Canadian Cancer Statistics

A **2024 special report** on the economic impact of cancer in Canada

Government of Canada Gouvernement du Canada

Canadian Cancer Society

This publication was developed by the Canadian Cancer Statistics Advisory Committee in collaboration with the Canadian Cancer Society, Statistics Canada and the Public Health Agency of Canada with cancer data provided by the provincial and territorial cancer registries through the Canadian Cancer Registry.
cancer.ca/statistics

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The development of this publication over the years has benefited considerably from the comments and suggestions of readers. The Canadian Cancer Statistics Advisory Committee appreciates and welcomes such comments. To offer ideas on how the publication can be improved or to be notified about future publications, complete the evaluation form or email stats@cancer.ca.

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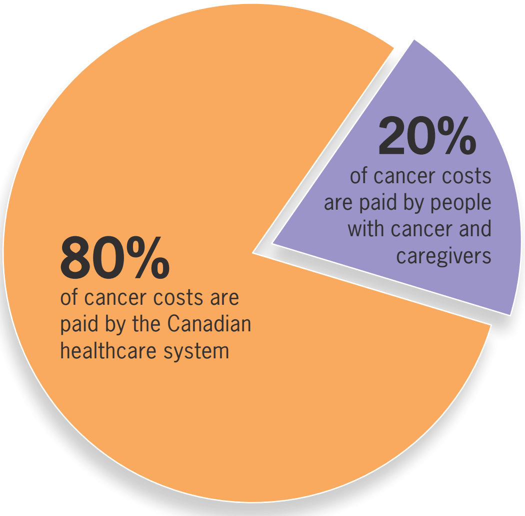
About this special report

Cancer remains a leading cause of mortality in Canada, with more and more people diagnosed each year.(1,2) Its physical, emotional and economic impacts are profound.

This special report examines the economic impact of cancer in Canada. It provides updated, detailed estimates of the societal cost of cancer in Canada, estimating both costs to health systems and costs for people with cancer and their caregivers, including time costs, out-of-pocket costs and indirect costs. The findings provide insights that can help in planning for the future allocation of resources and in identifying where gaps and opportunities exist. These estimates of economic impact highlight the considerable resource requirements for cancer control and care, while underscoring the substantial cost borne by those affected by cancer. Furthermore, the cost projections included in this report will be helpful for planning the human and economic resources required in the coming decade to address the costs associated with cancer.

The economic cost of cancer in Canada has been rising over time, affecting the Canadian healthcare system, people with cancer and their caregivers. In addition to the rising expense of cancer treatment and supportive care, inflationary pressures combined with a growing and aging population contribute to increasing costs. The considerable growth in the number of people and families affected by cancer is the primary driver of these increases in economic impact.

Cancer costs projected to be $37.7 billion in 2024 in Canada



The increases in the total number of people in Canada diagnosed with cancer have been previously reported in the annual Canadian Cancer Statistics publications and special reports. The increasing overall impact of cancer can be seen from previous trends: in 2000 there were 137,697 new diagnoses of cancer compared to 2024 where we project that 247,100 cases will be diagnosed in Canada.(1,2) Cancer prevalence has also continued to rise and, as of 2018, there were over 1.5 million people in Canada living with or beyond a cancer diagnosis.(3)

The results and discussion included in this report are not meant to be all-encompassing. They should stimulate dialogue and additional collaboration to better our collective understanding of the vast economic impact that cancer has on the Canadian health system and those affected by cancer. We note that while the estimates included reflect an average of individual and population outcomes, many individuals will have different experiences and outcomes than the summaries included here depict. We have included perspectives from people with cancer and caregivers along with the modelling to highlight the varied and challenging experiences of those impacted by cancer. We hope that our readers think critically about what these numbers mean and how they can be used to develop better overall care for those living with and beyond cancer in Canada.

> This special report sheds important light on the considerable societal cost of cancer, quantifying the costs to the healthcare system and those borne by people with cancer and caregivers.

About Canadian Cancer Statistics

Canadian Cancer Statistics is developed through a collaboration between the Canadian Cancer Society, Statistics Canada and the Public Health Agency of Canada, who bring together expertise from across the cancer surveillance and epidemiology community in the form of the Canadian Cancer Statistics Advisory Committee.

The three main Canadian Cancer Statistics products are:

1. **Full publication**: Every other year, we release a publication that provides detailed estimates of cancer incidence, mortality and survival by sex, age group, geographic region and time period for more than 20 of the most commonly diagnosed cancers in Canada. The most recent edition was Canadian Cancer Statistics 2023, which was released in November of 2023. The next edition will be published in 2025.
2. **Snapshot of projected estimates**: In between full-publication years, we release projected estimates of incidence and mortality by sex and geographic region for the current year. The purpose of this work is to ensure that current-year estimates are publicly available annually. The 2024 projected estimates were published in an article titled "Projected estimates of cancer in Canada in 2024" in the Canadian Medical Association Journal in May of 2024. The next snapshot will be released in 2026.
3. **Special report**: In the same years as the snapshot publication, we also publish a special report on a topic of particular importance to the cancer control community. The 2024 special report is on the economic impact of cancer in Canada.

These Canadian Cancer Statistics products are designed to inform health professionals, policy makers and researchers to help them make decisions and identify priorities for action in their respective areas. However, the information contained in these products is relevant to a much broader audience. As such, the media, educators and members of the public with an interest in cancer may also find these products valuable.

All Canadian Cancer Statistics products, along with supporting resources, are accessible through cancer.ca/statistics.

Introduction

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Key findings

- In 2024, the total societal cost of cancer in Canada is expected to be $37.7 billion.
- Costs incurred by health systems are expected to account for the majority ($30.2 billion) of these cancer-related costs to society in 2024.
- However, costs for people with cancer and caregivers are considerable and are expected to account for approximately 20% ($7.5 billion) of societal costs in 2024.
- Out-of-pocket costs make up the largest part of what people with cancer and caregivers pay, and these costs are expected to increase in the next 10 years.
- We anticipate an overall trend of rising costs from 2024 to 2034 across all cancer types, signalling increasing economic challenges to cancer care over time.
- Overall, in the next 10 years, cancer-related societal costs are expected to increase by 23%. This increase is due, in part, to population growth and aging, as well as better cancer survival.
- While the costs examined in this report represent estimates of the economic impact, they reflect the everyday challenges experienced by people with cancer and caregivers, as well as health systems decision-makers who are making difficult choices and trade-offs.

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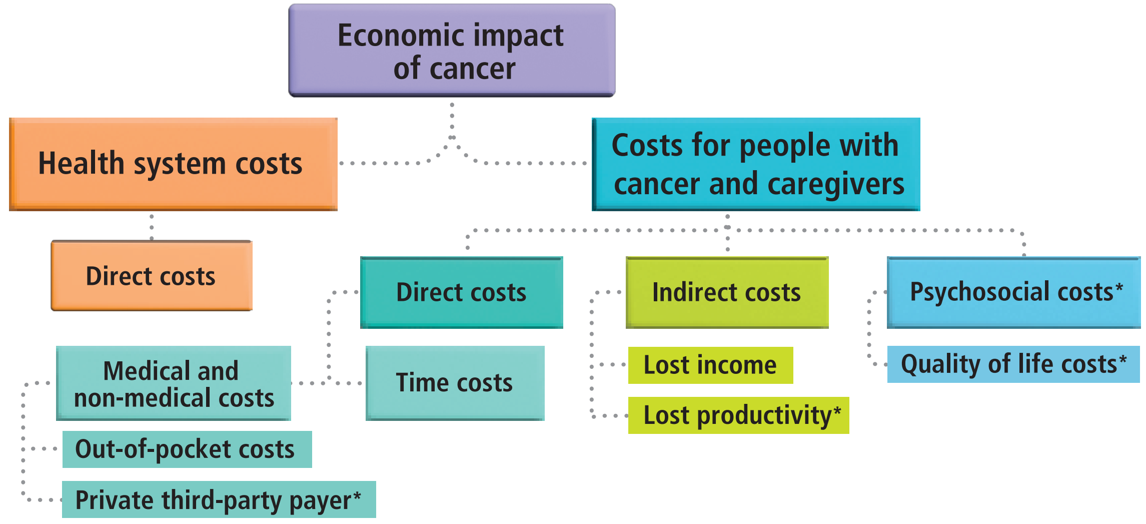
Background: Why is estimating economic impact important?

Cancer is a life-changing event that places tremendous physical and emotional burdens on the individual.(4) In Canada, cancer is a leading cause of morbidity and mortality and imposes a considerable impact and strain on the health of Canadians and the Canadian healthcare system.(1) The impact of cancer also refers to the multitude of ways that cancer and the cancer experience affects people with cancer, families and caregivers.(5)

The economic impact or "cost" of cancer is an important aspect of the overall effects of cancer.(5) In general, the economic impact of cancer encompasses the following broad categories (Infographic A): direct costs to the health systems, and direct, indirect costs and psychosocial costs for people with cancer and caregivers.(5)

INFOGRAPHIC A Breakdown of the societal costs contributing to the economic impact of cancer



*Data not available for this report

Note: Private third-party payer (e.g., private insurance) costs may cover some costs for people with cancer and caregivers. However, some people may still need to pay up front or incur co-payments or deductibles.

Societal costs

Combining direct health systems costs and costs for people with cancer and caregivers gives an estimate of the cost of cancer to society and its economic impact.

Health systems costs

Direct health systems costs

Direct health systems costs are health-related cancer management costs, including the costs of services provided in hospitals and by physicians. These costs could also include home care and complex continuing care, systemic drug therapies (e.g., chemotherapy, immunotherapy, targeted therapy), radiation therapy and some prescription drugs.(7)

Costs for people with cancer and caregivers

Note that academic researchers often refer to what people with cancer pay as "patient costs." We prefer to use person-first language. So for the purposes of this report, the terms "people with cancer" and "patients" should be viewed as synonymous unless expressly stated otherwise.

Direct out-of-pocket costs

Direct out-of-pocket costs are medical and non-medical expenses that are borne by people with cancer (patients) and caregivers.(8) These expenses could include prescription drugs, home care, homemaking services, devices, family care, travel-related expenses and accommodations, vitamins and supplements.

Direct time costs

People with cancer spend time travelling to and from care, waiting for care and receiving care, which represents time not spent pursuing other activities.(9) This time spent getting to, waiting for and receiving care is referred to as "patient time cost." Prior research has shown that patient time costs can be substantial.(9)

Indirect costs

Indirect costs include lost earnings from employment for people with cancer and caregivers. Indirect costs also include costs due to lost productivity. This report does not include lost productivity costs due to lack of adequate data.

Perspectives of people affected by cancer

Harjeet Kaur was diagnosed with an aggressive and rare form of non-Hodgkin lymphoma. She experienced many out-of-pocket costs, including having to pay for medication and travel.

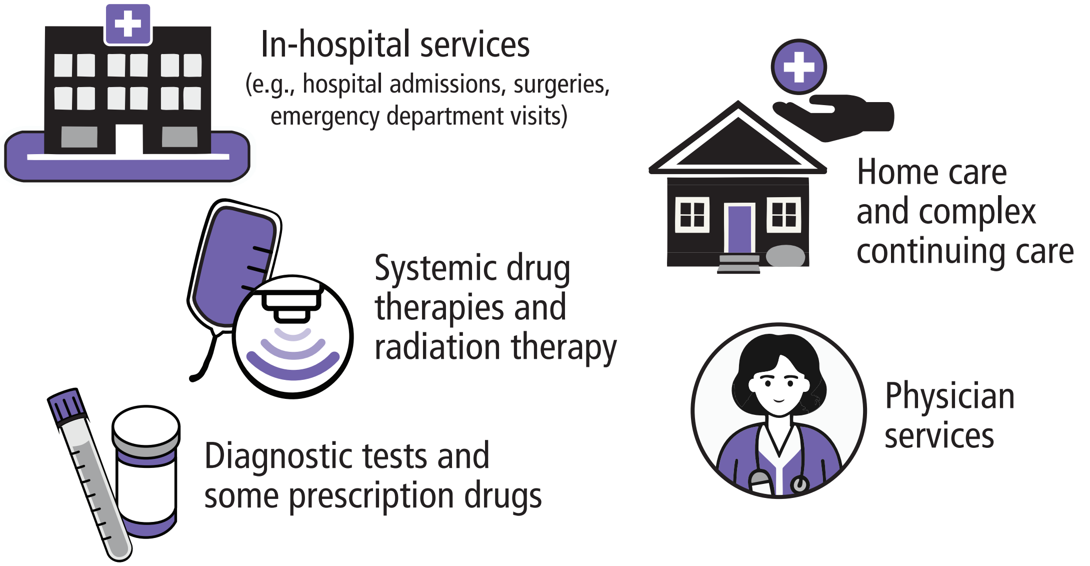
> *"Cancer affects you physically, financially and mentally. You're already going through the trauma of being diagnosed with cancer, and then on top of that there is the cost of treatment."*

For the analyses and reporting in this report, we used the following broad definitions and included cost examples (Infographics B and C). In brief, direct health systems costs are health-related cancer management costs, which include costs of services provided in hospitals and by physicians (Infographic B).(6) By and large, direct costs paid by people with cancer and caregivers include the use of resources for medical and non-medical care (Infographic C) and the time spent going to appointments and getting treatments.(5) Indirect costs for people with cancer and caregivers include those that result from the loss of income, resources and opportunities due to cancer.(5) The indirect costs of cancer are often underappreciated. However, these costs can have a considerable impact on lost economic productivity and output for the individual. Moreover, these indirect societal measures can have a meaningful impact on the health and economic productivity of the population.

Psychosocial costs are entirely borne by people with cancer and caregivers. This category of costs is the least well understood even though it impacts 44% of those affected by cancer.(5) Psychosocial costs are intangible costs associated with cancer and include impacts to quality of life (e.g., physical, psychological, spiritual and social well-being).(5) Although we were unable to quantify the psychosocial impact of cancer, this report highlights the importance of adopting a broader societal perspective in economic evaluations to account for the significant economic impact borne by people with cancer and caregivers.

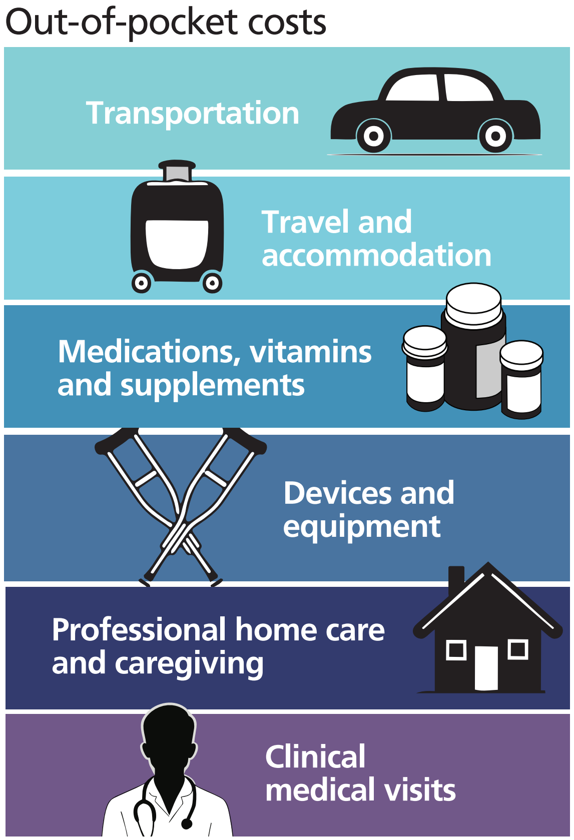
Canada has a publicly funded healthcare system where the costs are covered by a single public system (i.e., single-payer system). The economic impact of cancer in a single-payer healthcare system has considerable implications in terms of the allocation of care and adoption of new treatments and approaches. Leaders of health systems have the challenging task of prioritizing resources to get the best clinical outcomes possible for people with cancer while working to manage costs to the system and balance spending across many competing priorities. The estimates of the economic impact of cancer in this report highlight the considerable impact on health systems and resource requirements across the continuum of cancer care. Furthermore, the projections included in this report will be helpful for planning health human resources and economic resources required in future budgets. Supportive policies to minimize financial impacts on people with cancer and caregivers will be important because the number of people in Canada living with and beyond a cancer diagnosis continues to increase.(3)

INFOGRAPHIC B Examples of direct health systems costs



A better understanding of the cost of cancer from a societal perspective will help to illustrate the financial impact on health systems and people with cancer, caregivers and communities. This information will guide cancer-related polices and investments to improve cancer prevention and care. Furthermore, these estimates are essential in broadening awareness around the expanding costs related to cancer care in Canada as our population continues to grow and age.

