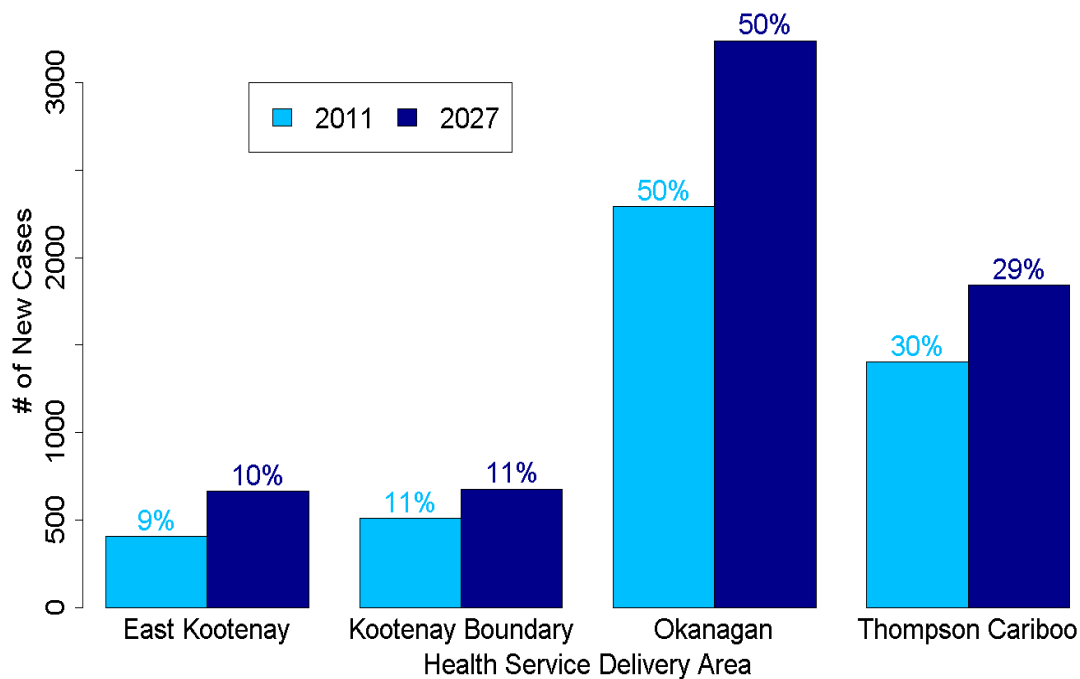


Table 6: Number of Cancer Deaths by Cancer Site for Interior Health, 2011-2027

Cancer	2011	2027	% Change
All Cancers (total)	1,824	2,101	+15 %
Males (total)	1,029	1,144	+11 %
Females (total)	795	957	+20 %
Selected Sites	2011	2027	% Change
Breast (female)	107	91	-15 %
Colorectal	221	245	+11 %
Lung	482	541	+12 %
Lymphoma/Leukemia	141	157	+11 %
Pancreas	121	124	+2 %
Prostate	126	127	+1 %

Vancouver Coastal Health

Vancouver Coastal Health (VCHA) is currently the second largest regional Health Authority by population and is expected to remain so in 2027. There is an expected increase of 47% in the number of annual new cancer diagnoses between 2011 and 2027, with more than 7,500 new cases expected in 2027.

Table 7: Number of New Cancer Cases by Cancer Site for Vancouver Coastal Health, 2011-2027

Cancer	2011	2027	% Change
All Cancers (total)	5,101	7,525	+48 %
Males (total)	2,660	4,003	+50 %
Females (total)	2,441	3,522	+44 %
Selected Sites	2011	2027	% Change
Breast (female)	815	1,115	+37 %
Colorectal	617	868	+41 %
Gastrointestinal (other)	345	447	+30 %
Lung	544	733	+35 %
Lymphoma/Leukemia	366	495	+35 %
Melanoma	245	421	+72 %
Prostate	734	1,148	+56 %
All Other Cancers	1,435	2,298	+60 %

Gastrointestinal (other) = Liver, Pancreas, Stomach and Esophagus

Figure 7: Number of New Cancer Cases for Vancouver Coastal Health, 2011-2027

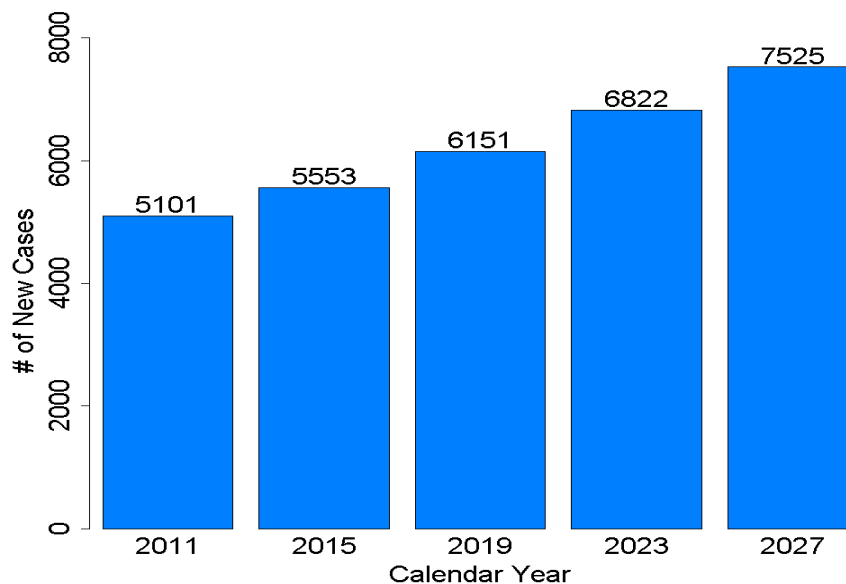


Figure 8: New Cancer Cases in 2011 and 2027 by Health Service Delivery Area – Vancouver Coastal Health

The percentage atop the bars in the figure below represents the percentage of all new cases of cancer diagnosed in the Vancouver Coastal Health in the year indicated that were diagnosed within the respective Health Service Delivery Area

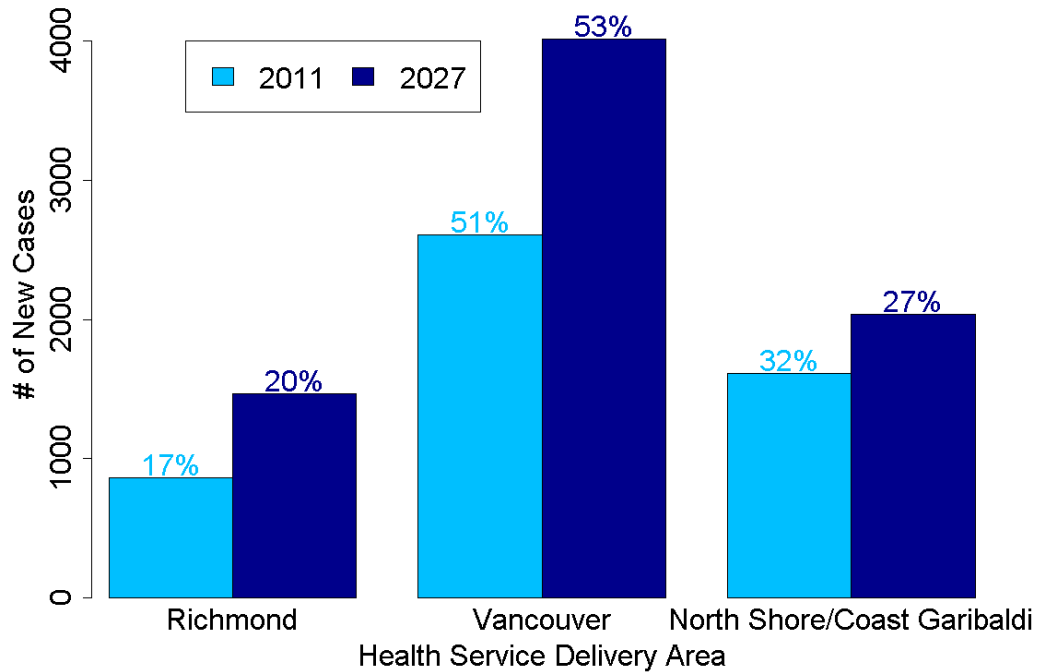


Table 8: Number of Cancer Deaths by Cancer Site for Vancouver Coastal Health Authority, 2011-2027

Cancer	2011	2027	% Change
All Cancers (total)	1,757	2,169	+23 %
Males (total)	899	1,197	+33 %
Females (total)	858	972	+13 %
Selected Sites	2011	2027	% Change
Breast (female)	131	106	-19 %
Colorectal	224	275	+23 %
Lung	415	465	+12 %
Lymphoma/Leukemia	116	166	+43 %
Pancreas	106	150	+42 %
Prostate	84	104	+24 %

Island Health

The number of cancers diagnosed within Island Health is expected to rise 44% to 7,197 cases in 2027; this percent growth in the number of new diagnoses is almost identical to the provincial expected growth (45%).

