The Conference Board of Canada

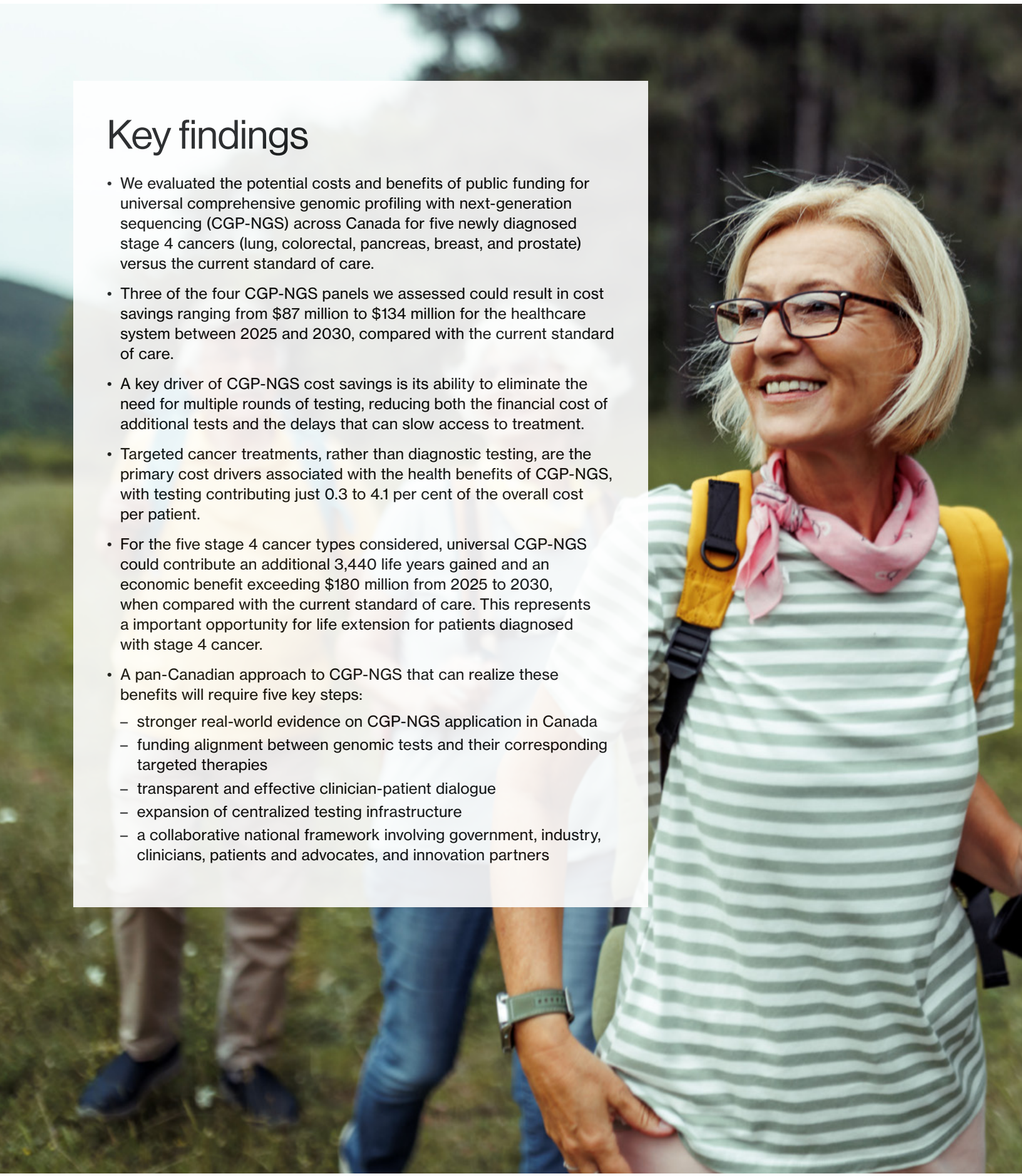
CCRAN Colorectal Cancer Resource & Action Network
RISCC Réseau d'informations et soutien pour le cancer colorectal
A PATIENT-FOCUSED ORGANIZATION

Precision in Practice

Costs and Benefits of Comprehensive Genomic Profiling for Five Stage 4 Cancers

Impact paper | November 6, 2025

Contents



Key findings

- We evaluated the potential costs and benefits of public funding for universal comprehensive genomic profiling with next-generation sequencing (CGP-NGS) across Canada for five newly diagnosed stage 4 cancers (lung, colorectal, pancreas, breast, and prostate) versus the current standard of care.
- Three of the four CGP-NGS panels we assessed could result in cost savings ranging from $87 million to $134 million for the healthcare system between 2025 and 2030, compared with the current standard of care.
- A key driver of CGP-NGS cost savings is its ability to eliminate the need for multiple rounds of testing, reducing both the financial cost of additional tests and the delays that can slow access to treatment.
- Targeted cancer treatments, rather than diagnostic testing, are the primary cost drivers associated with the health benefits of CGP-NGS, with testing contributing just 0.3 to 4.1 per cent of the overall cost per patient.
- For the five stage 4 cancer types considered, universal CGP-NGS could contribute an additional 3,440 life years gained and an economic benefit exceeding $180 million from 2025 to 2030, when compared with the current standard of care. This represents a important opportunity for life extension for patients diagnosed with stage 4 cancer.
- A pan-Canadian approach to CGP-NGS that can realize these benefits will require five key steps:
  - stronger real-world evidence on CGP-NGS application in Canada
  - funding alignment between genomic tests and their corresponding targeted therapies
  - transparent and effective clinician-patient dialogue
  - expansion of centralized testing infrastructure
  - a collaborative national framework involving government, industry, clinicians, patients and advocates, and innovation partners

A new lens on cancer care

This is the first pan-Canadian estimate of the costs and benefits of comprehensive genomic profiling with next-generation sequencing (CGP-NGS) across five newly diagnosed stage 4 cancers (lung, colorectal, pancreas, breast, and prostate). While there is evidence from a patient perspective of the desire to implement CGP-NGS, such as the work of the Colorectal Cancer Resource & Action Network (CCRAN),[1] the ability to connect this identified patient need to both cost and benefits has been missing. CCRAN and The Conference Board of Canada have partnered to address this gap.