INFOGRAPHIC C Examples of out-of-pocket costs related to medical and non-medical care for people with cancer and their caregivers



Considerations related to estimating economic impact

In this report, we provide national-level estimates of the economic impact of cancer. We encourage readers across Canada and beyond to reflect on the variability within their region. We acknowledge that the costs of care, including the costs of medicines, can vary by province and territory. The models used in this report reflect common care pathways, standards of care and healthcare resource utilization costs from people in Ontario up to the year 2022. While specific care pathways may differ somewhat by province, cancer-related standards of care and treatment protocols are expected to be largely similar across Canada.(10) In Canada, there are common approval processes for therapies and national medical organizations that work to share knowledge and practice guidelines across the country, such as the Canadian Associations of Medical Oncology, Radiation Oncology, and Surgical Oncology and other allied health professionals. However, there may remain important variations in costs per patient between provinces and territories that are not captured within this report.

The estimates included are projections based on the comprehensive, high-quality national population-level data, as well as cancer incidence and stage mortality data from Statistics Canada. Estimates of health systems costs have been extracted on a per-cancer type basis from ICES (previously known as the Institute for Clinical and Evaluative Sciences) up to the end of 2022 for 24 of the most common cancer types. Out-of-pocket costs are based on several Canadian publications.(8, 11–13) All cost estimates and projections were converted to 2024 Canadian dollars using the Consumer Price Index (CPI) for Health and Personal Care, as well as All Items using a background annual inflation rate of 2.7%.(14)

Perspectives of people affected by cancer

Vanessa Percoco was diagnosed with advanced colorectal cancer in 2022. In 2023, she paid over $4,000 for prescription drugs. She also had major expenses related to having an ostomy, including needing new ostomy bags every four days, physiotherapy sessions, osteopathic consultations and visits to a nutritionist. Vanessa had never imagined having to pay so much money out-of-pocket when she was diagnosed with cancer.

> *"It was a huge financial load to carry. There were months when I wondered how I was going to pay the rent. The end of every month was a source of stress because I knew I'd have to call my dad and ask him for the money I was short."*

A detailed description of the methods, including sensitivity analyses conducted to evaluate our modelling assumptions, are available in the Appendix.

In this report we do not specifically discuss or address cancer in children or adolescents and young adults (AYAs). The modelling approaches used focus on the most common cancers in Canada, which are most often diagnosed in adult populations. We acknowledge that children and AYAs with cancer often have very complex care pathways. Cancer can have considerable lasting effects on their quality of life, including the fear of cancer recurrence,(16) as well as long-lasting economic impacts on the individuals, their families and their caregivers. While these impacts may be considerable for the numerous children and AYAs diagnosed with cancer each year and their families, children and AYAs were not included expressly in the discussion of findings. We believe pediatric cancers and cancers among AYA require their own focused analysis.

Box A Measuring the economic impact of cancer using OncoSim

All estimates included in this report are projected estimates that have been generated using OncoSim, a web-based Canadian cancer suite of microsimulation tools led and supported by the Canadian Partnership Against Cancer, with model development by Statistics Canada.(15) For this report, we used the OncoSim All Cancers model (one of five OncoSim modules), which projects health and economic outcomes for 32 cancer sites that were grouped into 27 cancer types (see *Data sources and methods* for more details).(15) The model simulates a hypothetical Canadian population one person at a time, estimating if and when an individual will develop cancer in their lifetime and if the individual will die from cancer or other causes. OncoSim includes detailed data on the societal costs (both health systems costs and costs for people with cancer and caregivers). All of this information is aggregated to provide representative, population-based results. Overall, the OncoSim model uses rich, high-quality population-level demographic and cancer data from Statistics Canada combined with cancer treatment and societal costs to project the economic impact of cancer in Canada. More details on the methodology can be found in the Appendix.

The report focuses on the data that were available across phases of cancer care, including updated data about costs to health systems and rich data on costs for people with cancer and caregivers (including direct out-of-pocket and time costs, and indirect costs). However, data on costs before a cancer diagnosis were unavailable. These could represent significant costs to health systems, and people with cancer and caregivers, and so warrant quantification and exploration in future research.

The duration of care received by individuals may differ from the defined care phases included in the report. For instance, depending on the complexity of their case and their individual needs, some people with cancer may have active treatment for longer than the 12 months used for the initial care phase. Similarly, in the last year of life phase, some people may only be eligible to receive end-of-life care for 6 months, while others may not need any additional care during this time. The costs presented in this report are meant to reflect the costs of cancer averaged over the varied experiences of those affected by cancer and across health systems in Canada. Therefore, it should be noted that the range in costs, including those by care phase and cancer type, could differ based on geographic regions and across individual experiences. We have included discussion throughout the report and embedded personal perspectives to contextualize the findings.

This report also projects the expected societal costs of cancer over the coming decade (2024 to 2034) using OncoSim. The projections were done assuming the current state of cancer care remains unchanged, while accounting for future population demographics and inflation. The projections do not account for expected advancements and changes in diagnosis and treatment. Assumptions regarding inflation and population growth used for these projections are included in the Appendix. Sensitivity analyses was conducted to examine the impact of these assumptions on the projected societal costs. Details and results of these sensitivity analyses can be found in the Appendix.

While no modelling approach is without assumptions and limitations, the projections included in this report represent comprehensive estimates of cancer costs and economic impact in Canada.

Economic impact of cancer in 2024 from a societal perspective

Overall economic impact of cancer

The economic impact of cancer has implications for individuals, health systems and society. Figure 1 shows the overall economic impact of cancer from a societal perspective, including health systems costs, as well as out-of-pocket costs, time costs and indirect costs for people with cancer and their caregivers.

> The societal cost of cancer is projected to reach $37.7 billion in 2024.

Key findings

- In 2024, the total societal cost of cancer is expected to be $37.7 billion.
- Health systems costs are expected to account for the largest component of societal costs for cancer, estimated at $30.2 billion.
- Costs for people with cancer and caregivers are estimated at $7.5 billion, and are expected to account for approximately 20% of societal costs.
- Out-of-pocket costs represent a substantial portion of the economic impact that individuals face during their cancer experience.
- Costs vary by cancer type, with the four most commonly diagnosed cancers in Canada (breast, colorectal, lung and prostate) expected to have the largest overall economic impact in 2024.
- Blood cancers are expected to have some of the highest per person health systems costs over an individual's lifetime.

The total societal cost of cancer in Canada is expected to be $37.7 billion in 2024. Health systems costs are expected to account for the largest component of societal costs for cancer. The direct health systems costs are expected to be $30.2 billion (80%), while the direct out-of-pockets costs are expected to be $3.7 billion (10%), indirect costs due to lost earnings are expected to be $1.3 billion (3%) and direct time costs are expected to be $2.5 billion (7%). These proportions of costs are meant to reflect the average costs to Canadian society. However, we acknowledge that variations exist by province and region.

Costs for people with cancer and caregivers are expected to be $7.5 billion, which accounts for approximately 20% of the total societal cost. Out-of-pocket costs are expected to account for the largest proportion (49%), followed by time costs (34%) and indirect costs (18%).

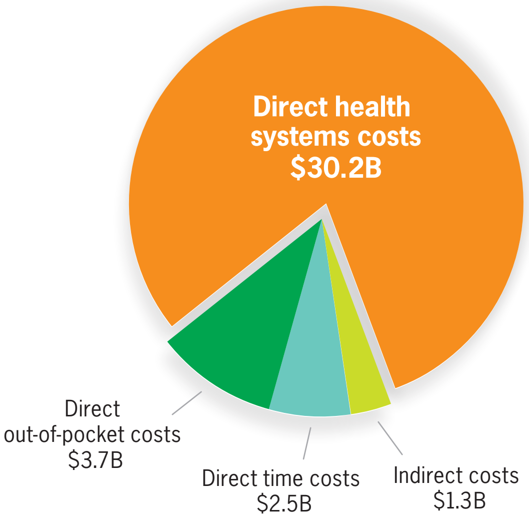
> Costs for people with cancer and caregivers are expected to account for 20% of the societal cost of cancer in 2024.

Impact on health systems and people affected by cancer

In Canada, healthcare is funded through tax revenues and administered by the federal government through transfers to the provinces and territories.(17) According to the Canada Health Act, the provinces and territories are responsible for delivering medically necessary hospital and physician services, which are reflected in direct health systems costs.(17) However, with evolving healthcare delivery models, there are healthcare services delivered beyond hospital or physician care and outside the Canada Health Act.(17) Therefore, out-of-pocket costs represent a substantial and growing portion of the economic impact that people face during their cancer experience. These costs include, but are not limited to, expenses related to medical care like drugs, devices and nutritional supplements, as well as costs related to homemaking, daycare services, travel and accommodations.

Direct health systems costs associated with hospitalization, systemic drug therapies, radiation therapy and surgery make up the largest component of cancer costs in Canada. As treatment modalities and therapeutic strategies evolve, a growing number of people with cancer will receive longer courses of therapy with hormonal or targeted drugs, as well as take-home anticancer medications. There have been many advances in clinical management and an expanded focus on person-centred care. These expansions, which include a broader scope of surveillance and resources provision, have led to improved outcomes reported by people with cancer.(5) However, this has come at a cost to both health systems and to people with cancer and caregivers. Canada spent 11.2% of its gross domestic product (GDP) on healthcare in 2022 and was among the group of higher-spending countries as reported by the Organization for Economic Co-operation and Development (OECD).(18) Despite this substantial investment, it only covered 73% of the total cost of healthcare, generally.(18) The remaining unaccounted healthcare costs, beyond just cancer-related care, were borne by patients and caregivers,(18) which often disproportionally impact socially disadvantaged populations. The findings in this report echo this substantial economic impact on patients and caregivers, with an expected 20% of cancer-related costs in 2024 related to out-of-pocket, time and other indirect costs for people with cancer and caregivers.

FIGURE 1 Projected economic impact of cancer from a societal perspective, including direct health systems costs, direct out-of-pocket costs, direct time costs and indirect costs, Canada, 2024



Analysis by: Canadian Partnership Against Cancer

Data sources: Multiple sources of data were used to develop this figure. For further details, see *Appendix: Data sources and methods*, Table A2.

While cancer treatments administered in hospitals are fully covered by public budgets and provided at no cost to people with cancer, take-home drugs are covered through a mix of public and private reimbursements with the potential for interprovincial variations, which adds to the complexity of cancer treatment and coverage.(19) Moreover, the provincial and territorial insurance plans differ based on multiple factors, such as differences in coverage for drugs and diagnostic tests, the types of home care services covered and reimbursement for travel from rural settings.(17) Consequently, people with cancer and caregivers may have different levels of access to important supports and care. For instance, take-home cancer drugs are emerging as a standard treatment option for many cancer types and account for half of the cancer drugs on the market, but they are not covered consistently.(20) Public funding available for take-home cancer drugs varies across provinces and territories.(20, 21) There is also considerable variation in who may be eligible for subsidies for home care services and medical equipment, resulting in many of these costs being borne by people with cancer and caregivers. Although private insurance plans may fund these services, most people in Canada have access to private insurance only through employment. This means that people who reduce their working hours or need to leave their jobs because of cancer or its treatment are vulnerable

Perspectives of people affected by cancer

> *"My main costs were driving costs, some medications that were not covered. Some meds were costly, but I chose not to use them."*
>
> ***—Anonymous***

to losing such coverage. Moreover, people with cancer and caregivers may still incur costs such as co-payment or deductibles as required by their private insurance plan.

Financial toxicity(5,21,23) may lead to physical and psychological harm, affecting decisions that can impact treatment selection and adherence, which could lead to worse outcomes. People might choose to have or not have certain treatments based on cost. For instance, the choice of surgical procedure for treating breast cancer (full mastectomy vs surgery with follow-up treatments) may be influenced by access to therapeutic interventions. A report from The Canadian Partnership Against Cancer and others noted that women with longer travel times to a radiation facility were much more likely to choose to have mastectomy.(24,25)

The Experiences of Cancer Patients in Transition Study asked 13,000 survivors across Canada about their experiences living with and beyond active cancer treatment.(4) The study found that 4 in 10 people reported having practical challenges after their treatment ended, and they most commonly reported concerns about returning to work and getting life insurance.(4) People reported paying healthcare bills and obtaining life insurance as some of the most challenging practical concerns.(4) The impact of travel was also a significant concern: almost 70% of people with cancer reported that they had to travel for tests or treatments.(4) People found travelling for treatment and arranging accommodations near the treatment centre to be financially and logistically challenging and to add significant distress.(4) Other Canadian studies have shown that the financial impact for people with cancer and caregivers can exceed $2,000 per month when out-of-pocket costs and lost income are taken into account.(11,26–29) Additionally, 33% of people with cancer in a national study found the financial strain from out-of-pocket costs to be high despite having publicly funded healthcare.(12)

Financial toxicity

Financial toxicity describes the distress and hardship arising from the financial impact shouldered by people with cancer and caregivers.(9,21,22) Financial toxicity can arise from out-of-pocket expenses, employment disruptions, productivity losses and the changing financial circumstances of individuals due to cancer diagnosis, treatment, continuing care and palliative care.(9,21,22)

Perspectives of people affected by cancer

> *"It makes me sick to know that someone without a decent drug plan might be suffering intractable nausea or receiving less than the gold standard in bone marrow stimulation because they don't have a drug plan that pays. I am concerned as to what will happen to me financially when my paycheck flips to employment insurance over short-term disability and that my long-term disability claim through work has the possibility of being denied. This will derail me financially for a while, it will pass – but it's a constant stress at a time when I need to focus on wellness and this disease."*
>
> —***Anonymous***

In addition to the financial toxicity of cancer, there is growing recognition of the substantial amount of time spent pursuing cancer therapies. This includes travel and wait times, hospitalizations, follow-up appointments and rehabilitation.(30) The loss of time incurred receiving treatments or treatment-related time toxicity may be most relevant for people with advanced cancer or who have been diagnosed with an incurable solid cancer where the survivorship benefit of most treatments can be modest.(30) In some instances, the time toxicity associated with a more intensive treatment could outweigh the potential survival benefit.(30) Therefore, some people with cancer may choose to forgo more intensive treatments that only marginally improve survival.(30) Consequently, where (hospital vs home) and how time will be spent are important considerations for those who face treatment decisions in the context of limited time.(30) Time toxicity can also apply to caregivers and support people, who often have to coordinate their schedule with that of the person with cancer or even have to pause school or career plans in some cases.(30)

Time toxicity

Time toxicity describes the loss of time incurred while receiving cancer treatments and other supportive care.(30) It can include time lost coordinating care and receiving care, which can include travelling to and waiting for appointments, as well as time lost due to hospitalizations, follow-up care and rehabilitation.(30)

At-risk populations

At-risk populations, in the context of this report, are those that are differentially impacted by the cost of cancer. Although we were unable to examine the differential economic impact of cancer across populations in the modelling, we acknowledge it deserves careful consideration and its own focused analysis.