Table 9: Number of New Cancer Cases by Cancer Site for Vancouver Island Health Authority, 2011-2027

Cancer	2011	2027	% Change
All Cancers (total)	4,994	7,197	+44 %
Males (total)	2,639	3,963	+50 %
Females (total)	2,355	3,234	+37 %
Selected Sites	2011	2027	% Change
Breast (female)	702	908	+29 %
Colorectal	613	800	+31 %
Gastrointestinal (other)	309	433	+40 %
Lung	563	702	+25 %
Lymphoma/Leukemia	331	387	+17 %
Melanoma	249	560	+125 %
Prostate	773	1,104	+43 %
All Other Cancers	1,454	2,303	+58 %

Gastrointestinal (other) = Liver, Pancreas, Stomach and Esophagus

Figure 9: Number of New Cancer Cases for Island Health, 2011-2027

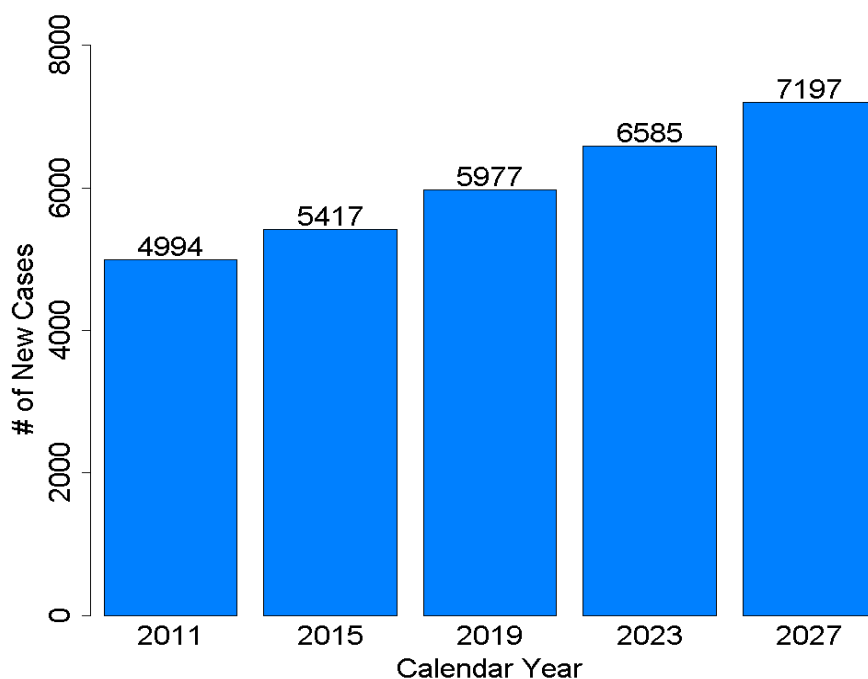


Figure 10: New Cancer Cases in 2011 and 2027 by Health Service Delivery Area – Island Health

The percentage atop the bars in the figure below represents the percentage of all new cases of cancer diagnosed in the Island Health in the year indicated that were diagnosed within the respective Health Service Delivery Area

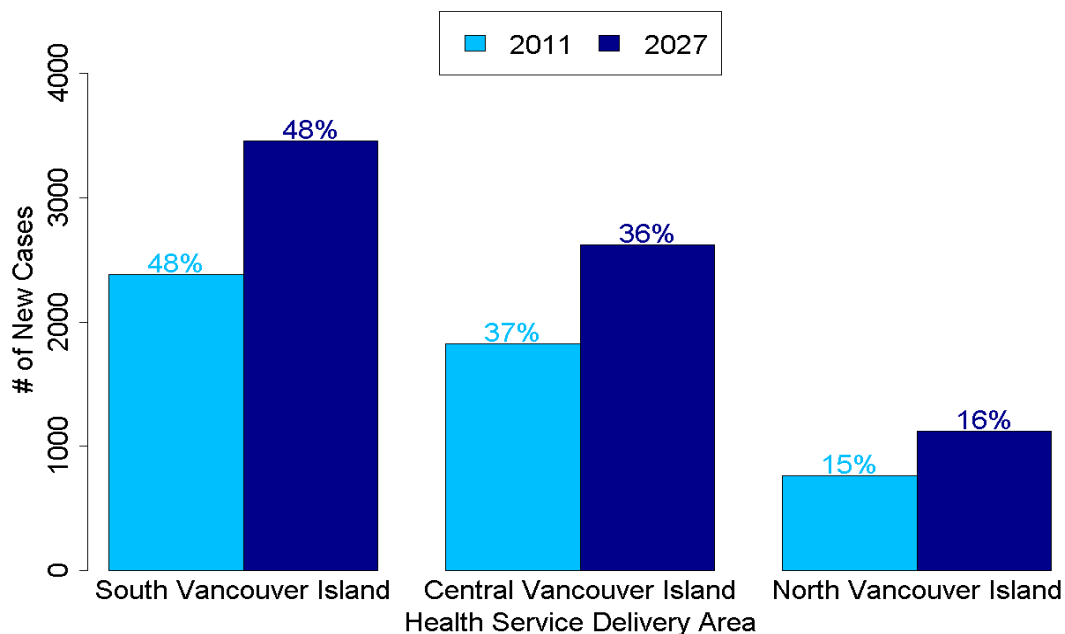


Table 10: Number of Cancer Deaths by Cancer Site for Island Health, 2011-2027

Cancer	2011	2027	% Change
All Cancers (total)	1,930	2,168	+12 %
Males (total)	1,025	1,193	+16 %
Females (total)	905	976	+8 %
Selected Sites	2011	2027	% Change
Breast (female)	142	104	-27 %
Colorectal	237	267	+13 %
Lung	464	560	+21 %
Lymphoma/Leukemia	144	174	+21 %
Pancreas	111	134	+21 %
Prostate	102	117	+15 %

Northern Health

Northern Health is the only regional Health Authority that is expected to see a growth in the number of new cancer diagnoses on par with the growth of the Fraser Valley. The number of new cases for Northern Health is expected to reach 2,044 cases in 2027 which represents a 62% increase over the number of diagnoses in 2011 (1,258 cases).

Table 11: Number of New Cancer Cases by Cancer Site for Northern Health, 2011-2027

Cancer	2011	2027	% Change
All Cancers (total)	1,258	2,044	+62 %
Males (total)	728	1,117	+53 %
Females (total)	530	927	+75 %
Selected Sites	2011	2027	% Change
Breast (female)	157	229	+46 %
Colorectal	135	225	+67 %
Gastrointestinal (other)	92	119	+29 %
Lung	190	360	+89 %
Lymphoma/Leukemia	109	192	+76 %
Melanoma	34	65	+91 %
Prostate	183	285	+56 %
All Other Cancers	358	568	+59 %

Gastrointestinal (other) = Liver, Pancreas, Stomach and Esophagus

Figure 11: Number of New Cancer Cases for Northern Health, 2011-2027

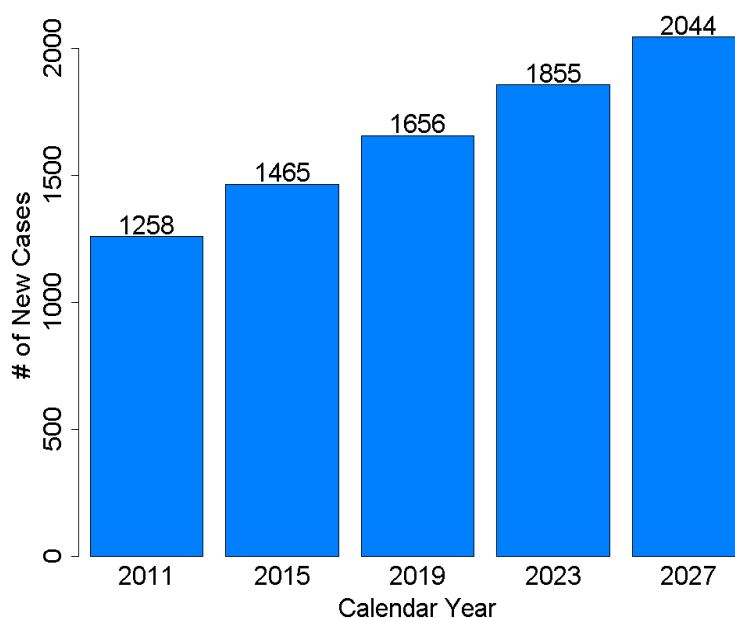


Figure 12: New Cancer Cases in 2011 and 2027 by Health Service Delivery Area – Northern Health