Cancer is the leading cause of death in Canada, with about one in four Canadians dying from it.[2] Lung, colorectal, pancreas, breast, and prostate cancers account for nearly 60 per cent of total cancer deaths in Canada (excluding Quebec) and are the five cancers with the highest age-standardized mortality rates as of 2024.[3]

For this report, we focus on newly diagnosed stage 4 cancers since these late-stage diseases are typically attributed with lower survival rates due to the complexity of disease, lack of treatment response, and their ability to spread uncontrollably.[4] Precise mapping of a tumour's genetic make-up and directing targeted treatment through CGP-NGS in these cases can be expected to yield the highest benefits.[5]

1 Snow and others, "Barriers and Unequal Access to Timely Molecular Testing Results."
2 Warkentin and others, "Progress in cancer control leads to a substantial number of cancer deaths avoided in Canada."
3 Canadian Cancer Statistics Dashboard, "Mortality."
4 Gui and others, "Evolution of metastasis."
5 Subbiah and others, "Imperative of Comprehensive Molecular Profiling as Standard of Care for Patients With Rare Cancers."

What is CGP-NGS?

Genomic profiling is a laboratory technique that uses tissue, blood, or other body fluid samples to analyze the genes of an individual or specific cell type, as well as how these genes interact with each other and the environment.[6] Beyond providing diagnosis, disease progression, and treatment response information, genomic profiling supports therapeutic judgment and a better understanding of disease and its biology.[7]

Using next-generation sequencing (NGS) technology, CGP-NGS is a diagnostic testing technique using large panels of genetic sequences that enables the simultaneous sequencing of multiple genes, providing a detailed mutational profile of a patient's tumour and guiding targeted treatment decisions. NGS is a technology used for determining deoxyribonucleic acid (DNA) or ribonucleic acid (RNA) sequences in entire genomes to study genetic variation associated with diseases or other biological phenomena.[8] NGS can sequence millions of DNA molecules at the same time and provide detailed information on genome structure, gene activity, and changes in gene behaviour with more accuracy and at a reduced cost compared with alternative sequencing methods.[9] NGS makes it possible to study a patient's whole genome and produce more accurate prognosis and personalized care for patients.

6 National Cancer Institute, NCI Dictionary of Cancer Terms, "Genomic characterization."
7 Goossens and others, "Cancer biomarker discovery and validation"; Narrandes and others, "Gene Expression Detection Assay for Cancer Clinical Use."
8 Satam and others, "Next-Generation Sequencing Technology."
9 Satam and others.

How genomic profiling informs cancer care

By leveraging a single test, CGP-NGS can identify the four main classes of genomic alterations associated with cancer growth, including base-pair substitutions, copy number variations, insertions/deletions, rearrangements,[10] and other clinically relevant, actionable alterations.[11] It is a critical, precise tool for informed clinical decision-making in cancer care.[12]

Beyond genomic structure and variations, CGP-NGS provides detailed insights into gene expression, revealing information about genetic changes within cells that promote tumour growth and progression.[13] It has been found to play a key role in assessing tumour mutational burden (TMB), detecting microsatellite instability (MSI) and microsatellite stability (MSS) to identify patients who may benefit from immunotherapy, and directing clinical trial enrolment for targeted therapies.[14] A 2024 study found a positive correlation between CGP and clinical trial enrolment for breast and prostate cancer patients across 280 cancer clinics in the United States.[15] In non-small cell lung cancer (NSCLC), CGP improved tissue stewardship, requiring about 30 per cent less tissue to assess the same number of biomarkers compared with single-gene testing.[16]

Unlike focused NGS (hotspot testing), CGP-NGS uncovers a broader range of clinically relevant genomic alterations. In clinical practice, CGP identified genomic alterations in 98 per cent of tumours compared with 77 per cent for hotspot testing in breast cancer.[17] Furthermore, 46 per cent of lung cancer patients, with no previous mutation identified from 30 single-gene testing combinations, tested positive for biomarkers using CGP.[18]

CGP-NGS has proven valuable in determining therapeutic implications for both newly diagnosed and recurrent stage 4 cancer, including increased enrolment of patients in clinical trials compared with those without a CGP-NGS report.[19] This highlights how CGP-NGS enhances the detection of actionable alterations, supporting the identification of targeted treatments, and is therefore of higher clinical value than alternative testing for patients across multiple tumour types.[20]

10 Fumagalli and others, “Making the Most of Complexity to Create Opportunities.”

11 Lawrence and others, “Mutational heterogeneity in cancer and the search for new cancer-associated genes”; Frampton and others, “Development and validation of a clinical cancer genomic profiling test based on massively parallel DNA sequencing.”

12 Chakravarty and others, “Clinical cancer genomic profiling.”

13 Pankiw and others, “Comprehensive genomic profiling for oncological advancements by precision medicine.”

14 Tjota and others, “Clinical Utility and Benefits of Comprehensive Genomic Profiling in Cancer”; Pankiw and others, “Comprehensive genomic profiling for oncological advancements by precision medicine”; Tanabe and others, “Clinical utility of comprehensive genomic profiling test for colorectal cancer.”

15 Huang and others, “Clinical value of comprehensive genomic profiling on clinical trial enrollment for patients with advanced solid tumors.”