Economic and income disparity continues to impact cancer experiences and outcomes in Canada. Data from multiple analyses show that cancer survival and favourable treatment outcomes are diminished at the lower end of the income scale.(31–34) These disparities exist across most cancer types and also include those where population-based screening programs exist. Disparities will often have a compounding effect for those who are economically and socially disadvantaged. For instance, such people may have a higher prevalence of risk exposure and be less likely to have a primary care provider to support screening, early diagnosis and survivorship care, or to receive curative treatments. As a result of these compounding effects, people who are economically and socially disadvantaged may ultimately have worse long-term outcomes.

For people with lower income, the considerable out-of-pocket costs related to cancer can represent a large proportion of their disposable income. People with fewer available financial resources, and those in precarious economic, living or employment situations, may choose to delay or forgo additional therapeutic options due to the associated costs, increasing the likelihood of worse outcomes. Recent evidence from a Canadian cancer study suggests that individuals with family incomes less than $50,000 per year were more likely to forgo care, report increased financial hardship and take time off work, all of which further exacerbates the financial impact of cancer.(17) Up to 20% of people with lower income in the study decided to go without medications and 29% chose to not to take vitamins and supplements.(17) A review of the national and international literature conducted by the Canadian Partnership Against Cancer found that, on average, people with cancer in Canada spent $253 per month out-of-pocket on medications, caregiver expenses, getting to appointments and other transportation costs.(35) People with lower income spent a greater proportion of their household income in the form of out-of-pocket costs than in other countries.(35) Costs were even higher for caregivers and people living in rural and remote areas.(35)

Disparities in access to cancer care and related health status also exist between rural and urban populations in Canada.(36,37) The urban/rural population distribution varies considerably among the provinces and territories.(38) For instance, in the Atlantic provinces the highest proportion of the population (up to 55% in 2021) lives in rural areas.(34) Whereas Ontario, Quebec, Alberta and British Columbia have the lowest share of rural residents, with only 13% to 19% of the population living in rural areas in 2021.(38) Moreover, Canada's rural population is experiencing faster growth than other countries with similar economies.(38) In addition to economic and employment challenges, rural and remote populations can face barriers accessing care, including limited public transportation and longer travel times at higher costs, as well as fewer available healthcare resources and cancer treatment facilities.(39,40) These challenges can have a significant financial impact on people with cancer and caregivers, which may affect their treatment decisions and even force some people to forgo treatment altogether.

Perspectives of people affected by cancer

> *"Financial impact is huge, I am in considerable debt because I could not work during treatment. I applied for grants, medical, employment insurance, and mortgage insurance disability coverage. There was a lot of red tape delays, so I ended up waiting 3 months without pay to get coverage. This impacted my choices in medication and complementary therapy when I was supposed to be focused on my health. Extremely stressful. I won't be able to return to full time work for 18-24 months and this has impacted my career negatively. I am grateful to be alive and of all the support I have received. There seems to be a lot of barriers to funding for cancer patients."*
>
> —***Anonymous***

There are appreciable differences between rural communities based on many factors, including, but not limited to, geography and proximity to urban areas, population demographics and availability and utilization of health services. These differences present considerable challenges in planning, resourcing and delivering healthcare, especially for remote areas or areas with small populations.(36) Consequently, rural Canadians are limited to a smaller range of healthcare providers and services.(40) For example, because of the barriers to accessing care, people living in rural or remote areas are less likely to access or participate in cancer screening.(39)

Hospital closures in rural areas and the centralization of specialized health services in urban areas – as well as a shift toward a greater concentration of essential health services, hospitals and physicians in urban centres – have meant people in rural areas have farther to travel to providers and care facilities and so creating further barriers to access.(40)

Perspectives of people affected by cancer

Vickie Iachetta was diagnosed with breast cancer in 2015. While she was able to have surgery and chemotherapy in her hometown, she had to travel to Kelowna for her radiation treatment. This was a major expense, and one that she couldn't afford when she had to stay away from home for a month.

> *"This was a huge expense for us. The drive is four and a half hours by car, when the roads are good," she explains. "We booked a hotel for the first three appointments, because they were just a night or two. But when I went for an extended stay during the peak summer months, the cost was significantly above what we could afford."*

Along with her travel expenses, Vickie also faced the cost of medications during her treatment. While her extended health benefits covered a portion of their cost, she paid out-of-pocket for prescription pain medication, antibiotics, wound dressings and more.

First Nations, Inuit and Métis populations in Canada are often impacted by a combination of systemic, economic and geographic barriers to accessing optimal cancer care. These barriers are known to affect experiences and outcomes from cancer.(41) For those living in the most northern parts of Canada, travel for treatment can involve significant distances and lengthy travel times, require translation supports, travel companions and accommodations. Additionally, First Nations, Inuit and Métis people may find it difficult to access traditional foods and medicines when they receive cancer treatment far away from their homes. Being far away from home also means a lack of support and isolation from caregivers, support people and the community during treatment, which can result in worse outcomes.(42) Individuals may face additional challenges due to communication and language barriers, lack of cultural safety and cultural supports, as well as discrimination and systemic racism.(42,43) These barriers can lead to poor outcomes, as well as further costs and financial distress, for the individual. Longer courses of therapy or advanced treatment options may also lead to additional financial distress, which may affect the treatments selected. For instance, the necessary time off from work to get lengthy treatments can become an insurmountable barrier that prevents some First Nations, Inuit and Métis people from receiving advanced care. We must make efforts to understand where these financial barriers and costs are most felt by First Nations, Inuit and Métis people, and how we can develop and implement equitable policies to mitigate their effect.

While ideally we would want to make care more available in areas of lower population density to meet the needs of at-risk populations, many cancer services require centralized facilities with sufficient staffing. Many specialist services depend on sophisticated high-cost technologies that are only available at centralized cancer centres serving larger communities. Therefore, without adequate financial supports, those living in rural and remote areas and other at-risk populations are often less able to access specialized cancer treatment options that may improve outcomes but require significant travel or time away from work. They may also not have access to innovative treatments, such as those offered through randomized controlled trials.(40,44)

Perspectives of people affected by cancer

> *"Can you imagine if you were diagnosed with cancer and you're on a pension or on social assistance? You're on a fixed income, there's no extra money for the medical trips. Everywhere we go, we have to travel – a five-minute appointment, we have to travel to Saskatoon. You know, it's so costly, nobody can afford that with the cost of gas and the cost of groceries nowadays. I think number one, is that people should be educated – and also get extra financial help for the people that are struggling with cancer. Some people still hitchhike to go to chemo; that's not acceptable."*
>
> — ***Terri Hansen-Gardiner***
> *Métis Knowledge Keeper*
> *and Cancer Survivor*

Economic impact of cancer by type

The economic impact of cancer varies by cancer type. This variation is due to a number of factors, such as the incidence of the cancer, the duration and intensity of the treatment, the demographics and comorbidities of the people with cancer, the stage of the cancer at diagnosis and survival time. The costs presented in this section reflect the average costs for each cancer type in Canada. Although we present average costs, the range in costs by cancer type could differ across each individual's experience and based on geography.

In 2024, health systems costs are expected to range across cancer types from $30 million to over $5 billion (Figure 2). Incidence is one of the most important determinants of cancer-specific costs for health systems. As a result, the four most commonly diagnosed cancers in Canada (breast, colorectal, lung and prostate) are expected to have a big economic impact on health systems. These four cancers combined are expected to account for 47% of health systems costs and are projected at $14.2 billion in 2024.

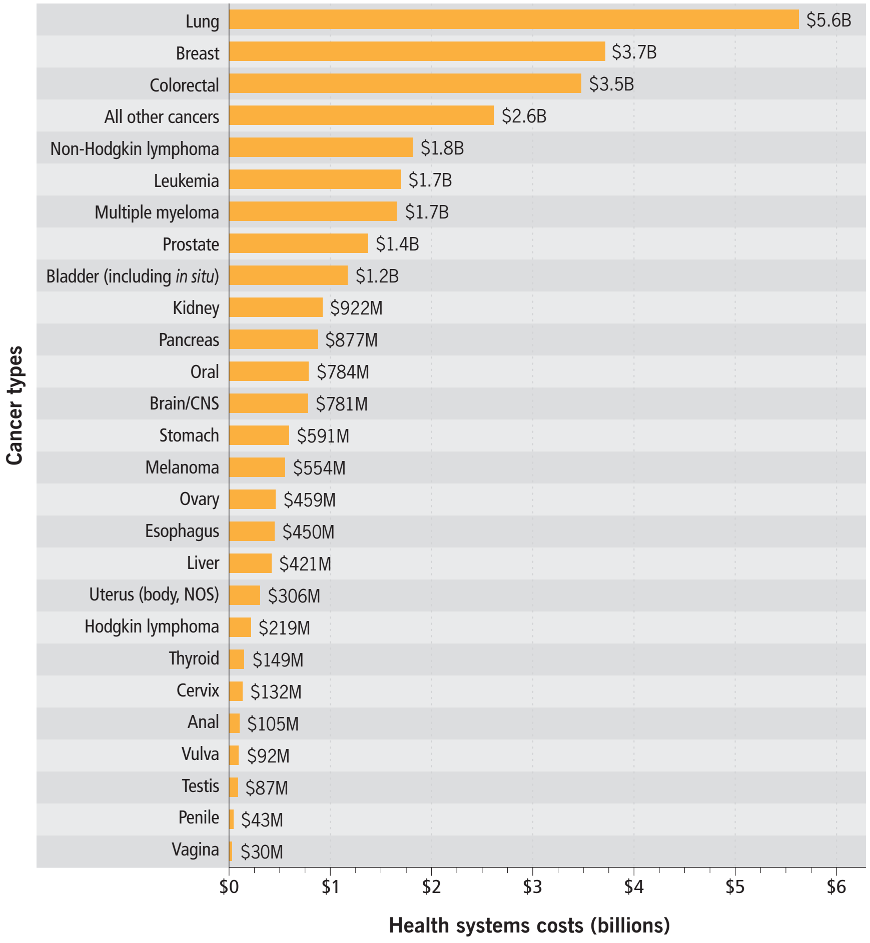
Perspectives of people affected by cancer

Natalie Lipschultz was diagnosed with stage 3 colorectal cancer and lost her job while undergoing treatment.

> *"I needed my benefits because of what I was going through. At the time I was like, 'What am I going to do?' I needed drugs that I was paying for myself privately. It was very scary. My husband was going back to school at the time, so there was just lots and lots of financial strain to afford our bills. Thankfully, we had some extended family that helped us out a little with mortgage payments and things like that, but I know not everybody has that."*

The most commonly diagnosed cancers (lung, breast, colorectal and prostate) are expected to account for almost half of all health systems costs in 2024.

FIGURE 2 Projected direct health systems costs by cancer type, Canada, 2024



CNS=central nervous system; NOS=not otherwise specified

Analysis by: Canadian Partnership Against Cancer

Data sources: Multiple sources of data were used to develop this figure. For further details, see *Appendix: Data sources and methods*, Table A2.

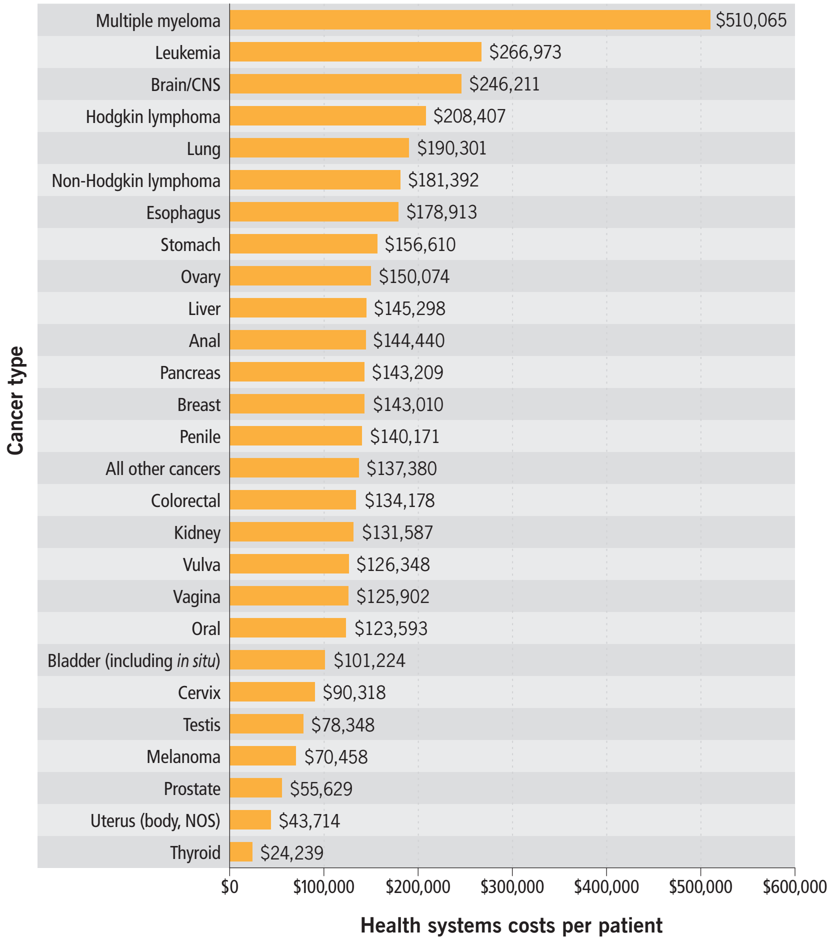
View data

Per patient costs

Per patient costs are reported as the costs expected over the projected lifetime of the person with cancer. Costs per patient are calculated by summing the costs incurred over the simulated lifetime of all people expected to be diagnosed with cancer in 2024 and dividing by the total number of people expected to be diagnosed with cancer in 2024.

Health systems costs per person with cancer also differ by cancer type (Figure 3). There is a 21-fold variation in projected health systems costs between cancer types from an average of about $24,000 to $500,000 per person over the lifetime of the person. On average, multiple myeloma, leukemia, brain/CNS cancer, lymphomas and lung cancer are expected to be the most expensive cancer types for health systems per person over their lifetime. Per patient costs paid by health systems can be affected by the duration, complexity and intensity of treatment. Care for hematologic (blood) cancers is particularly complex and often lasts a long time, which leads to high per patient costs for health systems over the lifetime of the person with cancer. For example, treatment for a blood cancer could include a stem cell transplant, which requires in-hospital services and are a major contributor to health systems costs.(45)

FIGURE 3 Projected direct health systems costs of cancer per patient over the lifetime, by cancer type, Canada*



View data

CNS=central nervous system; NOS=not otherwise specified

*Figure shows projected per patient costs for health systems estimated over the lifetime of the person for individuals simulated to be diagnosed with these cancer types in 2024.