The percentage atop the bars in the figure below represents the percentage of all new cases of cancer diagnosed in the Northern Health in the year indicated that were diagnosed within the respective Health Service Delivery Area

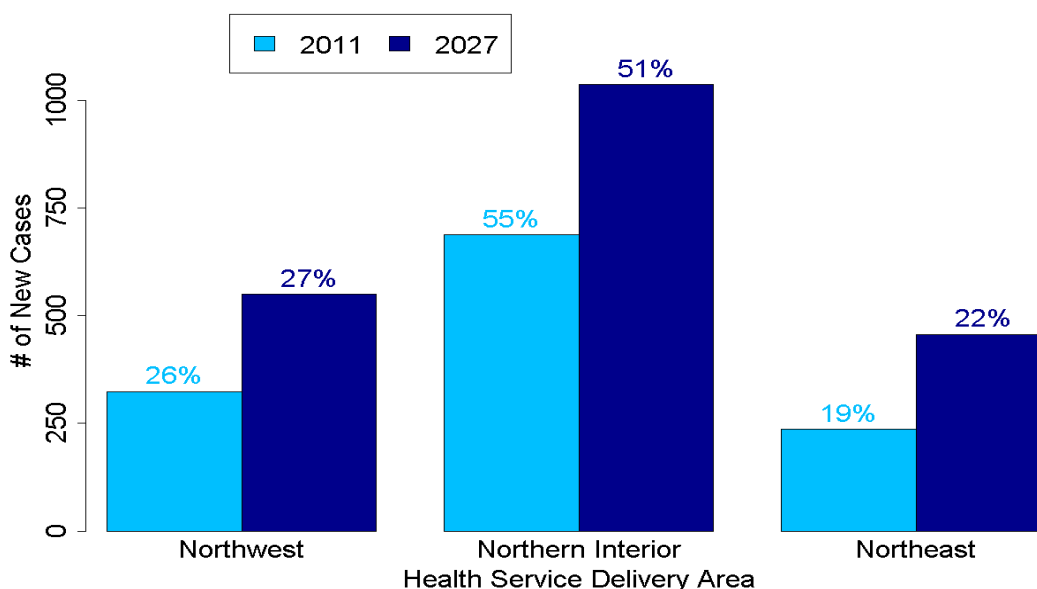


Table 12: Number of Cancer Deaths by Cancer Site for Northern Health, 2011-2027

Cancer	2011	2027	% Change
All Cancers (total)	531	781	+47 %
Males (total)	315	422	+34 %
Females (total)	216	358	+66 %
Selected Sites	2011	2027	% Change
Breast (female)	23	28	+22 %
Colorectal	65	81	+25 %
Lung	180	324	+80 %
Lymphoma/Leukemia	38	41	+8 %
Pancreas	37	45	+22 %
Prostate	40	41	+3 %



British Columbia Cancer Statistics Snapshot – 2011

This section contains a brief summary of statistics related to cancer incidence and mortality in British Columbia in 2011. This section is not a comprehensive inventory of BC cancer statistics and those interested in further statistical summaries should visit the [Cancer Statistics Section](#) of the BC Cancer Agency website. Additional reports found on the website describe cancer incidence, prevalence, mortality, survival and other indicators of cancer's impact on the BC population.

Incidence

- In 2011, 23,655 adults and 174 children and adolescents in British Columbia were diagnosed with cancer.
- About 65 adults are diagnosed with cancer in BC every day; a child or adolescent is diagnosed with cancer in the province approximately every two days.
- Of the British Columbians diagnosed with cancer in 2011, 62% were referred to a cancer centre or Community Oncology Network clinic operated by the BC Cancer Agency for part of their cancer care.
- In the 10-year period from 2002 to 2011, more than 200,000 cases of cancer were diagnosed in British Columbia residents. Among these were more than 30,000 cases of prostate cancer and more than 28,000 cases of breast cancer.

Childhood Cancers

- Cancer was diagnosed in 113 BC children (age 0-14) in 2011.
- The most commonly diagnosed cancers in children include (# cases): leukemia (34), brain and central nervous system (21), lymphoma (12), sarcoma (10) and germ cell tumours (9).

Lifetime Risk of Developing Cancer

- 1 in 2 British Columbia males is expected to develop cancer in their lifetime; 1 in 3 BC females will develop cancer in their lifetime.
- In BC, 1 in 8 females will develop breast cancer, 1 in 39 will develop uterine cancer and 1 in 77 will develop ovarian cancer over their lives.
- The lifetime risk of developing prostate cancer is about 1 in 7 for BC males.
- The lifetime risk of developing lung cancer is roughly the same in men and women; in BC about 1 in 14 people are expected to develop lung cancer over their lifetime.

The numbers of new cases of the most common cancers diagnosed in 2011 were presented previously in this report (Table 1). In Table 13 below we present the counts of new cancer diagnoses for a select number of less common cancer diagnoses.

Table 13: Number of New Cancer Diagnoses by Cancer Type and Sex for 2011.

Cancer	Males	Females	Total
Bladder (includes in situ)	1,015	296	1,311
Body of Uterus	-	693	693
Brain and Central Nervous System	193	146	339
Cervix	-	173	173
Kidney	369	172	541
Mesothelioma	53	7	60
Oral	357	188	545
Ovary	-	319	319
Testis	153	-	153
Thyroid	104	260	364

Mortality

- In 2011, 8,746 British Columbia adults and 21 children and adolescents died of cancer. This means that in British Columbia, 24 people die of cancer every day.

Lifetime Risk of Cancer Death

- In British Columbia, 1 in 5 females and 1 in 5 males are expected to die of cancer.
- Lung cancer is expected to kill 1 in 17 BC males and 1 in 19 BC females.
- 1 in 33 BC males and 1 in 38 BC females are expected to die of colorectal cancer.
- 1 in 36 BC females are expected to die of breast cancer.
- 1 in 29 BC males are expected to die of prostate cancer.

Years of Life Lost to Cancer

By comparing the age at death for British Columbians that die of cancer to the British Columbia average life expectancy, we can estimate the number of years of life that are lost due to cancer.

- 8,746 British Columbia adults died of cancer in 2011; this resulted in a total of 136,438 years of life lost to cancer. Put another way, this means that BC adults who died of cancer in 2011 lost an average of 15.6 years of their life expectancy to cancer.
- In 2011, there were 21 deaths in BC residents age <20 years. These children and adolescents lost an average of 68.6 expected years of life to cancer.
- Women dying of breast cancer in BC lose an average of 19.5 years of their life expectancy

Recent Work Accomplished with the BC Cancer Registry

Publications

Each year, there are many scientific and clinical journal articles written from research projects undertaken with the use of data from the BC Cancer Registry. Additionally, a number of cancer control reports utilize Cancer Registry data to communicate information about current and future cancer demands and the performance of the cancer treatment system. Some of these written reports and articles have brought about changes in clinical practice, suggested areas for future research and led to a better understanding of cancer risks associated with behaviours and environmental exposures.

Some research publications are written entirely from data collected within the Cancer Registry; others are written from data sets that link Cancer Registry information with additional data collected directly from research participants, administrative health records, or other clinical information.

The BC Cancer Agency data warehouse integrates the demographic, diagnosis, pathology and mortality information from the Cancer Registry with additional clinical, treatment and tumour-specific data. This integration of data enables a variety of researchers to make use of the Cancer Registry data for their research programs and ultimately leads to a better understanding of cancer in our province.

In the Spotlight

This year we would like to highlight some work performed over the past few years by researchers at the BC Cancer Agency that has led to important understanding of the role of polychlorinated biphenyls (PCBs) in the development of cancers. Earlier this year, a panel of international experts assembled at the International Agency for Research on Cancer (IARC) in France to review the evidence regarding the carcinogenicity of PCBs. At this meeting, the panel reviewed more than 70 independent published studies related to PCBs and cancer risk in humans; among them were two studies conducted by BC Cancer Agency researchers using data from the BC Cancer Registry.