16 Tjota and others, “Clinical Utility and Benefits of Comprehensive Genomic Profiling in Cancer.”

17 Alvarez and others, “Comparison of comprehensive genomic profiling (CGP) and hotspot next generation sequencing (NGS) assays in identifying treatment options for care of patients with metastatic cancer in the community setting.”

18 Nesline and others, “The Impact of Prior Single-Gene Testing on Comprehensive Genomic Profiling Results for Patients with Non-Small Cell Lung Cancer.”"

19 Hung and others, “Comprehensive genomic profiling in multiple cancer types”; Teuwen and others, “Comprehensive genomic profiling and therapeutic implications for patients with advanced cancers.”

20 Ida and others, “Clinical utility of comprehensive genomic profiling tests for advanced or metastatic solid tumor in clinical practice.”

CGP-NGS in oncology: Comparing Canadian and international practices

Clinical guidelines for CGP-NGS

The European Society for Medical Oncology (ESMO) and the American Society of Clinical Oncology (ASCO) lead the global oncology community by providing expertise, guidance, and education to clinicians, patients, and the public—helping to reduce the burden of cancer worldwide.[21] These oncology resources offer the latest treatment guidelines and support standardized clinical practice, ensuring care is informed by the most current evidence.[22] Both ESMO and ASCO widely support the utility of CGP-NGS in their guidelines for solid tumours and stage 4 disease.[23]

CGP-NGS availability in Canada varies by region

In Canada, CGP-NGS is not yet considered the standard of care in provincial and territorial health systems.[24] While opportunities for patient access exist, testing is typically localized to major cancer or academic hospitals (e.g., Oncomine Precision Assay at William Osler Health System in Ontario).[25] Furthermore, testing is not universally offered to every patient with a cancer diagnosis. Specific criteria, such as stage 4 NSCLC, must be met to receive testing and funding coverage.

In 2021, Cancer Care Ontario and ASCO issued joint guidelines recommending and offering reflex tissue testing with CGP-NGS for all patients diagnosed with stage 4 NSCLC.[26] Currently, these guidelines and allocated funding streams do not specify a particular CGP-NGS panel. However, there are examples of specific CGP-NGS panels being leveraged in Canada including the OncoPanel in British Columbia; Alberta's Cancer Biomarker Comprehensive DNA Panel; Oncomine Comprehensive and/or Precision Assay in Ontario, Saskatchewan, and New Brunswick; and the AmpliSeq Focus Panel in Quebec and Nova Scotia.[27]

In addition to these opportunities, CGP testing is accessible through research initiatives in provinces like Ontario,[28] Quebec,[29] and Nova Scotia.[30]

21 European Society for Medical Oncology, "About ESMO"; American Society of Clinical Oncology, "ASCO Overview."

22 European Society for Medical Oncology; American Society of Clinical Oncology.

23 Wang and others, "Comprehensive genomic profiling in solid tumors"; Ben-Shachar and others, "Real-World Adherence Patterns of Comprehensive Genomic Profiling to Biomarker Recommended Therapies in Patients With Advanced Non–Small Cell Lung Cancer"; Olsen and others, *The Untapped Potential of Comprehensive Genomic Profiling*.

24 Johnston and others, "Costs of in-house genomic profiling and implications for economic evaluation."

25 Nicholas and others, "Point of Care Liquid Biopsy for Cancer Treatment—Early Experience from a Community Center."

26 Hanna and others, "Therapy for Stage IV Non–Small-Cell Lung Cancer With Driver Alterations"; Breadner and others, "Implementation of Liquid Biopsy in Non-Small-Cell Lung Cancer."

27 Canada's Drug Agency, *Pharmacoeconomic Review-Capivasertib (Truqap)*; Nicholas and others, "Point of Care Liquid Biopsy for Cancer Treatment—Early Experience from a Community Center."

28 Health Quality Ontario, "Plasma-Based Comprehensive Genomic Profiling DNA Assays for Non-Small Cell Lung Cancer."

29 University of Laval, "Genomics Center."

30 IWK Health, "Clinical Genomics."

An example of this is British Columbia's offering CGP-NGS for cancer care through BC Cancer, such as OncoPanel and Focus Panels for solid tumours, making these services available to a broader patient base.[31] In 2024, Ontario Health further advanced the integration of genomic testing by recommending public funding for plasma-based comprehensive genomic profiling DNA panels (liquid biopsy testing).[32] These tests are specifically intended for NSCLC patients who have either insufficient tissue samples or tumours that are difficult to biopsy.

CGP-NGS uptake in Canada comes with challenges and opportunities

Overall, funding for CGP-NGS panels is inconsistent across provinces and territories, with clinical applications ranging from disease screening and hereditary cancer testing to predicting the risk of recurrence.[33] The lack of systematic oversight as well as inconsistent funding strategies for CGP-NGS contribute to its limited uptake.[34]

These issues are not new; similar gaps have been observed in molecular testing where disparities in funding and the availability of local pathology labs further hinder widespread access.[35]

As provincial and territorial governments continue to invest in cancer research programs, the use of CGP in routine cancer care is expanding. In Ontario, for example, Genome Canada, the Ontario Institute for Cancer Research (OICR), and Thermo Fisher Scientific have teamed up to develop NGS panels and software to improve the assessment and management of breast, prostate, and pancreatic cancers.[36]

Building on these provincial efforts, a pan-Canadian initiative led by the Terry Fox Research Institute and the Terry Fox Foundation, with support from the Government of Canada and a network of partners, is advancing the creation of the "Gold Cohort."[37] This ambitious project aims to gather genomic and clinical data from 15,000 cancer patients, further strengthening the national effort to integrate genomic insights into clinical care.