Analysis by: Canadian Partnership Against Cancer

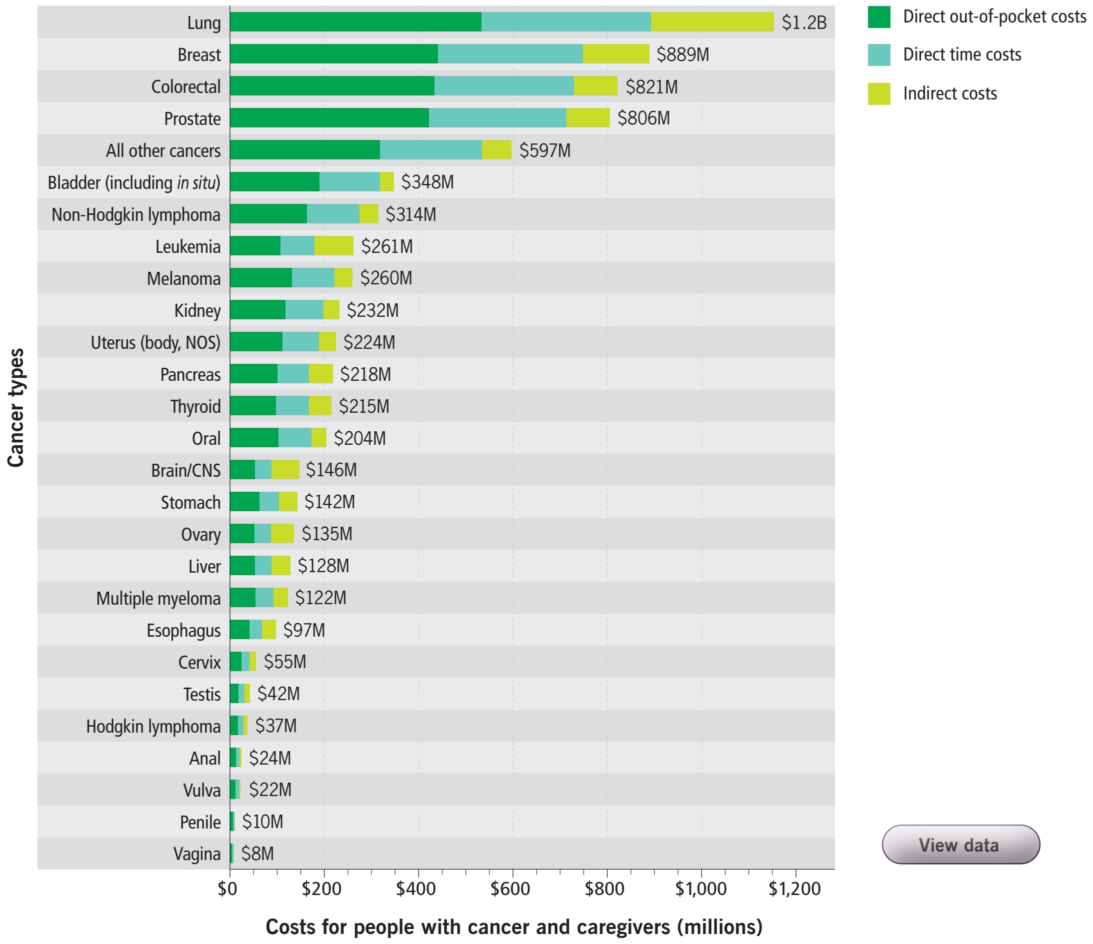
Data sources: Multiple sources of data were used to develop this figure. For further details, see *Appedix: Data sources and methods*, Table A2.

Costs for people with cancer and caregivers also differ across cancer types. On average, these costs are projected to range from about $8 million to over $1.1 billion in 2024, with out-of-pocket costs representing the highest proportion of these costs (Figure 4). The cost borne by people with cancer and caregivers for the four most commonly diagnosed cancers is expected to amount to $3.4 billion in 2024, representing 46% of total costs paid by people with cancer and caregivers.

We were unable to calculate per patient costs for people with cancer and caregivers by cancer type because some of the costs were not available for each cancer type, which is a key limitation and data gap that would be important to address in future research. However, we were able to calculate per patient estimates of costs for people with cancer and caregivers over the lifetime of the individual, averaged across all cancer types. Over the lifetime of each person, an average of $11,199 in time costs, $16,018 in out-of-pocket costs and $5,560 in indirect costs are expected to be incurred by people with cancer and their caregivers. In total, and averaged across all cancer types, an individual is expected to incur $32,778 in costs related to cancer over their lifetime.

Over their lifetime, people with cancer and their caregivers are projected to incur an average of $32,778 in costs related to cancer.

FIGURE 4 Projected population costs for people with cancer and caregivers (direct out-of-pocket costs, direct time costs and indirect costs), by cancer type, Canada, 2024



CNS=central nervous system; NOS=not otherwise specified

Analysis by: Canadian Partnership Against Cancer

Data sources: Multiple sources of data were used to develop this figure. For further details, see *Appedix: Data sources and methods*, Table A2.

Economic impact of cancer by phase of care in 2024

Cancer health systems costs by phase of care in 2024

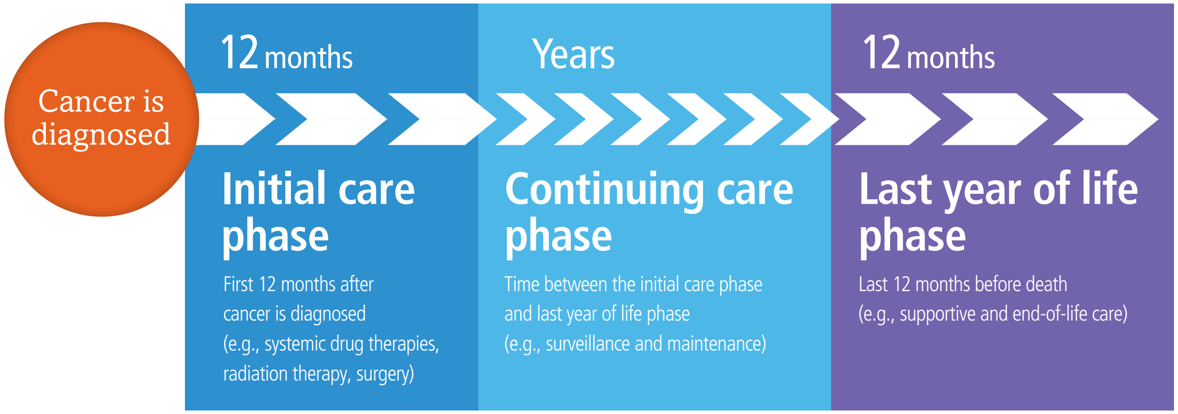
The experience of people with cancer and their caregivers varies greatly and is so much more than a singular moment or treatment. As an individual goes through one or more treatments, as well as supportive care, the economic impact and its landscape becomes more complex and has effects at the individual, caregiver and societal levels. While many people have been touched by cancer, each experience is unique. It is important to acknowledge and, as far as possible, quantify how this experience plays out. Therefore, this report aimed to quantify the costs across the three phases of care:

- initial care phase (first 12 months after diagnosis)
- continuing care phase (time between initial and last year of life, which can span years for some people)
- last year of life phase (last 12 months of life before death)

Key findings

- In 2024, the continuing care phase is projected to be the most expensive at $12.6 billion in expected costs for health systems.
- For people with cancer and caregivers, the initial care phase is expected to incur the highest expense due to the intensity of out-of-pocket costs.
- Costs for people with cancer and caregivers are projected to be $5.2 billion in the initial care phase in 2024, just under half of the costs borne by health systems in the initial care phase.

INFOGRAPHIC D Phases of care*



Cancer is diagnosed

12 months

Initial care phase

First 12 months after cancer is diagnosed (e.g., systemic drug therapies, radiation therapy, surgery)

Years

Continuing care phase

Time between the initial care phase and last year of life phase (e.g., surveillance and maintenance)

12 months

Last year of life phase

Last 12 months before death (e.g., supportive and end-of-life care)

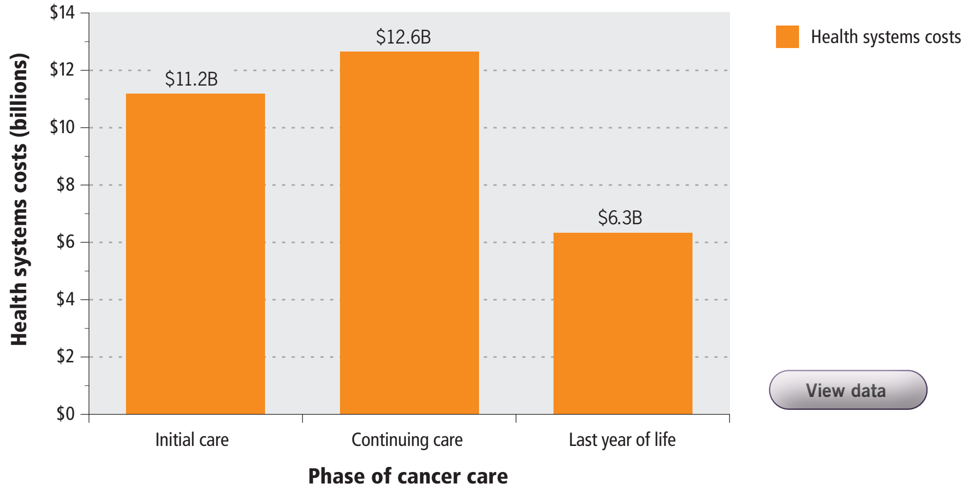
*Phases of care may vary by cancer type and this variation is not captured in this report.

Box B Phases of care

We examined three phases of care (initial, continuing and last year of life) that are commonly used in the economic analysis of cancer costs. However, not all people with cancer will follow the same timing and experience. For instance, many people will not need end-of-life care in their last year of life, some will receive it for only a few months, while others still may receive palliative and supportive care across all phases. Moreover, the precise phases of care and the duration of care received in each phase differ by cancer type.

In 2024, health systems costs are expected to be greatest in the continuing care phase at a projected $12.6 billion, followed by $11.2 billion in the initial care phase and $6.3 billion in the last year of life phase (Figure 5). Costs for people with cancer and caregivers in the initial care phase are projected to be $5.2 billion in 2024, which is just under half of the costs borne by health systems in the initial care phase. In addition, costs borne by people with cancer and caregivers (out-of-pocket, time and indirect costs) are expected to be greatest in the initial care phase (Figure 6). Out-of-pocket costs are expected to account for approximately 56% of costs ($2.9 billion) in the initial care phase. While we were unable to estimate prediagnosis costs due to data being unavailable, a previous study examining costs in the three-month period before a cancer diagnosis in Ontario found that mean prediagnosis costs were $2,060 for all people with cancer in 2009, which would be approximately $2,760 in 2024.(46)

FIGURE 5 Projected direct health systems costs by phase of cancer care,* Canada, 2024



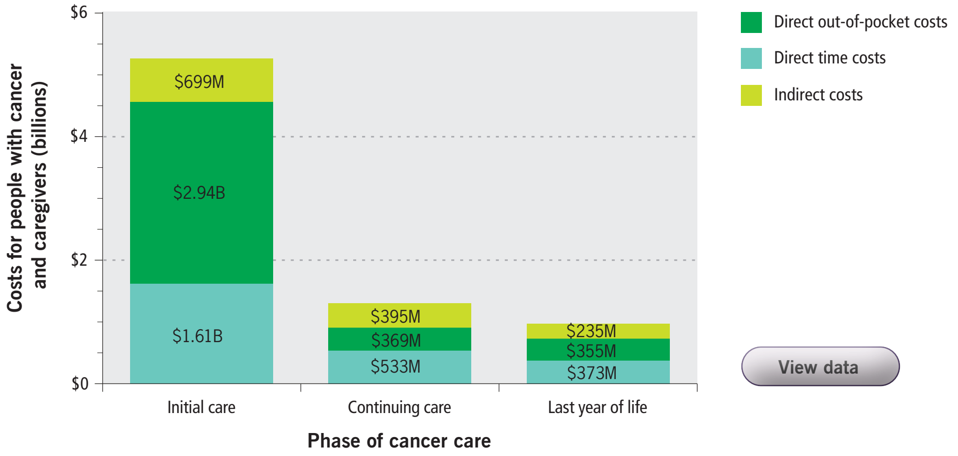
View data

*Costs for the prediagnosis phase were not available.

Analysis by: Canadian Partnership Against Cancer

Data sources: Multiple sources of data were used to develop this figure. For further details, see *Appendix: Data sources and methods*, Table A2.

FIGURE 6 Projected population costs for people with cancer and caregivers by phase of cancer care,* Canada, 2024



View data

*Costs for the prediagnosis phase were not available.

Analysis by: Canadian Partnership Against Cancer

Data sources: Multiple sources of data were used to develop this figure. For further details, see *Appendix: Data sources and methods*, Table A2.

Cost of cancer drugs

Over the past decade, many new discoveries and paradigm-changing therapies have emerged to treat most cancers. Previously untreatable cancers now have many therapeutic options. As a result, cancer survival has increased dramatically in Canada.(2) Cancer drugs were the most common class of therapies in Canada's drug pipeline in 2022, with cancer drugs representing 24.8% of total patented medicine sales. This is nearly triple the 9.1% share in 2013.(47) According to a 2022 report from the Patented Medicine Prices Review Board Oncology Medicines in Canada, the cancer drug market has doubled its share of the market over the past decade, which accounts for $4.6 billion in sales nationally in 2022 (Figure 7).

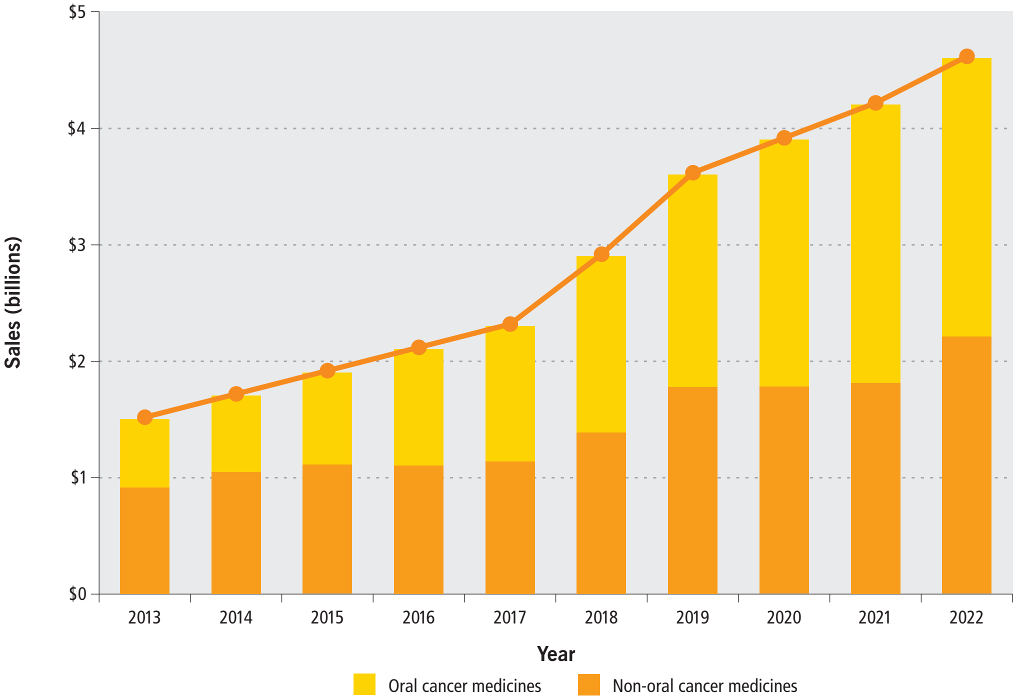
Perspectives of people affected by cancer

Kent Tarrant received life-changing news twice in less than four months. In late 2018, he learned that he and his wife were pregnant. Early the next year, Kent was diagnosed with stomach cancer. Because it was an aggressive form of cancer, Kent began seven intensive rounds of chemotherapy. His local hospital in Wabush, Newfoundland and Labrador, was not equipped to provide the type of chemotherapy he required. So Kent needed to travel regularly to St. John's for treatment — a two-day trip by car. Luckily, Kent was able to stay with family. While Kent managed to avoid some travel expenses during his treatment, he faced the cost of non-generic medication not covered by his insurance.

> *"It was probably a blessing in disguise that I spent so much time in the hospital, because when I was there, my drugs were covered. I remember walking into the pharmacy at one point and getting handed a bill for $500.00 for one week's worth of medication. I work for a company with good insurance, and even that only goes so far."*

> Costs for people with cancer and caregivers are expected to be the highest in the initial care phase, largely due to the considerable out-of-pocket and time costs in this phase.

FIGURE 7 Sales of patented cancer drugs in Canada, 2013–2022



Note: These results reflect the total sales for patented medicines used in the treatment of cancer. While some of these medicines may also be used to treat other conditions, the data used for this analysis does not distinguish between indications, and thus, the reported sales may reflect some non-oncology use.