A study by John Spinelli, Rick Gallagher and colleagues which examined PCBs and the risk of non-Hodgkin Lymphoma was published in 2007 in the [International Journal of Cancer](#). This study measured and compared the level of PCBs in plasma samples taken from people diagnosed with Non-Hodgkin Lymphoma to samples from a control population. The study found an association between levels of PCBs in plasma samples and non-Hodgkin lymphoma, suggesting PCBs could play a role in the development of this cancer. In 2011, the group published a [second manuscript](#) that examined the role of PCBs in the development of cutaneous (skin) melanoma. This study again compared plasma samples in cases with cancer, this time melanoma, with those from a control population and found that levels of PCBs were significantly higher in those who had melanoma. These findings provided additional support to previous studies that suggested that PCBs are involved in the development of melanoma.

Based on the review of evidence, the panel determined that PCBs should be listed as a 'Group 1' agent which means that PCBs are carcinogenic (cause cancer) in humans. A summary article describing the review of evidence can be found in the journal [Lancet Oncology](#). The BC Cancer Registry is excited to see research that has utilized the Registry data contribute to these kinds of global efforts to better understand cancer etiology and hopefully reduce the incidence of cancer in our population.

Publications

The BC Cancer Registry does not at this time maintain a comprehensive list of all publications resulting from the use of its data. Below is a sample of some of the many publications and reports from the past year or so that have used data collected within the BC Cancer Registry:

- Grundy A, Richardson H, Burstyn I, et al. **Increased risk of breast cancer associated with long-term shift work in Canada.** *Occup Environ Med*, 2013 Jul 1. [Epub ahead of print]
- Navaranjan G, Hohenadel K, Blair A, et al. **Exposures to Multiple Pesticides and the Risk of Hodgkin Lymphoma in Canadian Men.** *Cancer Causes Control*. 2013 Jun 12. [Epub ahead of print]
- McLean DI, Phillips N, Zhou Y, et al. **40-year trends in skin cancer in British Columbia, Canada, 1973 to 2003.** *Journal of Cutaneous Medicine and Surgery*, 2012 Mar-Apr;16(2):83-91.
- Coldman A, Phillips N. **Incidence of breast cancer and estimates of over diagnosis after the initiation of a population-based mammography screening program.** *CMAJ Canadian Medical Association Journal*, 2013; 185(10):E492-8.
- Davidson A, Chia S, Olson R, et al. **Stage, treatment and outcomes for patients with breast cancer in British Columbia in 2002: a population-based cohort study.** *Can Med Assoc J Open*: 1:E134-41.
- Kennecke HF, Chen L, Blanke CD, et al. **Panitumumab monotherapy compared with cetuximab and irinotecan combination therapy in patients with previously treated KRAS wild-type metastatic colorectal cancer.** *Current Oncology*, 2013; 20:326-32.
- Pataky R, Armstrong L, Chia S, et al. **Cost-effectiveness of MRI for breast cancer screening in BRCA1/2 mutation carriers.** *BMC Cancer*, 2013 Jul 10; 13:339.
- Zhang Y, Goddard K, Spinelli JJ, et al. **Risk of late mortality and second malignant neoplasms among 5-year survivors of young adult cancer: A report of the Childhood, Adolescent, and Young Adult Cancer Survivors Research Program.** *J Cancer Epidemiol*, 2012 Sep.
- Auluck A, Hislop TG, Bajdik C, et al. **Gender and ethnicity shifts in survival of oropharyngeal and oral cavity cancers in British Columbia.** *Cancer Causes Control*, 2012; 12:1899-909.
- Davidson JA, Cromwell I, Ellard SL, et al. **A prospective clinical utility and pharmacoeconomic study of the impact of the 21-gene Recurrence Score assay in oestrogen receptor positive node negative breast cancer.** *Eur J Cancer*; 2013 Apr 20; 49:2469–75.
- Karam I, Hamilton S, Nichol A, et al. **Population-based outcomes after brain radiotherapy in patients with brain metastases from breast cancer in the pre-Trastuzumab and Trastuzumab eras.** *Radiat Oncol*, 2013; 8:12.
- Hoskins P, Le ND, Wong F, et al. **Low Stage Ovarian Clear Cell Carcinoma: Population-based Outcomes in British Columbia, Canada with Evidence for a Survival Benefit Due to Irradiation.** *JCO*, 2012 May 10;30(14):1656-62.

- Bradley KL, Tyldesley S, Speers CH, et al. **Contemporary systemic therapy for male breast cancer.** Clin Br Ca, 2013 Oct 1 [Epub ahead of print].
- Turner MC, Krewski D, Armstrong BK, et al. **Allergy and brain tumours in the INTERPHONE study: Pooled results from Australia, Canada, France, Israel and New Zealand.** Cancer Causes Control, 2013 May;24(5):949-60.
- Permuth-Wey J, Lawrenson K, Shen HC, et al. **Identification and molecular characterization of a new ovarian cancer susceptibility locus at 17q21.31.** Nature Communications, 2013;4:1627
- Perrotta C, Kleefeld S, Staines A, et al. **Multiple myeloma and occupation: a pooled analysis by the International Multiple Myeloma Consortium.** Cancer Epidemiol, 2013;37(3):300-5.
- Canadian Partnership Against Cancer. **The 2012 Cancer System Performance Report.** Toronto, ON: Canadian Partnership Against Cancer; 2012.
- Alipour S, Woods R, Lim HJ, et al. **Body Mass Index and Body Surface Area and Their Associations with Outcomes in Stage II and III Colon Cancer.** J Gastrointest Cancer, 2013; 44:203-10.
- Faulds J, McGahan CE, Phang PT, et al. **Differences between referred and nonreferred patients in cancer research.** Can J Surg, 2013; 56(5): E135-41.
- Deyell RJ, Lorenzi M, Ma S, et al. **Antidepressant use among survivors of childhood, adolescent and young adult cancer: A report of the Childhood, Adolescent, and Young Adult Cancer Survivors Research Program.** Pediatr Blood Cancer, 2013;60(5):816-22.
- Kobayashi LC, Janssen I, Richardson H, et al. **Moderate-to-vigorous intensity physical activity across the life course and risk of pre- and post-menopausal breast cancer.** Breast Cancer Res Treat, 2013;139(3):851-61.
- Canadian Cancer Society's Advisory Committee on Cancer Statistics. **Canadian Cancer Statistics 2013.** Toronto, ON: Canadian Cancer Society; 2013.
- Kamper-Jørgensen M, Rostgaard K, Glaser SL, et al. **Cigarette smoking and risk of Hodgkin lymphoma and its subtypes: a pooled analysis from the International Lymphoma Epidemiology Consortium (InterLymph).** Ann Oncol, 2013;24(9):2245-55.
- Grundy A, Schuetz JM, Lai AS, et al. **Shift work, circadian gene variants and risk of breast cancer.** Cancer Epidemiol, 2013 May 28.
- Earp MA, Kelemen LE, Magliocco AM, et al. **Genome-wide Association Study of Subtype-Specific Epithelial Ovarian Cancer Risk Alleles Using Pooled DNA.** Human Genetics 2013 Nov 5. [Epub ahead of print]

Recent Research Projects

Every year a number of new research projects are initiated that utilize data collected within the BC Cancer Registry and this past year has been an exceptionally busy year. The following are examples of recent projects that obtained approval to use BC Cancer Registry data:

- **Examining the potential role of environmental exposures and radiofrequency fields emitted from communication devices on the development of tumours of the central nervous system in children and young adults** (PI: Dr. J. Spinelli).
- **Estimating incidence, mortality and survival rates of major cancers in British Columbia First Nations individuals** (PI: Dr. A. Coldman).
- **Determining the utilization of tamoxifen in DCIS, and exploring clinical factors associated with use, patient compliance, and estimated benefits of receiving tamoxifen** (PI: Dr. S. Tyldesley).
- **Exploring bottlenecks in cancer diagnostic and treatment pathways for vulnerable populations in northern British Columbia** (PI: Dr. R. Olson).
- **Impact on clinical outcomes of time from diagnosis to time of curative-intent chemotherapy in Hodgkin Lymphoma: a retrospective analysis of Hodgkin Lymphoma patients in British Columbia** (PI: Dr. D. Villa).
- **CONCORD-2: a global study of cancer survival in more than 60 countries** (PI: Dr. A. Coldman).
- **Breast Cancer Survivor Income and Employment Study: a study of changes in income and employment from diagnosis of breast cancer** (PI: Dr. P. Teckle).
- **The efficacy of pelvic floor muscle training in gynecological cancer survivors: A pilot study** (PI: Dr. S. Finlayson).
- **Spatial patterns of lung cancer and radon in British Columbia** (PI: T. Harvey).
- **Assessment of the Burden of Hepatitis C to Support Appropriate Prevention, Care and Treatment Using a Comprehensive Dataset of HCV and HIV Testers in British Columbia** (PI: Dr. M. Krajden).
- **Geospatial analysis of Head and Neck Cancers in British Columbia** (PI: Dr. M. Rosin).
- **The BC Generations Project** (PI: Dr. J. Spinelli).
- **Development of a Micro-simulation Model for Breast Cancer to Evaluate the Impacts of Different Early Detection and Screening Strategies** (PI: Dr. R. Rajapakshe).
- **Cancer Epidemiology in Adventists: a low-risk group** (PI: Dr. G. Fraser).