31 BC Cancer, *Cancer Genetics and Genomics Laboratory – BC Cancer*."

32 Health Quality Ontario, "Plasma-Based Comprehensive Genomic Profiling DNA Assays for Non-Small Cell Lung Cancer."

33 Weymann and others, "Allocating healthcare resources to genomic testing in Canada."

34 Johnston and others, "Costs of in-house genomic profiling and implications for economic evaluation."

35 Johnston and others, "Costs of in-house genomic profiling and implications for economic evaluation."

36 Ontario Institute for Cancer Research, "Canadian Government-Sponsored Collaboration Targets Standardized Cancer Testing."

37 Marra, "Driving Cancer Research with Comprehensive Data Types That Are Complete, Accurate, Permanent and Accessible."

Furthermore, a state-of-readiness report card developed in 2023 explored capacity to integrate routine use of genome-based testing in cancer care into the public health system based on the dimensions of infrastructure, operations, and environment for five provinces.[38] Each of these areas consists of multiple topic areas related to the systems level of establishing the requirements of genome-based testing. These requirements include the following:

1. Infrastructure
   a. creating communities of practice and healthcare system networks
   b. personnel, equipment, and resource planning
   c. informatics
2. Operations
   a. entry/exit point for innovation
   b. evaluative function
   c. service models
   d. awareness and care navigation
3. Environment
   a. integration of innovation and healthcare delivery
   b. financing approach
   c. education and training
   d. regulation

Based on these criteria, they reported that Alberta was the most prepared, followed by Quebec. In contrast, British Columbia, Nova Scotia, and Ontario were the least prepared to implement genome-based testing.[39]

Global adoption of CGP is uneven

While the adoption and funding of CGP-NGS in oncology varies globally, some regions are already demonstrating effective integration. Across Europe, CGP-NGS availability is inconsistent but available in the Western nations.[40] Denmark, France, Germany, and the United Kingdom provide complete access to CGP-NGS, while Italy and Spain lag behind with availability at 67 per cent and 83 per cent, respectively.[41] Additionally, since 2019, Croatia has pioneered nationwide CGP-NGS, which is offered by Foundation Medicine Inc., with full coverage provided by their national health insurance.[42]

In the United States, CGP-NGS is widely adopted and considered the standard of care according to ASCO guidelines. Currently, Medicare is covering reimbursement, and private insurance provides selective coverage.[43] As well, over 99 per cent of physicians report having used CGP-NGS in the last 12 months.[44] While these results indicate high utility, patient access is hinged on the presence of insurance coverage, with 8.2 per cent of the population considered uninsured and therefore unable to access CGP-NGS.[45]

Other nations that have incorporated CGP-NGS into cancer care include Australia and Israel. Australia currently offers two research programs with genomic testing—the Zero Childhood Cancer Program and Omico's Cancer Screening Program.[46]

38 Husereau and others, *Towards the Routine Use of Genome-Based Testing in Canada's Largest Regions: A State of Readiness Progress Report*.

39 Husereau and others, *Towards the Routine Use of Genome-Based Testing in Canada's Largest Regions: A State of Readiness Progress Report*.

40 Olsen and others, *The Untapped Potential of Comprehensive Genomic Profiling*.

41 Olsen and others.

42 Čerina Pavlinović and others, "Precision Oncology in Clinical Practice."

43 Olsen and others, *The Untapped Potential of Comprehensive Genomic Profiling*.

44 Kaminski and others, "Barriers to next-generation sequencing despite increased utilization."

45 Stewart, "2024 NHIS Full-Year Health Insurance Estimates Early Release: Public Coverage Fell While Private Coverage and Uninsurance Held Steady."

46 Rare Cancers Australia, *Advancing Genomic-Led Cancer Care in Australia*.

These programs are based on patient eligibility, focusing on childhood cancers and those with advanced (stage 3 or beyond) or rare disease. Israel has offered CGP-NGS since the fall of 2023 for all cancer patients at the Hadassah Medical Center.[47] This initiative was part of a larger partnership between Hadassah, Roche Israel, and Foundation Medicine.[48]

Evaluating the costs and benefits of CGP-NGS in cancer care

Expanding the accessibility of CGP-NGS within Canada's healthcare system is a multi-phase process. Until now, much of the evidence surrounding its value has been limited to individual care sites or provinces. We propose a pan-Canadian approach as the natural next step. This will allow us to assess the economic impact and, more importantly, quantify the effect on patients and the healthcare system, comparing a universally funded CGP-NGS landscape with the current model of care.

We assess four CGP-NGS panels

Four CGP-NGS panels were chosen for modelling. These are the following:

- FoundationOne CDx tissue (324 gene panel)[49]
- Oncomine Comprehensive Assay V3 (161 gene panel)[50]
- AmpliSeq for Illumina Focus Panel (52 gene panel)[51]
- Oncomine Precision Assay (50 gene panel)[52]

These panels were selected due to their current use within the Canadian healthcare landscape and/or the accessibility of publicly available data from Canadian care sites that are leveraging these tests. For this modelling, only tissue-based panels were included. While liquid biopsy panels are emerging as an important innovation—either complementing tissue-based testing or serving as stand-alone tools—tissue-based panels remain the gold standard for tumour diagnostics at the time of this research.[53]

47 Friedman, "Hadassah Medical Center and Roche Israel Collaborate to Offer Israel's First Personalized Cancer Treatment Based on Genomic Profiling."
48 Friedman.
49 Roche Canada, "Foundation Medicine."
50 "Oncomine Comprehensive Assay v3 - CA."
51 Illumina, "AmpliSeq for Illumina Focus Panel | Combined DNA and RNA Workflow."
52 "Oncomine Precision Assay on the Genexus System - CA."
53 Ma and others, "Liquid biopsy in cancer."