Created by: Canadian Cancer Society

Data source: Patented Medicine Prices Review Board, Government of Canada

Oral forms of cancer treatment represent more than half of all cancer drug sales and 12.9% of the patented medicine market in 2022, compared to just 3.6% in 2013. There has also been an increase in the use of biologic therapies or immunotherapies. These therapies have made a meaningful clinical impact for many cancer types, but they are associated with high costs.

Perspectives of people affected by cancer

Sharon Dennis was diagnosed with leukemia in 2001 and has been living with the disease ever since. In 2004, she was also diagnosed with breast cancer. The leukemia diagnosis meant that Sharon would need to begin daily chemotherapy treatments, almost an hour-long drive from her home. Fortunately for Sharon, once she was comfortable administering her own chemotherapy, she was given a prescription for take-home cancer drugs. While undergoing treatment at home may seem like an easier alternative for people like Sharon who require long-term treatment, accessing take-home cancer drugs can be challenging and costly.

> *"Driving to the hospital in traffic every day for treatment is an unnecessary added stress," Sharon explains. "It is also not possible for everyone to be able to drive themselves to their appointment and much easier to have the option to take your medication at home. They told me that I wasn't covered, and it would cost $5,000 to fill my prescription," says Sharon. "I don't have that kind of disposable income so being denied a ticket to health seemed like an unfair situation."*

Sharon relies on take-home cancer drugs as her primary treatment. In addition to the cost of medication, Sharon also has to pay for the shipping of paperwork to the pharmacy. The costs for her medication, along with cost-of-living expenses such as insurance, gas, car maintenance and food, had a huge financial impact on Sharon.

Projected economic impact of cancer from a societal perspective, 2024 to 2034

Projected economic impact of cancer, 2024 to 2034

Capturing the economic impact of cancer tells us what the current environment looks like. But combining these data with national models, like OncoSim, allows us to project future cancer incidence and prevalence, as well as future costs. This provides useful insights as we plan both human resource needs and capital expansion and improvements to provide optimal care for people with cancer as we move into the future. The projections were done assuming the current state of cancer care and accounting for population demographics and inflation, but they did not account for expected advancements and changes in diagnosis and treatment.

Key findings

- Direct health systems costs are projected to increase by about 24% (from $30.2 billion in 2024 to $37.4 billion in 2034), emphasizing the consistent financial pressure on Canada's healthcare system.
- The projected economic impact for people with cancer and caregivers is also expected to steadily increase over time.
- Lung cancer is expected to have the steepest increase and highest overall societal cost in 2034, with societal costs increasing 31% (from $6.8 billion in 2024 to $8.9 billion in 2034).

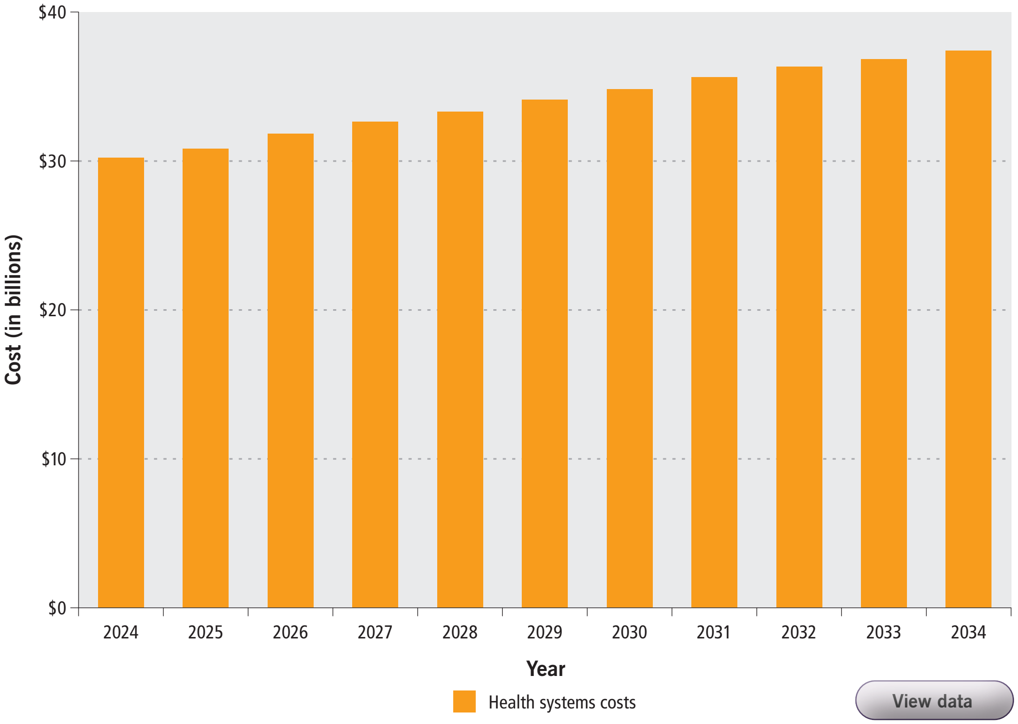
Perspectives of people affected by cancer

> *"Overall, things have been manageable on my long-term disability coverage from my employer, but a recent advancement of my cancer (metastasis to liver) has changed my treatment plan and the drugs are very expensive and one of them is not covered by pharmacare or my insurance, so it is a new out of pocket expense, and quite a burden ($1000/month). Although it will be something I'll figure out (because I have to) it will be difficult. I do plan to declare some on my taxes, but due to the timing of my treatments, that won't occur until 2020, so until then, my finances will be extremely tight. Although the medication is approved for its current use, I am waiting for it to be covered. This limbo is very frustrating and expensive, and I hope it will be resolved soon."*
>
> —***Anonymous***

Direct health systems costs are projected to increase from $30.2 billion in 2024 to $37.4 billion in 2034, emphasizing the consistent financial pressure cancer care has on Canada's healthcare system (Figure 8).

> Direct health systems costs are projected to increase by about 24% over the next decade.

FIGURE 8 Projected direct health systems costs, Canada, 2024–2034

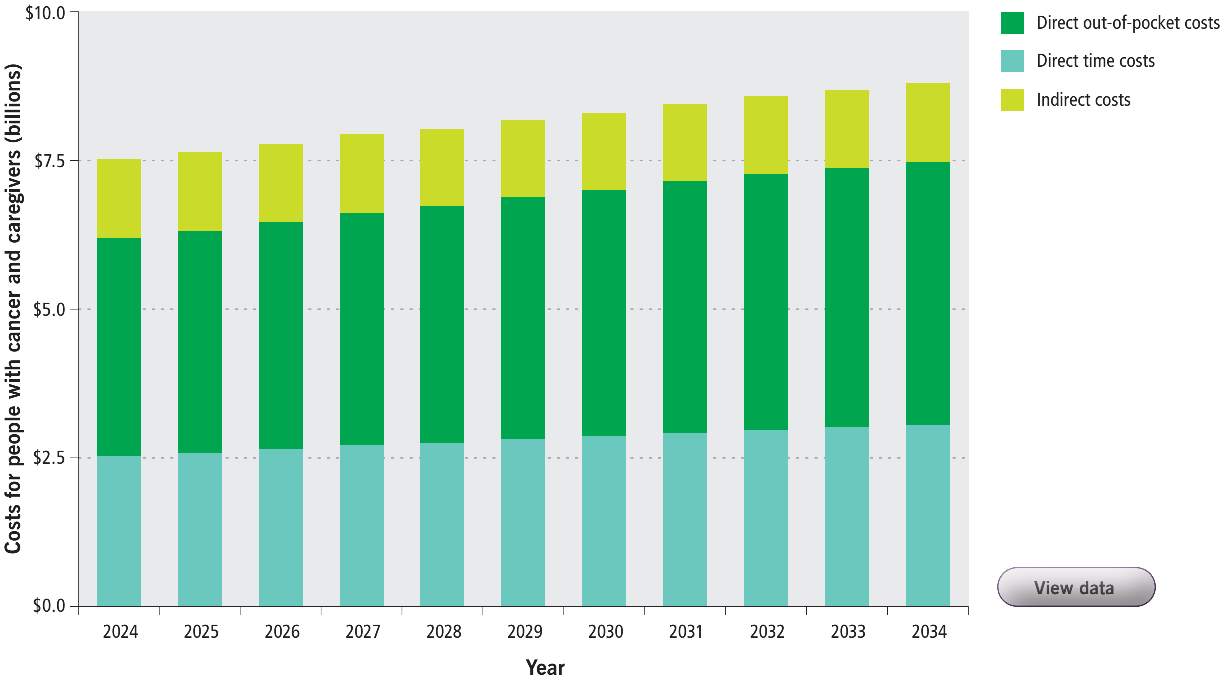


Analysis by: Canadian Partnership Against Cancer
Data sources: Multiple sources of data were used to develop this figure. For further details, see *Appedix: Data sources and methods*, Table A2.

The projected economic impact for people with cancer and caregivers is also expected to steadily increase from $7.5 billion in 2024 to $8.8 billion in 2034 (Figure 9). Out-of-pocket costs are projected to increase by almost 20% (from $3.7 billion in 2024 to $4.4 billion in 2034). This trend points to a heightened economic pressure on people with cancer and their support people, which could potentially exacerbate financial hardships, especially for those who are socially disadvantaged.

Out-of-pocket costs are projected to increase by about 20% in the coming decade.

FIGURE 9 Projected economic impact for people with cancer and caregivers (direct out-of-pocket costs, direct time costs and indirect costs), Canada, 2024–2034



Analysis by: Canadian Partnership Against Cancer

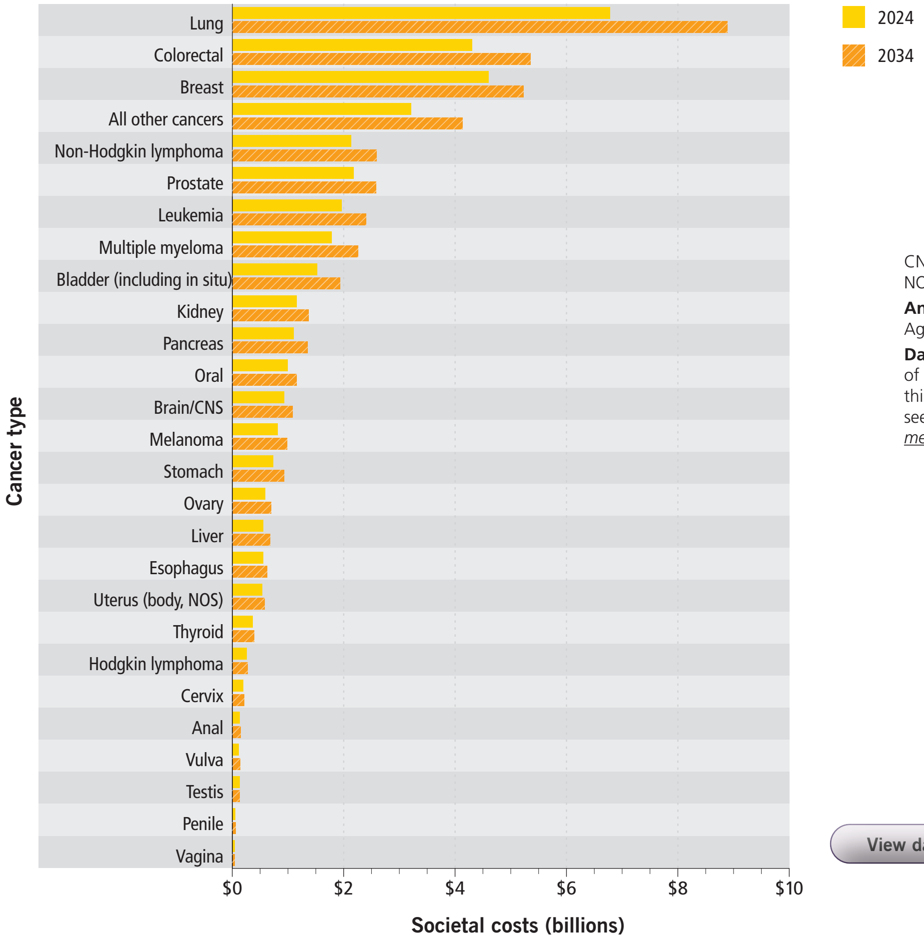
Data sources: Multiple sources of data were used to develop this figure. For further details, see *Appedix: Data sources and methods*, Table A2.

Projected economic impact of cancer by type, 2024 to 2034

Some cancer types, such as lung and colorectal, are expected to have steep increases in their economic impact from a societal perspective over the next decade (Figure 10). These rising costs reflect the increasing size and age of the Canadian population. By 2034, of all cancer types, lung cancer costs are projected to be the highest from a societal perspective, which includes both health systems costs and costs for people with cancer and caregivers. This highlights the need for better prevention, screening and early detection and treatment strategies for this type of cancer.

Costs related to lung cancer are projected to increase more than any other reported cancer type over the coming decade.

FIGURE 10 Projected economic impact from a societal perspective, including direct health systems costs, direct out-of-pocket costs, direct time costs and indirect costs, by cancer type, Canada, 2024 and 2034



CNS=central nervous system; NOS=not otherwise specified

Analysis by: Canadian Partnership Against Cancer

Data sources: Multiple sources of data were used to develop this figure. For further details, see *Appedix: Data sources and methods*, Table A2.

View data

Perspectives of people affected by cancer

Angus Pratt was diagnosed with lung cancer in 2018 as an incidental finding to male breast cancer.

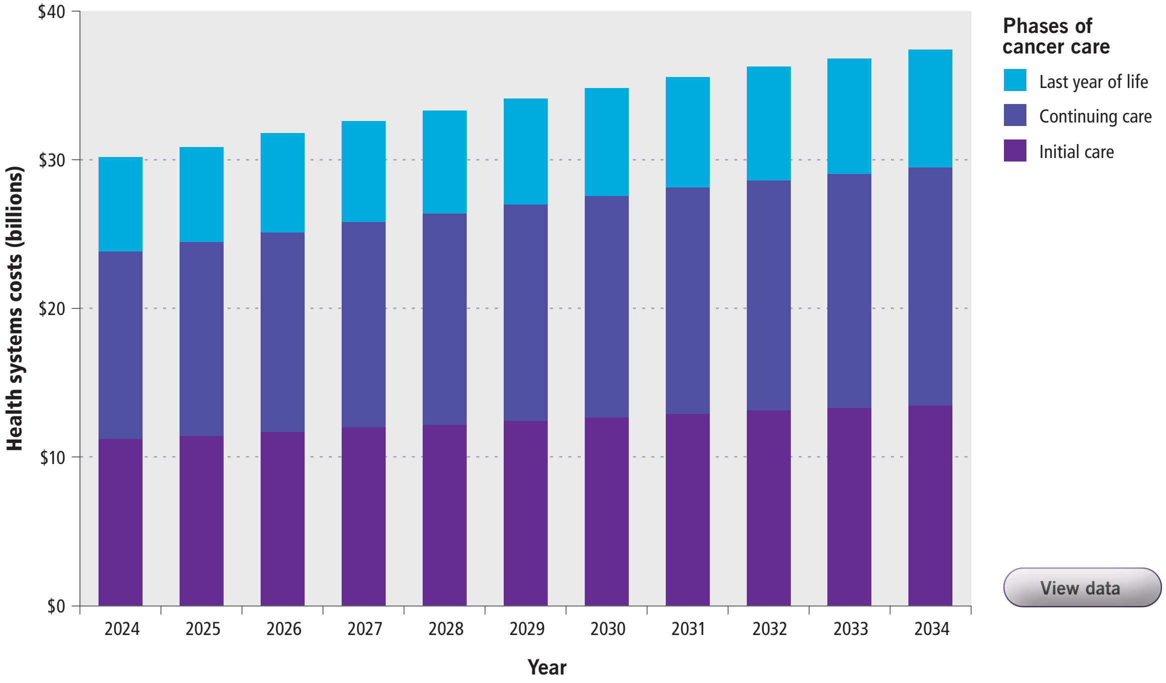
"Recovering in hospital from yet another surgery, I needed a private room because I was immunocompromised. I didn't ask for this; it was considered a necessity. Imagine my surprise when I received a bill. The last thing you need when you're facing cancer is unexpected costs. It can easily derail you when you already have so much on your plate."