Online Data Tools

Data from the BC Cancer Registry can be accessed and even manipulated into custom summaries from several locations on the internet. Those interested in comparing British Columbia cancer rates to other jurisdictions should consider visiting the websites listed below.

As noted previously, BC data are submitted to the Canadian Cancer Registry on an annual basis who in turn makes the data available online from the [Statistics Canada CANSIM](#) website. There, one can search for tables related to cancer statistics and manipulate the tables using the CANSIM query tool; this tool enables comparisons of relevant statistics by province or territory. A listing of table numbers for useful cancer statistics is provided below; any of these table numbers can be entered directly into the search bar:

Table 14: CANSIM Tables Numbers

CANSIM Table Number(s)	Cancer Statistics
103-0550	Crude Cancer Incidence Data
103-0553	Age-standardized Cancer Incidence Data
103-1569, 103-1570, 103-1571, 103-1572	Relative Survival Estimates for Selected Cancers (various tables)
103-0404	Cancer Incidence by Health Regions
102-0551	Mortality by Selected Causes of Death (including cancer deaths)

This past year marked our eighth successive participation in the WHO publication [Cancer Incidence in Five Continents](#). This publication is released every five years and is now in its tenth edition; the BC Cancer Registry is proud to have participated in this initiative since 1976 when the third edition was released. British Columbia data submitted to the IARC program as part of the *Cancer Incidence in Five Continents* project can be accessed online and comparative cancer incidence summaries by cancer site, region, sex and/or age group can be generated from the available tools. For more information on this project or to access data online, please visit the [IARC](#) website.

Population Data BC

The BC Cancer Registry continues to be an active supporter of Population Data BC, a multi-university resource that facilitates linkages of administrative health data for health research purposes. The BC Cancer Registry has contributed data to this facility for several years and has committed to provide additional information on cancer stage for selected cancers starting this year. BC Cancer Agency staff also support the facility through membership on the Data Stewardship Working Group, the Governance and Oversight Committee, as well as by reviewing study applications and providing assistance in understanding and interpreting our data.

Researchers who request access to data at [Population Data BC](#) are required to complete a detailed data application, obtain research ethics approval and complete necessary privacy training. De-identified data are accessed on a secure server at the University of British Columbia and are only made available to approved study team members. By making the cancer registry data available in this way, we have made it possible for health researchers to securely access the data and potentially link it to other important health data including hospital separations, physician billings, home and community care information and prescription drugs.

References

- 1) Canadian Cancer Society's Advisory Committee on Cancer Statistics. *Canadian Cancer Statistics 2013*. Toronto, ON: Canadian Cancer Society; 2013.
- 2) Fritz A, Percy C, Jack A, Shanmugaratnam K, Sobin L, Parkin D, et al., eds. *International Classification of Diseases for Oncology*. 3rd ed. Geneva, Switzerland: World Health Organization; 2000.
- 3) World Health Organization. *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*. Volumes 1 to 3. Geneva, Switzerland: World Health Organization; 1992.
- 4) Spinelli JJ, Ng CH, Weber JP, Connors et al. Organochlorines and risk of non-Hodgkin lymphoma. *Int J Cancer*, 2007; 121(12):2767-75.
- 5) Gallagher RP, Macarthur AC, Lee TK, et al. Plasma levels of polychlorinated biphenyls and risk of cutaneous malignant melanoma: a preliminary study. *Int J Cancer*, 2011 Apr 15;128(8):1872-80.
- 6) Lauby-Secretan B, Loomis D, Grosse Y, et al. Carcinogenicity of polychlorinated biphenyls and polybrominated biphenyls. *Lancet Oncology*, 2013; 14(4): 287-8.

Appendix I: Special Focus Supplemental Materials

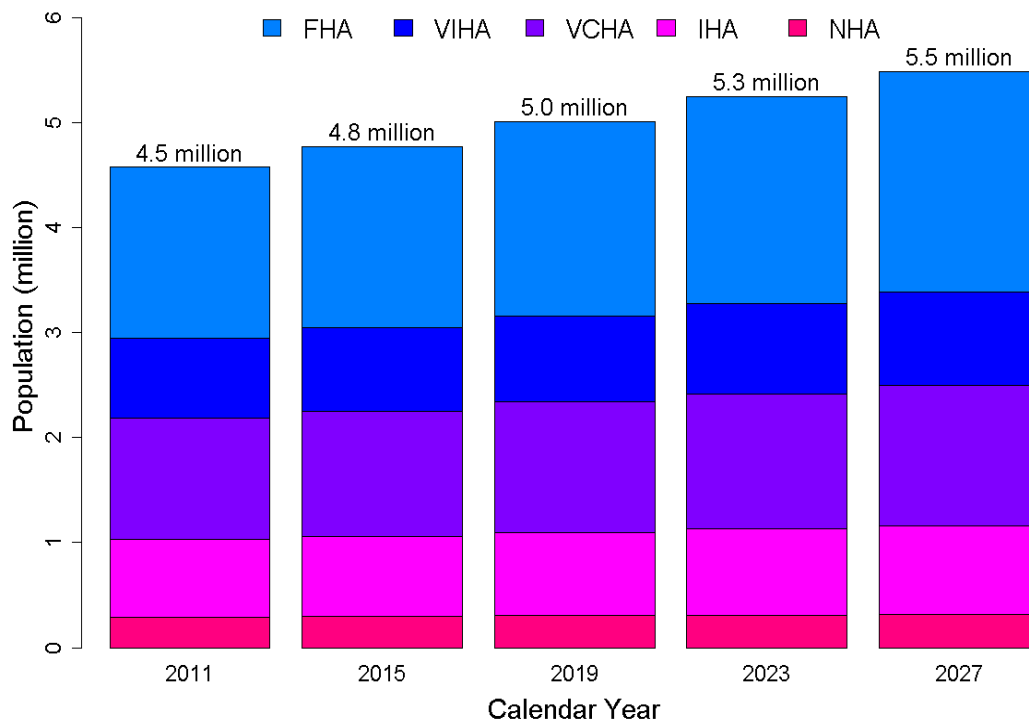
Drivers of Projected Cancer Burden for British Columbia

Population Growth and Aging

The population of British Columbia is expected to grow by almost a million residents between now and 2027 reaching a total population of about 5.5 million people in 2027; this amounts to an average population growth of about 20% across the province. As demonstrated by the summaries in this section, the population growth is not expected to be uniform across the province, nor within a specific regional health authority do we expect uniformity of population change. These variations in population growth around the province will have profound impact on the numbers of cancers diagnosed regionally.

- Fraser Health is expected to see the largest percentage increase in population (+29%) of any of the five regional health authorities (Table A1). The projected population of the Fraser Health Authority region is forecast to be almost 2.1 million people; this is an increase of close to half a million residents from the 2011 population.
- Population growth is expected to be lowest in Northern Health (+8%) with an expected increase of less than 25,000 residents between 2011 and 2027.
- Population growth for the remaining three Health Authorities is forecast to be slightly lower than the provincial average (+15-17%).

Figure A1: Projected Population Growth from 2011-2027 by Regional Health Authority.



Generally, the risk of developing cancer increases with age; the senior population (those aged 65 or older) is most at-risk of developing cancer. Thus when trying to understand the projected increase in cancer incidence for the province, one needs to consider not only the overall population growth, but also the growth in the seniors population.