We focus on five cancers with the highest mortality

Overall, lung, colorectal, pancreas, breast, and prostate cancers account for close to 60 per cent of Canadian cancer mortality.[54] Among these populations, those with stage 4 disease are at an even higher risk of cancer-related death due to the metastasis-initiating cells that result in tumours growing in distant organs.[55] Furthermore, these individuals have additional unmet needs due to fewer, and higher toxicity, treatment options.[56] Therefore, we have chosen to focus on those with stage 4 disease.

Colorectal and prostate cancers were modelled as single diseases, but due to the many nuances of tumour subtypes (e.g., rare disease) and extensive treatment lines for pancreatic, breast, and lung cancers, we focused on just the stage 4 subtypes with highest prevalence.

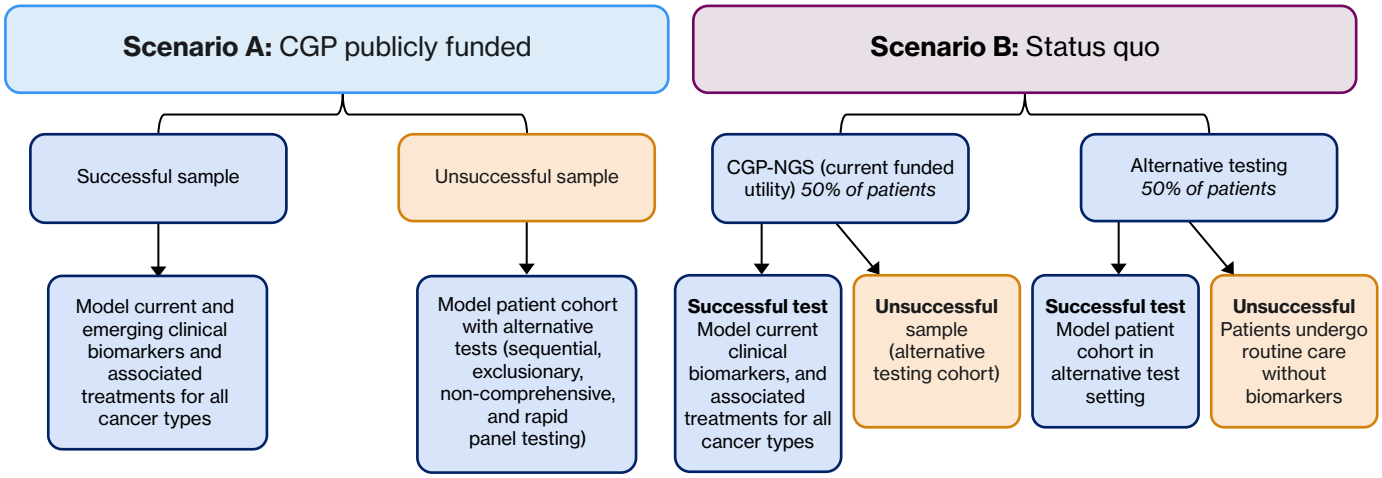
These are metastatic pancreatic ductal adenocarcinoma (90 per cent of pancreatic cancers[57]), metastatic invasive ductal carcinoma (80 per cent of breast cancers[58]), and metastatic NSCLC (87 per cent of lung cancers[59]).

Modelling framework

1. **Defining the scenarios**
   Two scenarios were modelled to compare the costs and benefits of CGP-NGS for newly diagnosed stage 4 lung, colorectal, pancreas, breast, and prostate cancers (2025–30):
   - **Scenario A (universal model):** All patients receive one of the four CGP-NGS panels.
   - **Scenario B (current standard of care):** Reflects the existing publicly funded mix (50:50) of CGP-NGS and alternative testing.

   (See Exhibit 1 for a visual representation of our modelling approach.)

Exhibit 1
Scenario-based modelling pathways



Source: The Conference Board of Canada.

54 Canadian Cancer Statistics Dashboard, "Mortality."
55 Ganesh and others, "Targeting metastatic cancer."
56 Lee and others, "Toxicities and Quality of Life during Cancer Treatment in Advanced Solid Tumors."
57 Sarantis and others, "Pancreatic ductal adenocarcinoma."
58 American Cancer Society, "Invasive Breast Cancer (IDC/ILC)."
59 American Cancer Society, "Lung Cancer Statistics | How Common Is Lung Cancer?"

2. Selecting the time horizon
Given the rapid evolution of biomarkers and therapies, we used a six-year horizon (2025–30) to capture both current and emerging technologies.

3. Estimating incidence rates
Historical age-standardized incidence data (1995–2024) from the Canadian Cancer Statistics Dashboard are used to project cancer incidence to 2030. (See Appendix A: Methodology)

We then calculated the incidence for each modelled cancer population from 2025 to 2030. (See Table 1.)

4. Incorporating clinical advancements
Current and emerging biomarkers with clinical utility (e.g., those that are able to be clinically addressed) in Canada are identified, with rates of occurrence applied to estimate patient eligibility and treatment regimens. These inputs informed the cost of clinical care for each cohort. (See Appendix A: Methodology for a complete list of current and emerging biomarkers included in this model.)

5. Matching therapies to biomarkers
Up to four treatment lines are assigned to each biomarker. Population proportions, line attrition, and therapy costs are applied to calculate the total and per patient treatment costs across tumour types.

6. Assembling the puzzle

Cost calculations
For each scenario, costs were calculated by combining the following:

- treatment costs: average treatment cost per patient, multiplied by the total population for each cancer type
- panel costs: cost of CGP-NGS or alternative panels, multiplied by the population tested
- delayed care costs: validated costs associated with turnaround times for both CGP-NGS and alternative testing
- alternative testing costs: applied to patients with unsuccessful CGP-NGS tests

These inputs provided the overall cost difference between Scenarios A and B, expressed as a total (2025–30), an annual difference, and a per patient difference.