Projected economic impact of cancer by phase of care, 2024 to 2034

Future cost projections are needed for healthcare planning, resource allocation and policy. Examining projected costs by phase of cancer care can help leaders of health systems and decision-makers allocate appropriate funding for cancer care across the care continuum. Cancer health systems costs for all phases are expected to increase in the next 10 years (Figure 11). The continuing care phase is expected to remain the biggest cost contributor to the overall expected health systems costs in the next 10 years, increasing approximately 27% from an expected $12.6 billion in 2024 to an expected $16.0 billion in 2034. Costs in the last year of life are expected to increase by approximately 26% (from $6.3 billion in 2024 to almost $8 billion in 2034). Costs for the initial care phase are also expected to increase, but to a lesser extent.

> Costs to the health systems during the continuing care phase are projected to increase by 27% over the coming decade.

FIGURE 11 Projected direct health systems costs by phase of cancer care,* Canada, 2024–2034



*Cost data for the prediagnosis phase were unavailable.

Analysis by: Canadian Partnership Against Cancer

Data sources: Multiple sources of data were used to develop this figure. For further details, see *Appendix: Data sources and methods*, Table A2.

Conclusion

How do we use these statistics?

The findings in this report help us to better understand the economic impact of cancer in Canada from a societal perspective, quantifying the expected costs to both the health systems in Canada and people with cancer and caregivers. These estimates of economic impact highlight the significant demands on the health systems and the considerable resource needs across the cancer care continuum. This provides valuable insights that can help with resource planning and allocation to support the complex and difficult work of health systems leaders in making informed decisions to improve the health and well-being of people across Canada, while balancing competing priorities and costs to the system. This report builds on previous extensive work done by researchers across Canada to advance the science of cancer costs in Canada.(5–7,11,26–29)

In 2024, the cost of cancer is expected to reach $37.7 billion dollars, 20% of which is borne by people with cancer and their caregivers through out-of-pocket expenses and costs related to lost earnings, and the loss of time to pursue other activities. Out-of-pocket costs were the largest contributor to costs for people with cancer and caregivers. The discussion and patient perspectives embedded throughout the report underscore how significant these costs can be. Literature indicates that these costs for people with cancer and caregivers disproportionately affect certain populations, including those with a low income, those living in rural and remote areas and First Nations, Inuit and Métis populations.(17,35,42) A review of national and international literature by the Canadian Partnership Against Cancer also found that cancer-related out-of-pocket costs in Canada (estimated at $253 per month on average in their report) were high when compared to other countries with universal health coverages (e.g., $93 in Australia and $240 in Western Europe).(35)

The higher out-of-pocket costs in Canada highlight a significant gap in support for people with cancer and their caregivers. Costs to individuals were particularly high during the initial care phase: our findings indicate that these costs are expected to be almost half of the costs borne by the health systems during this phase. Supports to reduce out-of-pocket and indirect costs, like protected leave from work and improved benefit plans, may be of particular importance during the initial phase of care to reduce the economic impact to people with cancer and caregivers.(21)

While the costs paid by people with cancer and caregivers are expected to be highest during the initial care phase ($5.2 billion), health systems costs are projected to be highest for the continuing care phase ($12.6 billion). This large investment in health systems costs for continuing care speaks to the considerable advancements in early detection and treatments that have led to increased survival for many cancer types.(2) As more and more people are living with and beyond cancer, investments are needed to provide appropriate care in the years following diagnosis.

This report projects that costs during the continuing care phase will remain the largest contributor to health systems costs. They are also expected to increase the most over the coming decade, from an expected $12.6 billion in 2024 to $16.0 billion in 2034. This further highlights the impact of the rising prevalence of cancer survivors in our population and their unique needs.(3)

This report also uniquely quantified the expected costs by cancer type, finding that costs related to lung cancer are expected to be the highest of all cancer types in 2024. Moreover, the costs associated with lung cancer are projected to increase the most in the coming decade. These findings highlight the need to invest in early detection and care for people at risk for and affected by lung cancer. Similar findings for other cancer types can inform healthcare planning and delivery.

It should be noted that the estimates projected to 2034 do not consider the expected improvements to prevention, early detection, diagnosis and treatment for many cancer types in the coming decade. So, while these findings highlight the continued and considerable economic impact of cancer over the coming decade, there are key emerging issues and areas of opportunity that health systems leaders and the cancer control community should consider when evaluating the findings from this report.

Looking to the future: Emerging issues and considerations

New treatments and therapies

An increasing number of people are receiving molecularly targeted therapies and immunotherapies that are improving population-level cancer outcomes. While clinically effective, these therapies, along with related companion testing and monitoring, are increasing overall cancer management costs.(48)

The proportion of people who received targeted IV anticancer medications (tIVAMs) increased from 9% in 2001 to 28% in 2011, whereas that of targeted oral anticancer medications (tOAMs) grew from 2% in 2001 to 14% in 2011. Targeted therapies are increasingly used in cancer care, but they are imposing a growing financial strain on privately insured people and their insurers. Data show a large increase in the use of tIVAMs from 2001 to 2011. Payments for tIVAMs per person with cancer remained at a constant high level of approximately $7,000 per month and $65,000 annually by 2010.(49)

In addition, emerging bio-engineered and designer therapies, such as chimeric antigen receptor (CAR) T-cell therapy, represent an exciting new class of treatments for some types of leukemia and lymphoma.(50) While effective at improving survival outcomes, these types of therapies are presently extremely costly. These therapies can easily cost in the hundreds of thousands of dollars per year per person with cancer. There are also a growing number of novel gene and cell therapies that are expanding to more people with cancer.

Value-based care

With the increased focus on precision oncology and personalized medicine using molecular diagnostics for targeted therapies, outcomes at the population level have improved.(48) With rising healthcare costs, providing value for care must be considered as a way to optimize care while controlling expenditures. Therefore, it is essential that novel therapies provide meaningful improvements both in survival and quality of life for people with cancer.

Value-based healthcare is a healthcare delivery model where payments are disbursed based on health outcomes of people with cancer. Extending value-based considerations to the reimbursement of treatments and therapies means that providers pay for treatments only if the treatments provide meaningful value and improve outcomes in the real world. These “outcomes-based agreements” are being conceptualized and developed as a method to provide the best evidence-based care while managing rising treatment costs.(51) Health Technology Assessment organizations in many countries with publicly funded health systems are working toward value-based agreements as a way to combat rising drug costs for novel medicines. In Europe, for example, performance-based management entry agreements are being developed and implemented for novel therapies.(52, 53)

In Canada, the present approach to evaluating and adopting new medicines remains a challenge. Due to the complex ways in which healthcare and reimbursement are managed in Canada, the implementation of outcomes-based agreements or managed entry agreements has been limited. Consequently, there is a delay in many new novel medicines reaching people with cancer while some other high-cost medicines result in minimal improvements in outcomes due to a lack of post-approval monitoring.(54) Therefore, there is a need for monitoring with real-world data to ensure that optimal outcomes are obtained for the healthcare investment of novel therapies.

Private insurance

Private health insurance in Canada accounts for approximately 13% of spending on health services not covered by public insurance programs. This often includes drug costs and other supportive services required during the initial care and continuing care phases.(55) Not all cancer drugs are covered by provincial programs. Varying considerably by province, the national average is approximately 96% of in-hospital drugs are covered while only 70% of take-home medications for cancer are covered.(19) This creates considerable disparity in access to such drugs, depending on private insurance status and economic status for people affected by cancer in Canada. Canada ranks second among nations in the OECD countries in terms of per capita private health insurance expenditures. However, only about 60% of people in Canada are covered by private health insurance, most often as a benefit of employment.(56) Comprehensive national drug coverage could help address the disparities in access to take-home cancer drugs.(57) Health policies, including drug coverage policies, need to consider the unique health needs of First Nations, Inuit and Métis people and work in collaboration and partnership to co-develop distinct policies for these populations.

Geographic disparities

There is considerable variability by province(21) in what treatments, home services and medical equipment are covered. While we have not examined system or out-of-pocket costs by province in this report, regional differences in the impact of out-of-pocket costs have been reported in the literature.(17) For instance, a recent study examining differences in costs for people with cancer and caregivers in British Columbia, Alberta, Manitoba and Ontario found that monthly average out-of-pocket costs were highest in Alberta ($938) and lowest in Manitoba ($280).(17)

The proportion of people living in rural and remote areas also varies considerably by province. The impact of rural inequity is important and contributes to the widening inequality in cancer outcomes among people in Canada. As noted in the earlier sections of this report, the challenges faced by rural populations vary greatly across the country. Atlantic Canada has comparatively higher rates of cancer than Western provinces. These differences are largely due to having older populations with comparatively worse population-level risk factor profiles.(2) Atlantic provinces also have, on average, lower income per capita and lower levels of system resources due to smaller provincial populations compounded by much of their populations living in rural and remote areas. The consequence of these demographic and geographic challenges is that the societal costs will likely be higher and borne by people with cancer and caregivers.

Services and programs that provide guidance to people with cancer as they navigate the healthcare system could help reduce financial distress and address some of the geographic disparities. Many provinces have implemented navigation services and plan to expand them as they have been shown to be an essential component of an integrated system of cancer care and important for delivering person-centred care.(58)

Prioritizing prevention and screening

Given the considerable increase in costs related to the initial and continuing phases of care for cancer, additional investment and attention should be directed in the coming decades to the prevention of cancer. Research shows that up to 40% of cancers in Canada can be prevented by reducing exposure to known risk factors.(59) Researchers are also uncovering additional factors that may be linked to increased risk in the coming years. Greater efforts are needed to promote the use and uptake of primary and secondary prevention strategies, such as smoking cessation and health promotion programs, organized vaccination programs and organized screening programs.

Canada is lagging other countries of similar economic standing on some widely accepted preventive measures for cancer. For example, school-based human papillomavirus (HPV) vaccination rates are falling behind other countries, such as Australia where a great deal of progress has been made.(60,61) Shifting population-level attention to and focus on prevention and screening can have a meaningful and likely cost-effective impact on the future burden to health systems. Additional examples include mitigation of radon exposure in homes given the amount of time Canadians spend indoors, tobacco cessation approaches and concerted effort toward improvements in food intake and physical activity as cancers linked to obesity are on the rise in Canada.(62)

Screening represents a cost-effective approach to lowering the financial impact of cancer in Canada. Although we were unable to estimate costs by disease progression in this report, we know that finding cancer at an early stage results in earlier, less invasive treatment, better outcomes and lower treatment costs.(63) Moreover, certain screening programs, such as cervical and colorectal screening, find lesions so they can

Perspectives of people affected by cancer

Jennifer Mitchell was diagnosed with acute lymphoblastic leukemia in 2016. After being in remission for almost five years, she received a second cancer diagnosis in 2021. She felt the impact of out-of-pocket costs more with her second cancer diagnosis. Because she did not have access to the treatment and care she needed in her hometown of Corner Brook, NL, Jennifer had to travel for her treatments. She had to drive eight hours to receive rounds of immunotherapy treatment in St. John's, NL, and then went to Ottawa, ON, for a stem cell transplant. These costs were compounded when Jennifer's husband had to quit his job and make the three-day drive to Ottawa in their car because Jennifer couldn't take public transit due to the risk of infection.

> *"Affordable access to treatment should not depend on where you live. I was unlucky enough to be diagnosed with cancer, and while I was fortunate to be reimbursed for a percentage of my travel costs, the upfront costs were still a huge burden."*

be removed before they become cancerous. Despite this potential impact across all provinces, screening rates remain below recommended levels. Estimates suggest that only 40% to 50% of adults in Canada are up to date with colorectal cancer screening guidelines, which remains below the national target of 60%.(64) Similar trends are observed for breast and cervical cancers.(65,66) The wider availability of screening and resource support for screening may help lower cancer's economic impact in the future. This includes working together with First Nations, Inuit and Métis communities to develop and implement culturally appropriate screening programs. In addition, future analyses that examine costs by stage and consider the economic impact of cancer screening programs would be helpful in planning where to invest in cancer prevention and screening strategies in Canada.

Summary

Our projections suggest that the societal costs of cancer are considerable and will continue to increase in the coming decade. This rise in costs is driven by the ever-increasing numbers of people diagnosed with cancer due to Canada's aging and growing population, the increasing costs of cancer care and inflation. This is concerning for the Canadian healthcare system, as well as for people with cancer and their caregivers. As more people are living with and beyond a cancer diagnosis, additional investments in the cancer system are needed to ensure appropriate care in the years after a diagnosis. In addition to investments in health systems, we will also need to focus our attention on prevention and screening to help decrease cancer incidence, as well as develop value-based frameworks to manage the rising costs associated with new therapies.

It is not only the healthcare system that is economically impacted by cancer. Our findings show that being diagnosed with cancer can have lasting economic effects for individuals, caregivers and families. Although Canada has a single-payer healthcare system, people with cancer and caregivers often bear significant direct out-of-pocket and time costs, as well as indirect costs. In Canada, people with cancer often pay more out-of-pocket costs than those in similar countries and many report financial distress and worry. Focused and coordinated efforts across the cancer care continuum are needed to address the rising costs of caring for cancer, while ensuring that outcomes and experiences for individuals are the best they can be. Collective action is necessary to improve access to prevention and screening and provide extensive and varied supports for treatment access and survivorship care.

Inequities exist throughout the Canadian healthcare and cancer care systems. Moreover, the economic impact of cancer disproportionately affects certain populations, such as people with a lower income, individuals living in rural and remote areas and First Nations, Inuit and Métis populations. These greater economic impacts may affect decisions about treatment options and ultimately impact outcomes for these populations. Greater support for underserved populations, including holistic and distinct rights-based approaches for First Nations, Inuit and Métis populations, is essential to address the imbalance created by rising out-of-pocket costs and the growing reliance on private health insurance to access necessary care.(21,67,68)

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Appendix

Data sources and methods

Who was involved?

The Canadian Cancer Statistics reports are developed by the Canadian Cancer Statistics Advisory Committee in collaboration with the Canadian Cancer Society, Statistics Canada and the Public Health Agency of Canada with cancer data provided by the provincial and territorial cancer registries through the Canadian Cancer Registry. For this special report, the Canadian Partnership Against Cancer conducted all of the analyses in collaboration with the Health Analysis Division of Statistics Canada, except for Figure 7 which was created by the Canadian Cancer Society, Surveillance, with data extracted from the Patented Medicine Prices Review Board’s Annual Report 2022 (published in November 2023; ISSN: 1495-056). The Canadian Cancer Statistics Advisory Committee’s Working Group (WG) advised on the methodology and interpretation of results and wrote the accompanying text with contributions from three content experts. The Canadian Cancer Society coordinated the production of this report and the work of the committee, as well as engaged with patient partners to provide perspectives from people with cancer and inform the report. Two peer reviewers examined the full draft and provided clinical and epidemiologic expertise. The Public Health Agency of Canada translated the report into French.

Data sources and analysis

The OncoSim All Cancers Model (version 3.6.3.9) projects health and economic outcomes for 32 cancer sites in Canada. A summary of the included cancer types, and the corresponding ICD-O-3, ICD-9 and ICD-10 codes for cancer incidence and mortality, is presented in Table A1. For this report, we group the various oral and laryngeal cancers into one type ("oral") and we do not report on non-melanoma skin cancers due to limitations in data and reporting. Therefore, 27 cancer types appear in this report (see Table A1).