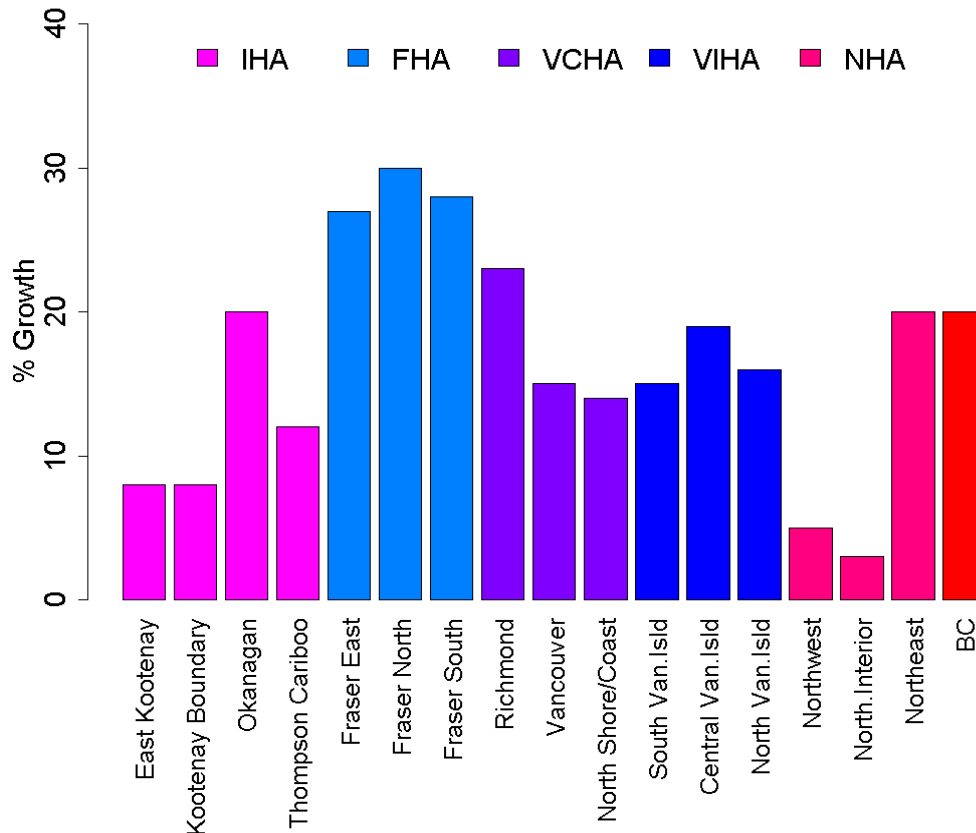
- The population of seniors in BC will be greater than 1.2 million individuals in 2027 (Table A1).
- The growth in the population of seniors in the province is expected to increase by 72% between 2011 and 2027. This equates to an increase of approximately 500,000 BC seniors over this period.
- The north is projected to have the largest percent increase of seniors (~100% increase). This contrasts with the north having the lowest projected overall population growth over this same period suggesting the population of seniors in the north is growing, while the population of younger people is falling.
- In 2027 Fraser Health will be home to more than 400,000 seniors; more seniors will reside in this health region than any other region.

Table A1: Projected Population Growth for 2011 and 2027 by Regional Health Authority

Health Authority	2011 Population (All ages)	2027 Population (All ages)	Percent Growth (All ages)	2011 Population Age ≥ 65	2027 Population Age ≥ 65	Percent Growth Age ≥ 65
Interior	737,468	847,283	15%	138,184	222,911	61%
Fraser	1,629,695	2,096,855	29%	240,690	408,313	70%
Vancouver Coastal	1,153,753	1,335,737	16%	148,643	270,504	82%
Vancouver Island	761,990	889,731	17%	140,117	238,189	70%
Northern	290,415	313,121	8%	32,888	65,276	98%
BC Provincial	4,573,321	5,482,727	20%	700,522	1,205,193	72%

Figure A2 below presents the variation in expected population growth across the Health Service Delivery Areas (HSDA's) within each regional Health Authorities. This clearly demonstrates that population growth is not generally uniform within the regional health authorities.

Figure A2: Percentage Population Growth from 2011 to 2027 by Health Service Delivery Area



- The population growth for all HSDA's within Fraser Health is expected to be similar and will be greater than the provincial population growth.
- Interior Health's population growth is expected to be lower than the provincial growth; this is true for regions in the Kootenays and Thompson-Cariboo. The Okanagan however is expected to see growth in-line with the provincial growth rate.
- The Northeast region of Northern Health is expected to grow much faster than the other regions of the north.
- In Vancouver-Coastal Health, the population of Richmond is expected to grow faster than the Vancouver or North-Shore/Garibaldi regions.

Trends in Selected Cancer Sites

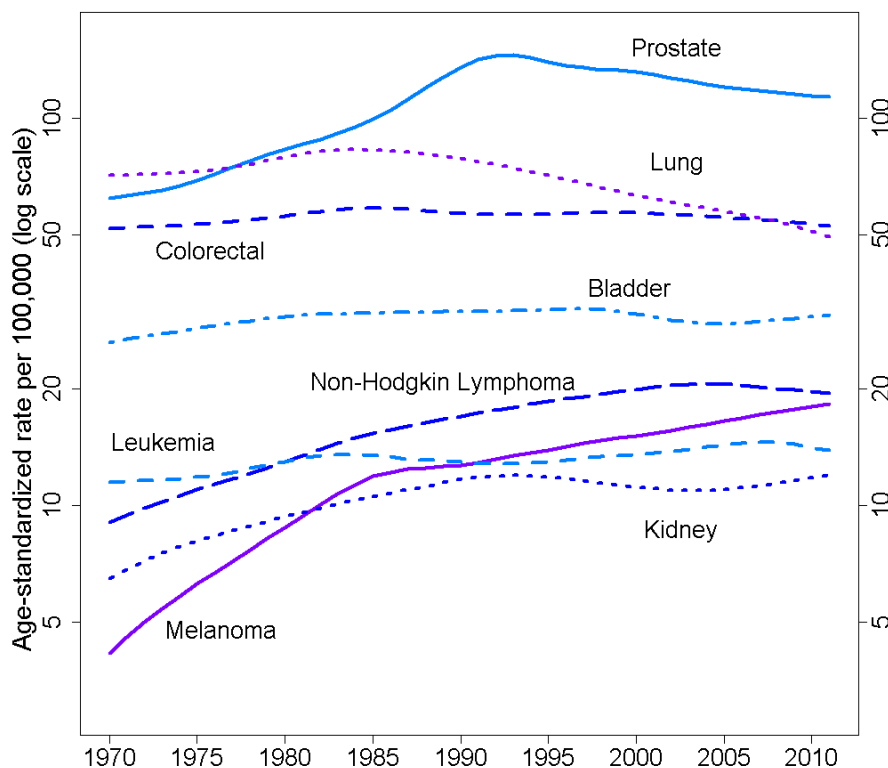
Estimates of future cancer cases are impacted not only by the projected change in the population structure going forward but also by present trends in the underlying cancer rates. There is no single summary statement that can describe recent cancer incidence or mortality trends in general, as the pattern varies markedly by the type of cancer as well as between males and females. As a result, in trying to understand the determinants of future cancer incidence or mortality, one needs to look at trends in individual cancers and by sex.

Trends in Cancer Incidence Rates for Common Cancers in Males

Figure A3 below presents the trends in the age-standardized incidence rates of selected cancers for British Columbia males; the individual lines show how the rates of cancer have changed from 1970 to 2011 for different cancers in our male population. What is quickly discerned from this plot is that the individual cancer types show very different patterns over time.

- Some cancers appear to have a fairly flat profile suggesting there hasn't been a significant increase or decrease in the rates over time; bladder cancer and colorectal cancer in males are good examples of this. Thus any projected increase in the numbers of these cancers in our population will be driven largely by changes in the population itself (aging and growth).
- A steady decrease in the rates of lung cancer in males is visible from about the mid-1980's demonstrating the effect of earlier changes in the frequency of smoking in the male population; this is important and helps to explain why lung cancer incidence in males is projected to grow by 29% while the total number of cancers is projected to increase 45%. The decreasing trend in the incidence rates is helping to reduce the impact of population growth and aging for this cancer.
- The fairly significant 'bump' in the prostate cancer incidence rates visible in the early 1990's corresponds to a period of rapid uptake in PSA testing (a test commonly used in prostate cancer screening) within the province which led to an increase in new diagnoses.