Benefit calculations
Two primary benefits were modelled:

- life years gained—derived from higher rates of identifying actionable biomarkers and receiving matched therapies
- societal contribution—measured through increased total income linked to improved survival

For both Scenario A and Scenario B, we multiplied each cancer cohort by the survival gains and average total income that generated the incremental life years and societal contributions for each scenario.

Table 1
Incidence for each modelled cancer population from 2025–30
(modelled incidence per year)

Year	Lung cancer (mNSCLC)	Colorectal cancer (mCRC)	Breast cancer (mIDC)	Prostate cancer (mPC)	Pancreatic cancer (mPDA)
2025	11,821	5,079	889	1,980	2,630
2026	11,821	5,042	891	1,977	2,648
2027	11,877	5,029	896	1,984	2,678
2028	11,998	5,043	906	2,004	2,722
2029	12,118	5,057	915	2,023	2,767
2030	12,238	5,069	925	2,042	2,812

Headings: mCRC- metastatic colorectal cancer; mPDA- metastatic pancreatic ductal adenocarcinoma; mNSCLC- metastatic non-small cell lung cancer; mIDC- metastatic invasive ductal carcinoma; mPC- metastatic prostate cancer
Source: The Conference Board of Canada.

(See Table 2A for a complete list of costs and benefits included in this model in Appendix A: Methodology.)

For a more detailed explanation of our modelling inputs, approach, assumptions and their limitations, see Appendix A: Methodology.

Universal public coverage of CGP-NGS can reduce costs

Under the conditions of our model, universal public funding of CGP-NGS proved to be less costly compared with the standard of care for the Oncomine Precision, AmpliSeq Focus, and Oncomine Comprehensive V3 panels, but not for FoundationOne CDx. The highest cost savings were observed in the stage 4 colorectal cancer cohort, ranging from $1,677 to $2,495 per patient. This was followed by stage 4 pancreatic ductal adenocarcinoma ($1,161 to $1,751 per patient), stage 4 non-small cell lung cancer ($715 to $1,075 per patient), stage 4 prostate cancer ($130 to $392 per patient), and stage 4 invasive ductal carcinoma ($4 to $272 per patient).

FoundationOne CDx ranged between $131 to $770 per patient more expensive than the standard of care, with stage 4 NSCLC being nearest to cost neutral, and stage 4 invasive ductal carcinoma being the most expensive. The two factors contributing to this cost difference versus the other three tests were the higher panel cost and delay in treatment cost associated with the testing turnaround time. (See Table 2 for a comparison of total cost, yearly cost, and per patient cost by CGP-NGS panel and cancer type.)

Two key factors drive the cost savings of CGP-NGS compared with the standard of care in our model: the cost of sequential testing, and the cost of treatment delays.

In the standard of care scenario, sequential testing increases overall system costs, even though each individual test is less expensive. The need for multiple tests adds up, both in time and money. CGP-NGS panels, while more expensive per test, eliminate the need for sequential testing by identifying multiple biomarkers at once. This offsets the higher upfront cost of CGP-NGS.

Delaying treatment also adds substantial costs to the system, estimated at between $160.42 and $431.36 per patient per week in this model.[60] By enabling simultaneous testing for multiple biomarkers, CGP-NGS reduces diagnostic delays. In doing so, it delivers earlier treatment access, demonstrating that the higher upfront testing cost can be outweighed by long-term value.

As shown in Table 2, total cost savings per test depend on the number of stage 4 cancer patients eligible for testing. On a per patient basis, all five cancers modelled show cost reductions with three CGP-NGS panels. Colorectal and pancreatic cancers show the largest savings, while breast and prostate cancers show the smallest.

This difference is explained by biomarker complexity and the cost of individual tests. For instance, breast cancer often involves a single actionable biomarker—meaning a single test can identify it. In contrast, colorectal cancer involves multiple biomarkers, requiring more sequential tests to achieve what CGP-NGS can do in one step. Likewise, single biomarker test costs vary widely, from $100 to $683. For cancers like pancreatic, where multiple high-cost tests are needed, the value of CGP-NGS becomes even more important.

While panel costs and treatment delays were factors in each scenario, it's crucial to contextualize these diagnostic expenses relative to the cost of treatment. Depending on the cancer type, panel testing made up just 0.3 to 4.1 per cent of total treatment costs. Lower percentages were linked to more complex, high-cost cases; higher ones to less expensive treatments. Any future reductions in the cost of treatments for these stage 4 cancers will have a greater impact on systematic costs compared with those of diagnostic testing.

60 De Oliveira and others, "Estimating the cost of cancer care in British Columbia and Ontario."

Table 2
Cost comparison analysis between universal CGP-NGS and standard of care with an estimated CGP-NGS utility of 50 per cent

Lung Cancer				
Calculation	**FoundationOne CDx**	**Oncomine Precision Assay**	**AmpliSeq Focus Panel**	**Oncomine Comprehensive Assay V3**
$ difference (total)	–$9,412,156	$77,230,187	$67,076,608	$51,369,169
$ difference (per year)	–$1,568,693	$12,871,698	$11,179,435	$8,561,528
$ difference (per patient-total)	–$131	$1,075	$933	$715

Colorectal cancer				
Calculation	**FoundationOne CDx**	**Oncomine Precision Assay**	**AmpliSeq Focus Panel**	**Oncomine Comprehensive Assay V3**
$ difference (total)	–$3,672,954	$29,963,877	$25,680,535	$20,137,072
$ difference (per year)	–$612,159	$4,993,979	$4,280,089	$3,356,179
$ difference (per patient-total)	–$306	$2,495	$2,138	$1,677

Pancreatic cancer				
Calculation	**FoundationOne CDx**	**Oncomine Precision Assay**	**AmpliSeq Focus Panel**	**Oncomine Comprehensive Assay V3**
$ difference (total)	–$8,773,215	$21,032,159	$18,735,579	$13,949,135
$ difference (per year)	–$1,462,203	$3,505,360	$3,122,596	$2,324,856
$ difference (per patient-total)	–$730	$1,751	$1,560	$1,161

Note: Calculations based on the total cost of CGP minus the total cost of standard of care. Positive values indicate cost savings to the healthcare system.
Source: The Conference Board of Canada.