The All Cancers Model comprises several features, including the simulation of cancer incidence, cause-specific survival, cancer deaths, prevalence, societal costs (direct health-related cancer management, direct out-of-pocket, direct time and indirect costs) and the population attributable fractions of cancer incidence and deaths for associated risk factors. The data sources used for developing the model are reported in Table A2.

TABLE A1 Cancer types and the corresponding ICD-O-3, ICD-9 and ICD-10 codes in the OncoSim All Cancers Model

	Cancer type*	Incidence	Cause of death	
		ICD-O-3 Site/Type (incidence)[†]	ICD-9 (for date of death prior to year 2000)[‡]	ICD-10 (for date of death 2000 and onwards)[‡]
1	Oral[§]	C00–C14	140–149	C00–C14
1a	Oral cavity	C01–C06	141, 143–145	C01–C06
1b	Oropharynx	C09, C10	146.0–146.9	C09, C10
1c	Hypopharynx	C12, C13	148	C12, C13
1d	Larynx	C32	161	C32
1e	Other oral	C00, C07–08, C11, C14	140, 142, 147, 149	C00, C07–08, C11, C14
2	Esophagus	C15	150	C15
3	Stomach	C16	151	C16
4	Colorectal	C18–C20, C26.0	153, 159.0, 154.0–154.1	C18–C20, C26.0
5	Liver	C22.0	155.0, 155.2	C22.0, C22.2–C22.7
6	Pancreas	C25	157	C25
7	Lung	C34	162.2–162.5, 162.8–162.9	C34
8	Melanoma	C44 (type 8720–8790)	172	C43
9	Breast	C50	174–175	C50
10	Cervix	C53	180	C53
11	Uterus (body, NOS)	C54–C55	179, 182	C54–C55
12	Ovary	C56.9	183.0	C56
13	Prostate	C61.9	185	C61
14	Testis	C62	186	C62
15	Bladder (including *in situ*)[**]	C67	188	C67
16	Kidney	C64.9, C65.9	189.0–189.1	C64–C65
17	Brain/CNS	C70–C72	191,192	C70–C72
18	Thyroid	C73.9	193	C73
19	Hodgkin lymphoma[††]	Type 9650–9667	201	C81
20	Non-Hodgkin lymphoma[††]	Type 9590–9597, 9670–9719, 9724–9729, 9735, 9737, 9738 Type 9811–9818, 9823, 9827, 9837 all sites except C42.0, C42.1, C42.4	200, 202.0–202.2, 202.8–202.9	C82–C85, C96.3
21	Multiple myeloma[††]	Type 9731, 9732, 9734	203.0, 238.6	C90.0, C90.2
22	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, C42.1, C42.4	202.4, 203.1, 204–208	C91–C95, C90.1
	Non-melanoma skin[‡‡]	C44.0–C44.9 (type 8085–8089, 8111–8719, 8791–9049, 9056–9139, 9141–9589)	173	C44
23	Vulva	C51	184.1–184.4	C510–C512, C518–C519
24	Vagina	C52.9	184.0	C52
25	Anal	C21	154.2, 154.3, 154.8	C210–C212, C218
26	Penile	C60	187	C600–C612, C608, C609
27	All other cancers	All sites C00–C80, C97 not listed above	All sites 140–208 not listed above	All sites C00–C80, C97 not listed above

CNS=central nervous system; NOS=not otherwise specified

*Statistics Canada uses the Surveillance, Epidemiology and End Results (SEER) Groups for Primary Site based on the World Health Organization International Classification of Diseases for Oncology, Third Edition (ICD-O-3) for classifying cancer site/type in the Canadian Cancer Registry.

†Unless otherwise specified, histology types 8000–9049, 9056–9139 and 9141–9589 apply to all cancer sites.

‡Source: SEER cause of Death Recode 1969+ (04/16/2012) (http://seer.cancer.gov/codrecode/1969+_d04162012/index.html)

§Oral cancers have been combined into a single cancer type (oral cavity, oropharynx, hypopharynx, larynx and other oral).

**Missing Ontario *in situ* cancer cases were imputed.

††Histology types 9590–9992 (leukemia, lymphoma and multiple myeloma), 9050–9055 (mesothelioma) and 9140 (Kaposi sarcoma) are excluded from other specific organ sites.

‡‡Non-melanoma skin was not included in analyses.

Note: ICD-O-3 refers to the International Classification of Diseases for Oncology, Third Edition.(1) ICD-9 refers to the International Statistical Classification of Diseases and Related Health Problems, Ninth Revision.(2) ICD-10 refers to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision.(3)

TABLE A2 Data sources used for developing the OncoSim All Cancers Model

Data element	Data source
Demography	Observed (up to 2019 for birth, immigration and interprovincial migration; up to 2021 for all-cause mortality) and projections from Statistics Canada
Incidence	Canadian Cancer Registry 1992–2017, Statistics Canada(4)
Stage-specific survival	Canadian Cancer Registry 2000–2017, Statistics Canada(4)
Stage distribution	Canadian Cancer Registry 2010–2017, Statistics Canada(4)
Cause of death	Statistics Canada. Table 102-0522 – Deaths, by cause, Chapter II: Neoplasms (C00 to D48), age group and sex, Canada, annual (number) (accessed: December 4, 2023). Data years 2015–2019.
Direct health systems costs	**Analysis based on the methods of**: de Oliveira et al. Phase-specific and lifetime costs of cancer care in Ontario, Canada. BMC Cancer (2016) 16:809 **Databases used to estimate costs (2017–2022)**: The Registered Person Database The Ontario Health Insurance Plan database The Ontario Cancer Registry The Discharge Abstract Database The National Ambulatory Care Reporting System The Continuing Care Reporting System Long-Term Care
Direct out-of-pocket costs	**Initial phase of care**: Longo CJ, Fitch MI, Loree JM, Carlson LE, Turner D, Cheung WY, Gopaul D, Ellis J, Ringash J, Mathews M, et al. Patient and family financial burden associated with cancer treatment in Canada: A national study. Support Care Cancer. 2021;29(6):3377–86. **Continuing phase of care**: de Oliveira C, Bremner KE, Ni A, Alibhai SMH, Laporte A, Krahn MD. Patient time and out-of-pocket costs for long-term prostate cancer survivors in Ontario, Canada. J Cancer Surviv. 2014;8(1):9–20. **Last year of life phase**: Dumont S, Jacobs P, Turcotte V, Turcotte S, Johnston G. Palliative care costs in Canada: A descriptive comparison of studies of urban and rural patients near end of life. Palliat Med. 2015;29(1):908–17.
Direct time costs	**Initial, continuing and last year of life phase**: Yabroff KR, Warren JL, Knopf K, Davis WW, Brown ML. Estimating patient time costs associated with colorectal cancer care. Med Care. 2005;43(7):640–8.
Indirect costs	**Initial, continuing and last year of life phase**: Jeon SH. The long-term effects of cancer on employment and earnings. Health Econ. 2017;26(5):671–84.

Cancer incidence and diagnosis

Estimation of cancer incidence

Incidence was estimated using cancer incidence equations (regression analysis) of the Canadian Cancer Registry data (1992–2017). The cancer incidence equations included province or territory, sex, five-year age groups and year as variables (Table A3). In the cancer incidence equations, the baseline incidence was estimated for 2010 with a time trend coefficient applied to reflect changes over time.

Since we only had cancer incidence data up to 2017, we projected future incidence rate to 2024 for the 27 cancers reported on based on historical cancer incidence and Canadian population counts from 1992 to 2017 (2010 for Quebec, as data after 2010 was not reported at time of analysis) from the Canadian Cancer Registry.

Details on the cancer incidence equations:

For each cancer type, a logit regression model was generated based on variables, including age group, sex, province and diagnosis year, to estimate the probability of developing the cancer type:

$$logit[p(y_i = 1)] = \ln\left(\frac{p(y_i = 1)}{1 - p(y_i = 1)}\right)$$

$$= \beta_{i0} + \sum_{j=1}^{k} \beta_j x_{ij} + e_i = \beta' X + \epsilon$$

Where $y_i=1$ when an individual has a cancer of a certain type and $y_i=0$ otherwise. Therefore, $p(y_i=1)$ is the probability of having a cancer of a certain type. x_j contains a set of explanatory variables:

- age at diagnosis (five-year age group as categorical variable: 0–4, 5–9, 10–15, …, 80–84, 85+)
- sex assigned at birth (binary variable: male or female)
- geographic region (categorical variable: 10 provinces, Yukon/Nunavut/Northwest Territories combined)
- diagnosis year (continuous from 1992 to 2017, centred at year 2010)

In addition to the main effects, two-way and multi-way interaction terms of the explanatory variables were also considered during the model selection process. A stepwise selection approach was used to select significant variables. Table A3 summarizes variables included for each cancer type. Models were validated by comparing the model-generated incidence with the observed data.

Simulation of cancer incidence and diagnosis

The parameters estimated from the regression model for each cancer type were used in the simulation process in the following steps.

1. The parameter of the time trend (diagnosis year) was used as a model input parameter, which varied by cancer type, province or territory, age group and sex.
2. For each simulated individual, a probability of developing a particular cancer was calculated from the model parameters.
3. The probability of developing a particular cancer was converted to an annualized hazard so that the cancer incidence was continuous over time:

$$Hazard_i = -\ln(1 - p_i)$$

4. A random number (u) between 0 and 1 was generated and converted to annualized hazard:

$$Hazard^*_i = -\ln(u_i)$$

5. Waiting time to cancer diagnosis was calculated as:

$$Wait\ time_i = -\ln\left(\frac{Hazard^*_i}{Hazard_i}\right)$$

The same method was used to project from 2024, year after year, to 2034.

TABLE A3 Variables included in cancer incidence equations

Cancer type	Regression coefficients (multiplication of variables indicates interaction terms)													
	prov	sex	age	yr	prov x sex	prov x age	prov x yr	sex x age	sex x yr	age x yr	prov x sex x age	prov x age x yr	prov x sex x yr	sex x age x yr
Oral[*]														
Oral cavity	x	x	x		x			x						
Oropharynx	x	x	x	x			x	x	x	x				x
Hypopharynx	x	x	x	x	x					x				
Larynx	x	x	x	x	x		x	x		x				
Other oral	x	x	x	x	x	x	x	x	x	x				
Esophagus	x	x	x	x	x		x	x	x					
Stomach	x	x	x	x	x	x	x	x	x	x				
Colorectal	x	x	x	x	x	x	x	x		x		x		
Liver	x	x	x	x	x	x	x	x	x	x				x
Pancreas	x	x	x	x	x	x	x	x		x				
Lung	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Melanoma	x	x	x	x	x	x	x	x	x	x				x
Breast	x	x	x	x	x	x	x	x	x	x		x		
Cervix	x		x	x		x	x			x				
Uterus (body, NOS)	x		x	x		x	x			x				
Ovary	x		x	x		x	x			x		x		
Prostate	x		x	x		x	x			x		x		
Testis	x		x	x			x			x				
Bladder (including *in situ*)[†]	x	x	x	x	x	x	x	x	x	x			x	
Kidney	x	x	x	x	x	x	x	x		x				
Brain/CNS	x	x	x	x	x	x	x	x		x				
Thyroid	x	x	x	x	x	x	x	x	x	x			x	x
Hodgkin lymphoma	x	x	x					x						
Non-Hodgkin lymphoma	x	x	x	x	x	x	x	x		x		x		
Multiple myeloma	x	x	x	x		x	x	x						
Leukemia	x	x	x	x		x	x	x						

continued...

TABLE A3 Variables included in cancer incidence equations *(continued)*

	Regression coefficients (multiplication of variables indicates interaction terms)													
Cancer type	prov	sex	age	yr	prov x sex	prov x age	prov x yr	sex x age	sex x yr	age x yr	prov x sex x age	prov x age x yr	prov x sex x yr	sex x age x yr
Vulva	x		x	x			x			x				
Vagina	x		x											
Anal	x	x	x	x	x		x	x	x	x				
Penile	x		x											
All other cancers	x	x	x		x	x		x			x			

CNS=central nervous system; NOS=not otherwise specified; prov=province or territory; yr=year

"x" indicates variables included in final equations.

*Oral cancers have been combined into a single cancer type (oral cavity, oropharynx, hypopharynx, larynx and other oral).

†Missing Ontario *in situ* cancer cases were imputed.

Cancer mortality and survival

Estimation of cancer mortality and survival

Deaths from each cancer type by sex were estimated from death data linked to the Canadian Cancer Registry for tumours diagnosed between 2000 and 2017. One- or two-piece Weibull distributions were fitted to the survival data and the Weibull parameters were the input values to the simulation. The technical details are presented here.

The cancer deaths in the OncoSim All Cancers Model were estimated from the cause-specific and stage-specific survival curves for each cancer type. Survival models were estimated using data from the Canadian Cancer Registry linked to the Canadian Vital Statistics Database for the years between 2000 and 2017. Survival curves were estimated by cancer type, stage and sex. Cancers diagnosed in Quebec were excluded from the analyses for all years since incident cancer cases after 2010 were not available at time of analysis. The survival parameters for brain/CNS, multiple myeloma and leukemias were not stage-specific because stage information for these cancers was not available in the Canadian Cancer Registry. Cancers with missing diagnosis or death date were also excluded from the analyses. About 1.5% of total cancers analyzed had reported the dates of diagnosis and death on the same day. For these cases, one day of survival was assigned.(5)

Kaplan-Meier curves for each cancer type, stage and sex were first generated to explore the shape of the survival curves and any potential sex and stage differences. Plots of log of negative log of survival probabilities (log(-log(St))) against log of time (log(t)) were assessed to see if the Weibull functional form was appropriate. Graphical assessment indicated that piecewise (two-piece) Weibull distributions were suitable for most cancer types. However, for some cancers among males (breast, prostate, multiple myeloma and leukemia), a piecewise Weibull distribution did not converge, indicating the absence of inflection point in survival. For those cancers, a one-piece Weibull distribution was estimated. It should be noted that using a one-piece instead of a two-piece Weibull distribution may oversimplify cancer survival patterns, potentially missing critical shifts in survival rates and affecting the accuracy of prediction.

Simulation of survival

Estimated Weibull parameters and information on time at the inflection point were used to simulate survival for each individual diagnosed with cancer (see Estimation of cancer incidence). When a person was diagnosed with a specific type of cancer, a random number was drawn between 0 and 1 and a waiting time corresponding to an inverse of the cumulative distribution function of the Weibull distribution for that cancer type determined the waiting time to death. For further methodological detail, see Berthelot et al (1997).(6)

Summary of the simulation

The simulation created a hypothetical Canadian population one person at a time, estimating if and when an individual developed cancer according to cancer type and how they progressed through the phases in the simulation. The cost estimates next described were then used as direct inputs to the simulation and applied to simulated individuals diagnosed with cancer.

Estimation of cancer management costs

Direct health systems costs

Direct health systems costs came from a retrospective administrative database analysis that estimated net healthcare costs of adults diagnosed between 2017 and 2022 with a primary cancer who survived 30 days or more. Here, “net” refers to the additional costs attributable to cancer care, accounting for the difference between the total healthcare costs for people with cancer and the expected healthcare costs if they had not had cancer. The analysis used a similar phase costing methodology as previous Canadian costing studies.(7,8) The average net costs of cancer care were reported by cancer type and sex, as well as by phase of care, which included:

- The initial care phase is defined as the 12 months after diagnosis.
- The continuing care phase is defined as the period following initial care phase and prior to the last 12 months of life (interim years).
- The last year of life phase is defined as the last 12 months of life.

The analysis classified people with cancer into 24 groups, which were realigned with the 32 cancer sites in OncoSim under the following assumptions:

- Costs associated with head and neck cancers are applied to all oral (including laryngeal) cancers.
- Costs associated with lymphomas are applied to both Hodgkin and non-Hodgkin lymphoma.
- Costs of non-melanoma skin cancer is set to 0 because no data are available.
- Costs of the “all cancer” group in de Oliveira et al.(7,8) are applied to anogenital cancers and “other cancers” in OncoSim.