Figure A3: Trends in Age-Standardized Cancer Incidence Rates for Selected Cancers – MALES



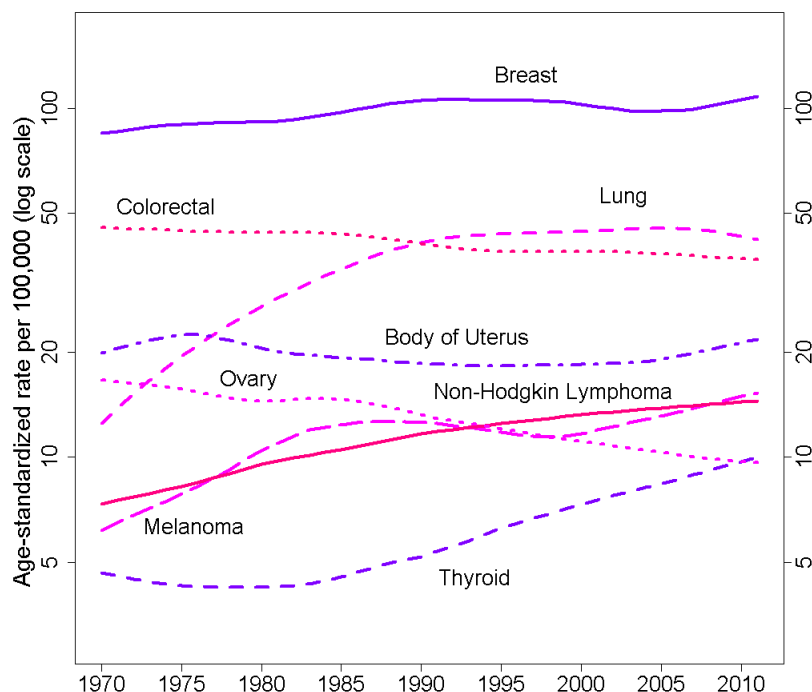
- There are some cancer types that show increasing trends in the cancer incidence rates. Melanoma rates have increased fairly steadily in males over the past 40 years. Non-Hodgkin Lymphoma rates increased steadily from 1970 until very recently when they started to level. Sites such as these will generally experience the largest percentage increase in their projected cancer counts due to the impacts of both the increasing trend in the cancer rates as well as the growth and aging of the population.

Trends in Cancer Incidence Rates for Common Cancers in Females

Figure A4 shows the changes over time in the age-standardized incidence rates for common female cancers in British Columbia. Similar to the plot for males, what we see is that rates for individual cancer types have different profiles over time. There are a few notable differences between the male (A3) and female (A4) figures for common cancers which are interesting to note:

- Lung cancer incidence has not yet shown the steady decline in rates observed in males; this largely relates to when smoking uptake and cessation occurred in the female population relative to males. The incidence appears to have peaked in females, however, it remains to be seen when the expected decline in rates will start and how quickly rates will decline.
- Colorectal cancer incidence has also been generally declining over time in women, which contrasts with the steady incidence rate in males.

Figure A4: Trends in Age-Standardized Cancer Incidence Rates for Selected Cancers – FEMALES



These differences in the patterns between males and females are important to note as they help to explain why projected increases in a certain type of cancer might be quite different between males and females. Other notable trends in female cancers include:

- Thyroid cancer in females is perhaps the most rapidly increasing cancer in British Columbia. This steady increasing pattern has been observed consistently across Canada and reported in much of the Western world. Rates of Non-Hodgkin Lymphoma have also steadily increased in BC females and, similar to what was observed in males, the rate of increase has been slowing in recent years.
- Ovarian cancer rates have been in fairly steady decline in the province over the past 30-40 years.

Trends in Cancer Mortality Rates

Figures of age-adjusted cancer mortality rate trends for British Columbia males and females are provided in this section; they are similar in format to those presented above for cancer incidence. Changes in mortality rates over time are influenced by changes in incidence patterns (as fewer new cases diagnosed influences the number of people that die of cancer) but also by improvements in cancer screening, diagnosis and treatment. The difference in pattern between mortality and incidence trends explains the lower proportional increase in mortality compared to incidence predicted to occur between 2011 and 2027.

Figure A5: Trends in Age-Standardized Cancer Mortality Rates for Selected Cancers – MALES

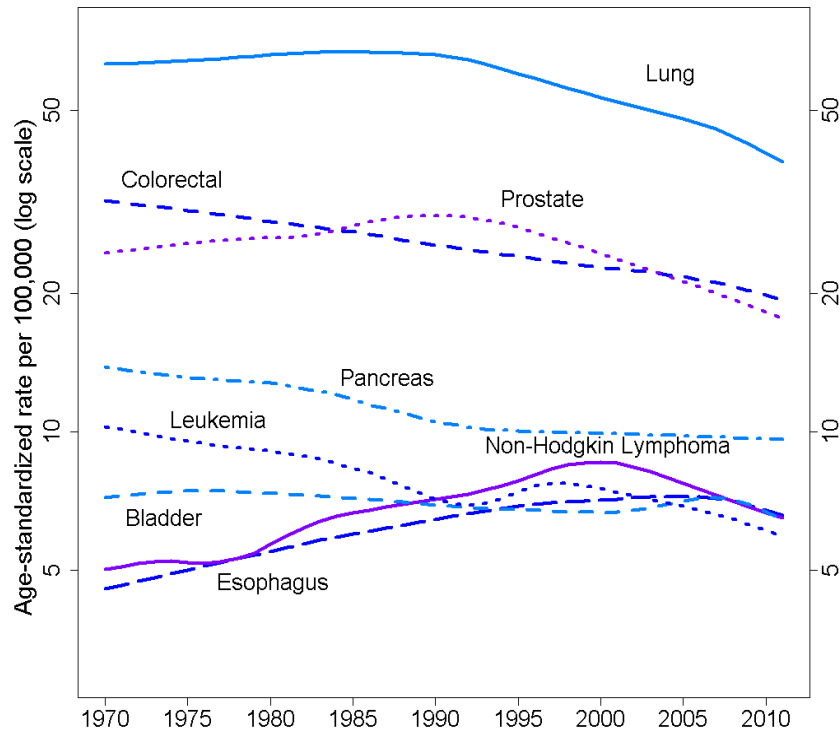
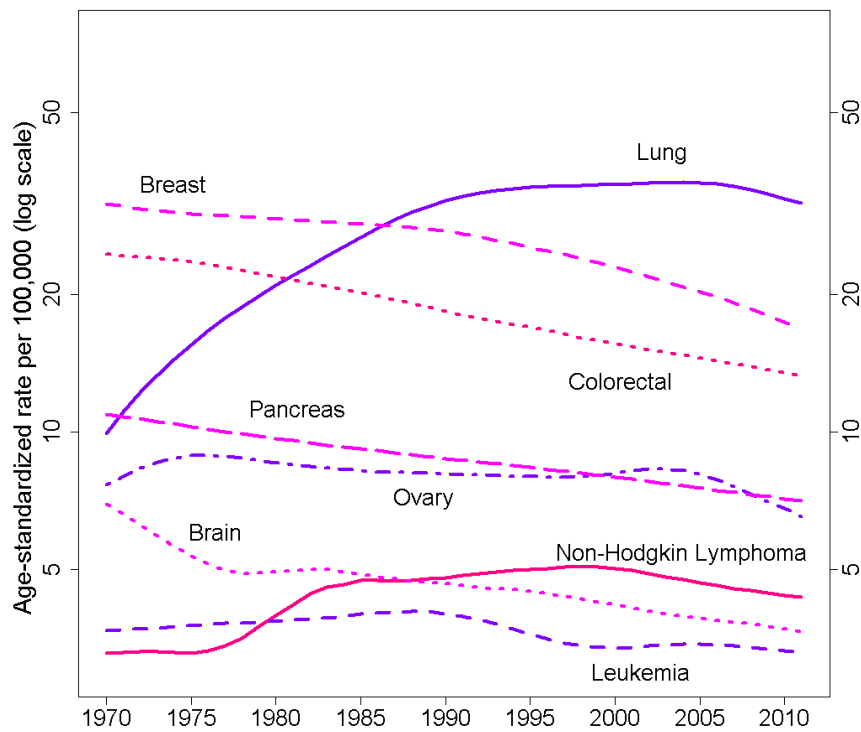


Figure A6: Trends in Age-Standardized Cancer Mortality Rates for Selected Cancers – FEMALES



Challenges with Cancer Incidence Projections

As noted previously in this report, a key assumption made when producing cancer incidence projections is that recent trends in the cancer rates can be extrapolated into the future. For this to be true, we must then assume that trends in the behaviors and risk factors that influence cancer will remain fairly stable over the period for which we are making projections. Cancers that are subject to programmatic or ad-hoc screening are particularly challenging for projecting future numbers of cases as changes in the screening uptake within a region can result in surges of new diagnoses. Following a surge in newly diagnosed cases, it is further challenging to predict if additional surges will be seen in coming years with more screening uptake or if following the initial surge, the case count will level or decrease. Perhaps the best example of this issue in recent years is the uptake in prostate-specific antigen (PSA) testing and the impact on prostate cancer incidence.