Breast cancer				
Calculation	**FoundationOne CDx**	**Oncomine Precision Assay**	**AmpliSeq Focus Panel**	**Oncomine Comprehensive Assay V3**
$ difference (total)	–$4,177,270	$1,472,766	$706,849	$20,224
$ difference (per year)	–$696,212	$245,461	$117,808	$3,371
$ difference (per patient-total)	–$770	$272	$130	$4

Prostate cancer				
Calculation	**FoundationOne CDx**	**Oncomine Precision Assay**	**AmpliSeq Focus Panel**	**Oncomine Comprehensive Assay V3**
$ difference (total)	–$7,674,902	$4,704,688	$3,007,906	$1,564,013
$ difference (per year)	–$1,279,150	$784,115	$501,318	$260,669
$ difference (per patient-total)	–$639	$392	$250	$130

Improved treatments informed by CGP-NGS can extend lives

Universal public funding of CGP-NGS across these five stage 4 cancers could result in an additional **3,440 life years gained**, equating to more than **$180 million in societal contribution**.

In total, universal public funding of CGP-NGS for nearly 136,000 patients across the five newly diagnosed stage 4 cancers analyzed could result in an additional 3,440 life years gained over the life years gained in the current standard of care scenario. These additional life years for patients equate to a societal contribution exceeding $180 million. (See Chart 1, Comparison of life years gained.)

The benefits observed are directly related to the size of each cancer cohort. Consequently, cancers with a higher number of newly diagnosed stage 4 patients demonstrate the greatest realized benefits. Lung cancer shows the largest gains, whereas breast cancer, with relatively few new stage 4 diagnoses, shows the smallest.

Next steps

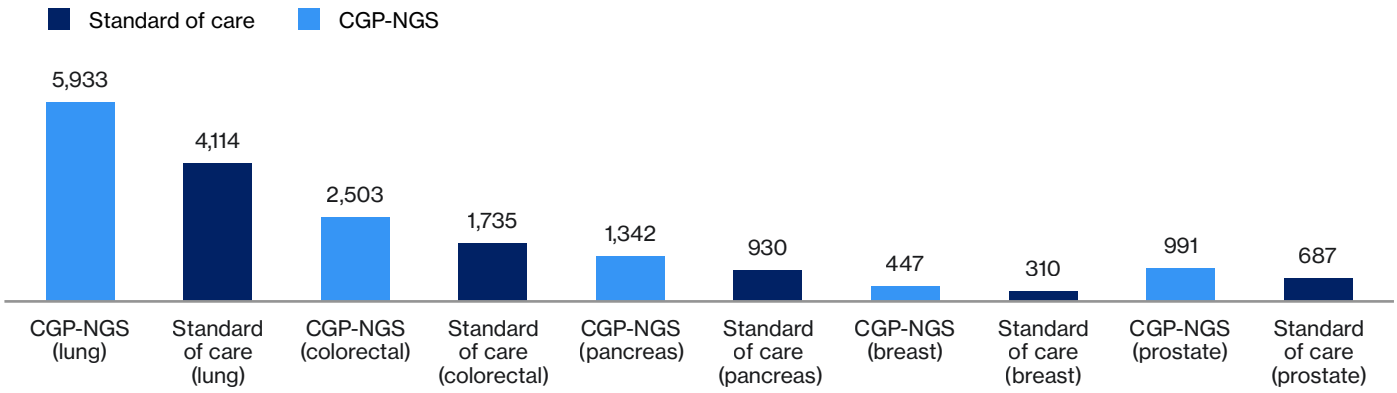
Each patient's unique genomic profile offers valuable insights, helping to shape personalized treatment strategies that can predict better outcomes. The use of CGP-NGS across five newly diagnosed stage 4 cancers could not only extend lives but also deliver substantial cost savings for healthcare systems and increase societal contributions. There are several steps that the Canadian health systems can take to leverage the power of CGP-NGS technology.

Realizing the benefits of CGP-NGS for Canadian cancer patients

We see the following steps as necessary conditions for moving forward:

1. Enhance the collection and accessibility of cost-and-benefit data related to CGP-NGS.
2. Address current barriers to the integration of CGP-NGS within the Canadian clinical context.
3. Align these results and additional evidence into the Canadian healthcare/cancer care, industry/private sector, and clinical practice context.

Chart 1
Comparison of life years gained: Publicly funded CGP-NGS vs. 50:50 split with alternative testing in five cancer cohorts
(life years gained)



Source: The Conference Board of Canada.

Enhance the collection and accessibility of cost-and-benefit data

Recommendation: Provincial cancer systems and care sites can increase data collection and build real-world evidence infrastructure.

Both individual care sites and provincial cancer care systems can enhance their data reporting to generate practice-level evidence on the results associated with current publicly funded CGP-NGS initiatives. This approach can build on real-world evidence studies from British Columbia and Ontario[61] to include other provincial and territorial health systems, ensuring that standardized indicators, surveillance, and monitoring are implemented, thus strengthening the knowledge base.

As many of the current publicly funded CGP-NGS initiatives are centralized, we recommend that these programs collect real-world data on key factors such as testing time, sample quality, costs, treatment outcomes, and the demographic characteristics of populations both within and outside these centralized sites. By comparing patient outcomes and system-wide impacts, this data would provide valuable insights for future planning and could accelerate the appropriate uptake and expansion of CGP-NGS.