The cancer group and sex-specific cost estimates were used as direct inputs to the simulation and applied to individuals diagnosed with cancer according to type and how they progress through the phases in the simulation. Cancer management costs included systemic drug therapies (e.g., chemotherapy, immunotherapy, targeted therapy), radiation therapy, all physician services (diagnostic tests and laboratory services included), in-patient hospitalizations, ambulatory care, emergency visits (including same-day surgeries and procedures), home care, long-term care, complex continuing care and outpatient prescription drugs for eligible groups.(8)

Direct out-of-pocket costs

Three studies were used to estimate cancer-related out-of-pocket costs (OOPCs) in OncoSim. Gross costs were used because there were limited data available on OOPCs. Gross costs encompass all expenses associated with a cancer diagnosis, without comparing these expenses to those incurred by people accessing healthcare for non-cancer-related diagnoses (referred to as non-cancer patients).

To populate the initial phase of cancer care in OncoSim, we adapted the estimates from Longo et al. (2021) longitudinal study.(9) Longo et al. (2021) reported OOPCs for people with cancer and their caregivers as an aggregate average. The costs included self-reported OOPCs, which covered drugs, home care, homemaking, vitamins, supplements, family care, accommodations, devices, costs related to imputed travel, parking fees or transit fares and other costs.(9) The cohort included people with breast, colorectal, lung and prostate cancers who had at least four weeks of cancer treatment (68% were still on active treatment).(9) In OncoSim, the same aggregate average reported by Longo et al. (2021) was used for all cancer types and both sexes as direct inputs.

For the continuing phase of care in OncoSim, OOPCs estimates were modified from de Oliveira et al. (2014).(10) The study surveyed long-term prostate cancer survivors and included expenditures related to health professional visits, medication, equipment, community services, household assistance, travel, parking, accommodation and food.(10) While this study focused only on a single cancer type, we assumed that its findings would most accurately reflect continuing care OOPCs (considering limited data availability). Our assumption stems from the fact that a significant portion of individuals in the continuing care phase are cancer survivors, leading to the expectation of lower cancer-related expenses compared to individuals undergoing active treatment in the initial or last year of life phases of care. In OncoSim, the same average OOPC reported by de Oliveira et al. (2014) was used for all cancer types and both sexes as direct inputs.

To estimate OOPCs in the last year of life phase of care in OncoSim, we modified costs from Dumont et al. (2015).(11) The study examined OOPCs as the personal costs related to palliative care from people with cancer who were enrolled in a regional palliative care program in Canada. The study reported average OOPCs by rural and urban areas.(11) To populate the OncoSim model, we calculated the weighted average of OOPCs using the rural and urban population percentages in Canada. This weighted average was applied as direct input for all cancer types and both sexes.

Direct time costs

To estimate the phase-specific net direct time costs, the average net hours spent receiving care was multiplied by the median hourly wage in Canada for 2021 ($19.14).(12) The net hours of care were derived from a study conducted in the US.(13) The study investigated individuals aged 65 years or older diagnosed with colorectal cancer and those accessing healthcare for reasons other than colorectal cancer, categorized by the phase of care.(13) In this study, net hours considered time associated with travel to and from care, waiting for appointments and time spent receiving care.(13) We assumed that people with cancer in the US and Canada would have a similar average of number of hours spent in each treatment phase. On average, Yabroff et al. (2005) found that people with cancer in the initial care phase (first 12 months after diagnosis) and the last year of life phase of care (final 12 months of life) spent a net of 302 hours and 183 hours, respectively. In the continuing care phase, people with cancer spent approximately net 20 hours annually. For each phase of care (excluding the prediagnosis phase, where no time costs were considered), the same average time costs were applied as direct input for all cancer types and both sexes in OncoSim. While these hours are based on a colorectal cancer diagnosis and older data from 2005, we acknowledge that the transferability of these estimates to other cancer types and current care practices may be limited. However, due to a lack of more recent and specific data, these estimates remain the best available input for our calculations and should be noted as a limitation.

Indirect costs

Net indirect costs by phase of care were estimated from Jeon et al. (2017), where they were defined as lost earnings by people with cancer due to changes in employment or annual earnings (e.g., loss of employment or reduction in hours worked).(14) Using linked data from the Canadian Cancer Registry, the Vital Statistics Registry and personal income tax records, we derived net indirect costs for people with cancer aged 25 to 61 years who survived at least three years after their diagnosis.(14) Differences in overall income likely reflect differences in unemployment, absenteeism and, to some extent, presenteeism. It is worth noting that Jeon et al. (2017) used the human capital approach (i.e., valuing costs of lost income from the individual's perspective) to estimate indirect costs.

The study also reported indirect costs by time since diagnosis, allowing for estimation of costs by phase of care. In the OncoSim All Cancers model, for the initial care phase inputs, indirect costs were derived from the category first-year post-diagnosis, while estimates for the continuing care phase were an average of the indirect costs for the second- and third-years post-diagnosis. For the last year of life phase, the model inputs utilized the same indirect cost estimates from the initial phase of care, as there is a lack of high-quality studies on indirect costs associated with the last year of life phase. This decision was guided by the understanding that during the last year of life phase people with cancer typically receive end-of-life care, palliative care or both, making their active participation in employment unlikely. As a result, it is reasonable to assume that both the initial care and last year of life phases would exhibit comparable periods of absence from the labour market.(15,16) Using a five-year relative survival ratio for 26 cancer types,

TABLE A4 Summary of costs used in OncoSim

Study	Jurisdiction	Cost type	Cost inclusion from study	Cohort definition from study	Corresponding OncoSim phase
Analysis based on de Oliveira et al. (2016)	Ontario	Net* direct health systems costs	Health-related cancer management costs included systemic drug therapies, radiation therapy, all physician services (diagnostic tests and laboratory services included), in-patient hospitalizations, ambulatory care, emergency visits (including same-day surgeries and procedures), home care, long-term care, complex continuing care and outpatient prescription drugs for eligible groups	Adults diagnosed in 2017–2022 with a primary cancer who survived 30 days or more	Initial care, continuing care and last year of life phases
Longo et al. (2021)	Canada	Gross[†] direct out-of-pocket costs	Costs reported by people with cancer related to drugs, home care, homemaking, vitamins, supplements, family care, accommodations, devices, costs related to imputed travel, parking fees and transit fares and other costs	People with breast, colorectal, lung and prostate cancers who had at least four weeks of cancer treatment (ideally still on active treatment)	Initial care phase
de Oliveira et al. (2014)	Ontario	Gross[†] direct out-of-pocket costs	Costs reported by people with cancer related to health professional visits, medication, equipment, homecare, travel, parking, accommodation and food	Long-term prostate cancer survivors diagnosed in 1993–1994, 1997–1998 and 2001–2002	Continuing care phase
Dumont et al. (2015)	Canada	Gross[†] direct out-of-pocket costs	Costs paid by people with cancer and caregivers related to palliative care	People with cancer enrolled in a regional palliative care program and their informal caregivers	Last year of life phase
Yabroff et al. (2005)	USA	Net* direct time costs	Time costs for people with cancer associated with travel to and from care, waiting for appointments and time spent receiving care	Individuals aged 65 years of age or older diagnosed with colorectal cancer between 1995–1998	Initial care, continuing care and last year of life phase
Jeon et al. (2017)	Canada	Net* indirect costs	Lost earnings by people with cancer due to changes in employment or annual earnings	People aged 26 to 61 years who survived at least three years after their cancer diagnosis	Initial care, continuing care and last year of life phase

*Net costs refer to the additional expenses associated with a cancer diagnosis. These costs are determined by matching people with cancer (cases) to non-cancer patients (controls) and calculating the difference in expenses between the two groups.

†Gross costs encompass all expenses associated with a cancer diagnosis, without comparing these expenses to those incurred by non-cancer patients.

Jeon et al. (2017) also reported indirect costs by cancer survival (categorized as high-, middle- and low-survival). In the OncoSim All Cancers model, we assigned each cancer type their respective indirect costs based on their categorization as a of high-, middle- or low-survival cancer. Both sexes had the same costs applied in OncoSim All Cancers.

Additional calculations and assumptions

In the OncoSim All Cancers model, all cost estimates and projections were converted to 2024 Canadian dollars using the Consumer Price Index (CPI) for Health and Personal Care, as well as All Items.(17)

The OncoSim All Cancers model is designed to project cancer-related costs throughout an individual's lifetime. Even when a person is in remission or has returned to work (indirect costs), the model will continue to estimate costs during that period. To avoid overestimating continuing care costs, we made a few key assumptions. First, we assumed that people with cancer would receive additional medical care (i.e. health systems costs) related to cancer for a maximum of 10 years in the continuing care phase, which is based on the longest observation from the source study.(7,8) This same maximum of 10 years was also used for out-of-pocket and time costs in the continuing care phase. For indirect costs in the continuing care phase, a maximum of one year was applied. This assumption is based on previous literature indicating that 60% of people return to work within one to two years after a cancer diagnosis.(18,19) Therefore, after one year in the continuing care phase, the average person with cancer would not bear any indirect costs because they would have likely returned to work by that point. Using this assumption in the model, people with cancer will bear indirect costs for a maximum of three years over their lifetime, including one year during the initial care phase, one year in the continuing care phase and one year during the last year of life phase. Lastly, indirect costs were considered only for people diagnosed with cancer before the age of 64.9 years, aligning with the median retirement age in Canada in 2023.(20) We made this decision because the average individual over the age of ~65 would not be working and, therefore, would not incur indirect costs during this period.

Sensitivity analysis

Sensitivity analyses were conducted to evaluate some assumptions (Table A5).

TABLE A5 Summary of sensitivity analyses

Assumption	Base case	Sensitivity analysis
Maximum number of years incurring health systems, out-of-pocket and time costs	12 years	5 and 17 years
Maximum number of years out of work due to cancer	3 years	2 and 5 years
Age limit for incurring indirect costs (income losses)	65 years	60 and 70 years
Annual inflation rate	2.7%	3% and 5%
Population growth	Mid-level	Low and high (Statistics Canada demography assumptions)(21)

The sensitivity analysis indicated that the total societal cost of cancer in 2024 ranges from a low of $29.7 billion to a high of $41.0 billion, with the base case reported at $37.7 billion in the main body of the report. Costs for people with cancer and their caregivers could vary from $7.0 billion to $8.2 billion, with the base case indicating that these costs totalled $7.5 billion in 2024. Overall, the societal cost of cancer is expected to increase in the next 10 years. It may increase by as little as 20% or as much as 24%, depending on the assumptions used. See Table A6 for more information.

TABLE A6 Summary of sensitivity analyses results

Scenario	Total cost of cancer (societal) in 2024	Costs for people with cancer and caregivers	Proportion of cost borne by people with cancer and caregivers	Societal cost increase in the next 10 years (2024 to 2034)
Base case scenario*	$37.7 Billion	$7.5 Billion	1/5	23%
Age limit for incurring indirect costs (income losses): 70 years	$38.3 Billion	$8.2 Billion	1/5	22%
Age limit for incurring indirect costs (income losses): 60 years	$37.2 Billion	$7.0 Billion	1/5	23%
Maximum number of years out of work due to cancer: 5 years	$38.3 Billion	$8.2 Billion	1/5	22%
Maximum number of years out of work due to cancer: 2 years	$37.3 Billion	$7.1 Billion	1/5	23%
Maximum number of years incurring health systems, out-of-pocket and time costs: 17 years	$41.0 Billion	$7.8 Billion	1/5	24%
Maximum number of years incurring health systems, out-of-pocket and time costs: 5 years	$29.7 Billion	$7.0 Billion	1/4	20%
Annual inflation rate: 5%	$39.5 Billion	$7.9 Billion	1/5	23%
Annual inflation rate: 3%	$38.8 Billion	$7.7 Billion	1/5	23%
Population growth: high	$37.7 Billion	$7.5 Billion	1/5	24%
Population growth: low	$37.6 Billion	$7.5 Billion	1/5	22%

*Base case scenario assumptions: age limit for incurring indirect costs (income losses) is 65 years; maximum number of years out of work due to cancer is 3 years; maximum number of years incurring health systems, out-of-pocket and time costs is 12 years; annual inflation rate is 2.7%; population growth is medium (M3).(22)

Community partner engagement

Recognizing the importance of including perspectives from people affected by cancer, particularly as it relates to the current topic of the economic impact of cancer, the Canadian Cancer Society engaged with three people affected by cancer (our community partners) to help inform the report. Patient partners reviewed a draft of this report and provided written feedback on readability and accessibility of the report, suitability of quotes and perspectives embedded in the report, clarity of figures and infographics and any gaps not addressed. Patient partners were offered compensation for their time in alignment with the Canadian Cancer Society compensation policies and procedures.

Peer review

The peer-review process was overseen by the Canadian Cancer Statistics Advisory Committee's Working Group (WG) on the economic impact of cancer in Canada. The WG recruited two peer reviewers based on their clinical and epidemiologic expertise. A full draft of this report (including text, figures and the description of data sources and methods) was sent to those who agreed to participate. Peer reviewers were given two weeks to review the materials, and they provided written feedback on the materials directly to the WG. The WG reviewed and discussed the feedback as a group and decided what changes would be made as a result.

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Contact us

Collaborators

Canadian Cancer Society

For general information about cancer (such as cancer prevention, screening, diagnosis, treatment or care), contact the Canadian Cancer Society's Cancer Information Helpline at 1-888-939- 3333 or visit cancer.ca. For questions about this publication, email: stats@cancer.ca.

Public Health Agency of Canada

For information on chronic diseases including cancer, their determinants and their risk and protective factors in Canada, please refer to https://www.canada.ca/en/public-health.html (select "Chronic Diseases") or email: phac.chronic.publications-chronique.aspc@canada.ca.

Statistics Canada

More detailed information on the Canadian Cancer Registry is available from the Centre for Population Health Data at Statistics Canada, National Enquiries Line (1-800-263-1136) or through Client Services at the Centre for Population Health (statcan.hd-ds.statcan@canada.ca or 613-951-1746).

Canadian Council of Cancer Registries

Cancer incidence data are supplied to Statistics Canada by provincial and territorial cancer registries to form the Canadian Cancer Registry (CCR). The CCR is governed by the Canadian Council of Cancer Registries (CCCR), a collaboration between the 13 provincial and territorial cancer registries and the Centre for Population Health Data Statistics Canada. Information about the CCR and CCCR can be found on Statistics Canada's Canadian Cancer Registry (CCR) website. Detailed information regarding the statistics for each province or territory is available from the relevant registry:

Newfoundland and Labrador
Prince Edward Island
Nova Scotia
New Brunswick
Quebec
Ontario
Manitoba
Saskatchewan
Alberta
British Columbia
Nunavut
Northwest Territories
Yukon
Statistics Canada

Vital Statistics Council for Canada

Mortality data are supplied to Statistics Canada by the provincial and territorial Vital Statistics Registrars to form the Canadian Vital Statistics—Death Database (CVSD). The Canadian Vital Statistics System is governed by the Vital Statistics Council for Canada (VSCC) since 1945. The VSCC is a collaboration between the 13 provincial and territorial Vital Statistics Registrars and the federal government represented by the Centre for Population Health Data of Statistics Canada. Detailed information on the VSCC and the CVSD can be found on Statistics Canada's Vital Statistics—Death Database (CVSD).

Contributors

Canadian Partnership Against Cancer

More detailed information on methodology used in this report and OncoSim is available from the Canadian Partnership Against Cancer. OncoSim is led and supported by the Canadian Partnership Against Cancer, with model development by the Health Analysis Division of Statistics Canada (had-das@statcan.gc.ca). It is made possible through funding from Health Canada.

Questions about cancer?

When you want to know more about cancer, call the Canadian Cancer Society's Cancer Information Helpline.

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