Figure A7: Observed and Projected New Prostate Cancer Diagnoses from 1975 to 2005

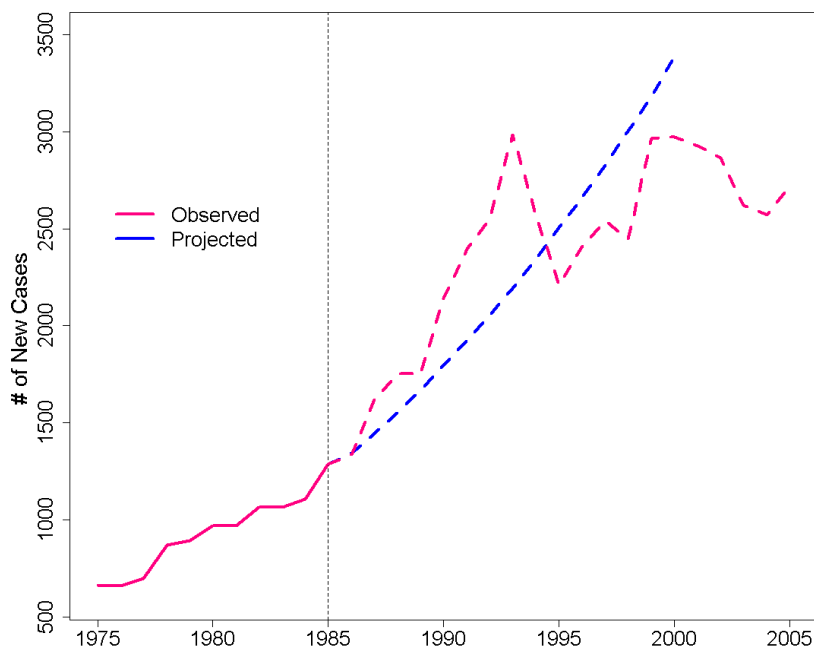


Figure A7 above shows the number of prostate cancer cases diagnosed in BC from 1975 to 1985 (solid pink line); this period pre-dates the use of PSA testing in BC males. The projected number of new cases for the 15-year period following 1985 is shown by the blue dashed line; this projection may seem reasonable given the observed increasing trend in the case numbers up to 1985. However, when we plot the observed data for the period from 1986 to 2005 on this same plot (pink dotted line), we see that the actual number of cases deviated markedly from the previous trend; by 1992 this difference had surged to an increase of more than 500 cases (~25%) from the projected total. This period coincides with the initial uptake of PSA testing in BC males and demonstrates the resulting increase in cancer incidence attributable to this new form of screening and its impact on the accuracy of cancer projections. These surges in the cancer projections are particularly challenging for cancers such as prostate which already represent a significant proportion of the total annual number of cancer cases in the province; a surge of 25% in this single cancer actually amounts to a significant increase in total cancer incidence.

Projection Methodology

Projections for both incidence and mortality use the most recent 10 years of diagnoses or cancer deaths in the projection base (2002-2011 for this report). Counts of cancer cases or deaths are aggregated by year of diagnosis (or death for mortality), sex, cancer type, age group (groups: '0-19', '20-39', '40-49', '50-59', '60-69', '70-79', '80+') and health authority (five regional health authorities).

Poisson regression is used to model the cancer case counts with terms included in the model for health authority, sex (for cancers that arise in both sexes), age group, year of diagnosis (or death) and interaction terms between these variables; the log of the corresponding populations is included as an offset variable in the model. Several models are fit for each cancer site, each including subsets of the above variables; the different models are compared using the AIC with the “best” model chosen as that with the lowest AIC. Projections for a given cancer site are based on this “best” model and are obtained by applying the model-fitted rates to future population projections.

As a result of cancer screening’s potential to produce rapid changes in the incidence rates for female breast and male prostate cancers, incidence projections for these cancers use average rates from the most recent two years of diagnoses (by health authority and age group) in place of the Poisson regression models. The recent average rates are applied to population projections to obtain future projections of new cases.

Within the report, regional cancer cases and deaths for 2011 are presented and the total of these regional counts should in theory sum to the provincial total. However, due to some cases in the province being reported without a valid postal code, the counts for BC will exceed the sum of the regional counts due to the small number of cases that we cannot accurately assign to a region. Projections for each region have been adjusted by increasing them according to the recent percentage of missing postal codes in the province. This adjustment has been made assuming cases with missing postal codes are distributed proportionally to regional populations around BC.

Population projections used in this project were obtained from [BC Stats](#) (PEOPLE 2012).

All analyses were performed using the R statistical language (version 2.15.0).



BC Cancer Agency

CARE + RESEARCH

An agency of the Provincial Health Services Authority

Appendix II: Other Materials

Acknowledgements

The BC Cancer Registry would like to acknowledge the commitment of the many health care professionals who continue to provide active support to the Registry. We would also like to acknowledge the Vital Statistics Agency of British Columbia for their ongoing support in providing mortality information to the BC Cancer Registry which has enabled us to report on cancer mortality in our province and create mortality projections such as those within this report.

Contact Information

If you would like more information about the BC Cancer Registry and any of our activities, please feel free to contact us. Additionally, if you have any questions or feedback on this report we would be happy to hear from you.

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Abbreviations

BC	British Columbia
BCCA	BC Cancer Agency
BCCR	British Columbia Cancer Registry
FHA	Fraser Health
HA	Health Authority
HSDA	Health Service Delivery Area
IARC	International Agency for Research on Cancer
IHA	Interior Health
NHA	Northern Health
PCB's	Polychlorinated Biphenyls
PHSA	Provincial Health Services Authority
PSA	Prostate-Specific Antigen
RT	Radiation Therapy
VCHA	Vancouver Coastal Health
VIHA	Island Health
WHO	World Health Organization

Glossary

Cancer Incidence

The number of new cases of a given type of cancer diagnosed in a specified time period. The basic unit of reporting is a new case of cancer rather than an individual patient.

Cancer Incidence Rate

The number of new cases of a given type of cancer per person in the general population (usually expressed as a rate per 100,000 people).

Cancer Mortality

The number of deaths attributed to a particular type of cancer in a given time period. Included are deaths of patients diagnosed in earlier years, persons with a new diagnosis during the year, and patients for whom a diagnosis of cancer is made only after death.

Cancer Mortality Rate

The number of new deaths of a given type of cancer per person in the general population (usually expressed as a rate per 100,000 people).

Projection

An estimate or forecast of the future number of new cancer cases or deaths.

Trends

The change in the rate of new cancer cases or deaths in the population over time.

Cancer Site Definitions

Table B1 - Cancer Site Definitions

Cancer	ICD-O-3 Site/Type (incidence)	ICD-10 (mortality)
Bladder (including <i>in situ</i>)	C67	C67
Body of Uterus	C54–C55	C54–C55
Brain	C70–C72	C70–C72
Breast	C50	C50
Colorectal	C18–C20, C26.0	C18–C20, C26.0
Esophagus	C15	C15
Kidney	C64.9, C65.9	C64–C65
Leukemia	Type 9733, 9742, 9800–9801, 9805–9809, 9820, 9826, 9831–9836, 9840, 9860–9861, 9863, 9865–9867, 9869–9876, 9891, 9895–9898, 9910, 9911, 9920, 9930–9931, 9940, 9945–9946, 9948, 9963–9964 Type 9811–9818, 9823, 9827, 9837 sites C42.0,.1,.4	C91–C95, C90.1
Lung	C34	C34
Melanoma	C44 (Type 8720–8790)	C43
Non-Hodgkin Lymphoma	Type 9590–9597, 9670–9719, 9724–9729, 9735, 9737, 9738 Type 9811–9818, 9823, 9827, 9837 all sites except C42.0,.1,.4	C82–C85, C96.3
Ovary	C56.9	C56
Pancreas	C25	C25
Prostate	C61.9	C61
Thyroid	C73.9	C73
All Cancers	All invasive sites (including <i>in situ</i> bladder)	All invasive sites

Note: ICD-O-3 refers to the *International Classification of Diseases for Oncology, Third Edition* and ICD-10 refers to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*.



Boundaries of British Columbia Health Regions

Below are maps depicting the geographic boundaries of the British Columbia Health Authorities and Health Service Delivery Areas referred to throughout this report. These maps were created by BC Stats and are available from the [BC Stats](http://BCStats.ca) website.