Address current barriers to integrating CGP-NGS within the Canadian clinical context

Recommendation: Provincial payers can expand funding alignment between biomarker testing and targeted therapies.

As part of our modelling approach, a team of Expert Reviewers—oncologists with experience in treating one or more of the five cancers, alongside clinical pathologists—were tasked with aligning current and emerging biomarkers within each cancer cohort to publicly available and funded treatment regimens, the proportion of patients receiving each treatment, and estimating treatment line attrition rates. Based on these discussions, experts noted that, in many cases, identifying a biomarker through CGP-NGS did not lead to a change in treatment regimen compared with alternative testing, highlighting the ongoing limitations in clinical uptake across certain tumour types.

Additionally, when a matched therapy was available, it was not always funded for first-line treatment. While this may be influenced by treatment guidelines, it underscores that identifying an actionable biomarker does not guarantee access to targeted therapies. To address this gap, provinces may benefit from bundling targeted therapies with their companion diagnostics (CGP-NGS), recognizing that they are clinically dependent on one and the other. Nationally, there is the opportunity to potentially expand pan-Canadian Pharmaceutical Alliance (pCPA) negotiations to a national funding framework that may minimize disparities amongst provinces and expedite treatment availability.

Recommendation: Clinicians can enhance patient dialogue and transparency.

Clinicians can align their clinical recommendations with patient expectations to ensure transparency about testing capabilities and available treatment options. Key factors such as panel size, testing turnaround time, treatment options (including clinical trial eligibility), and expected outcomes can be communicated to enhance testing transparency.

61 Hernando-Calvo and others, “Impact on costs and outcomes of multi-gene panel testing for advanced solid malignancies”; Weymann and others, “Early-stage economic analysis of research-based comprehensive genomic sequencing for advanced cancer care”; Regier and others, “Real-world diagnostic outcomes and cost-effectiveness of genome-wide sequencing for developmental and seizure disorders”; Perdrizet and others, “Integrating comprehensive genomic sequencing of non-small cell lung cancer into a public healthcare system.”

For example, increasing panel size does not always increase the number of identified actionable biomarkers. As a result, the treatment course is often the same regardless of panel size. This is important, as panel size may impact the turnaround time for results, especially if it is analyzed offsite. There may also be out-of-pocket costs involved. As such, better communications from clinicians can help patients understand that, at present, bigger may not be better. An exception to this may be when standardized testing and treatment have been deemed ineffective, where a larger panel can be leveraged to direct clinical trial enrolment.

Ultimately, the decision about which panel to request is the responsibility of the clinical pathology and oncology teams to ensure value-based clinical judgment, not cost-reduction, is the driver in test selection. The considerable variability in molecular profiles, treatment pathways, and patient responses underscores the need for a range of diagnostic tools at different stages of care.

Recommendation: Provincial cancer systems can expand centralized CGP-NGS testing infrastructure with standardization protocols.

A major barrier to national CGP-NGS implementation is the increased resource capacity required to deliver it. Aside from the panel cost and technology (e.g., Genexus Sequencer), there may be increased laboratory requirements over traditional testing modalities, as well as increased staffing to process, analyze, and interpret the samples.

One method that has been proposed to mitigate this barrier has been to centralize CGP-NGS testing, which many of the provincial testing facilities are currently following.[62] Focusing the infrastructure on a reduced number of sites may promote adoption, improve coordination and administration of these technologies, and potentially reduce testing turnaround time.[63] While this method has many advantages, there are certain aspects that require attention. Standardized sample collection and quality control would need to be monitored to ensure rapid testing time,[64] and our Expert Reviewers noted that geographic representation will need to be considered to ensure equitable access and reduced sample shipment costs.

Aligning the evidence in a Canadian context

Recommendation: Canadian cancer and genomics leaders establish a pan-Canadian framework and strategy for CGP-NGS delivery with collaboration with government, industry, clinicians, patients and advocates, and innovation stakeholders.

CGP-NGS implementation in Canada is currently occurring in silos. The Canadian healthcare system is split into isolated provincial and territorial approaches with each having a different capacity to perform and deliver technology such as CGP-NGS. Variability in data systems, clinical practice, testing facilities, and capacity to fund new diagnostic technologies and precision treatment exacerbates these silos.

A recent article highlights these gaps and examines provincial and territorial readiness for genome-based testing.[65] It recommends the need for the following:

- linked information systems and data integration
- timely and transparent evaluative processes
- increased navigational tools for care providers
- dedicated funding to facilitate rapid onboarding and support test development and proficiency testing
- broader engagement with innovation stakeholders beyond care providers and patients

Building on these recommendations, the real-world evidence highlighted earlier in this report can empower healthcare systems to make informed, data-driven decisions that support the expansion of publicly funded CGP-NGS. This aligns with findings from Canada's Drug Agency (CDA), which in 2022 identified uncertainty in CGP's cost-effectiveness due to limited robust effectiveness data.[66]

62 Basharat and others, *An Overview of Comprehensive Genomic Profiling Technologies to Inform Cancer Care*.
63 Basharat and Farah, "An Overview of Comprehensive Genomic Profiling Technologies to Inform Cancer Care."
64 Basharat and Farah, "An Overview of Comprehensive Genomic Profiling Technologies to Inform Cancer Care."
65 Husereau and others, "Progress toward Health System Readiness for Genome-Based Testing in Canada."
66 Basharat and others, *An Overview of Comprehensive Genomic Profiling Technologies to Inform Cancer Care*.

However, to build this database, we require evidence and collaboration across private and public sectors. Implementation in health systems requires industry- and research/innovation-sector organizations with investments in CGP technologies and associated therapeutics to support increased patient access to publicly funded CGP-NGS. This is especially relevant to the manufacturers financing the research, development, and delivery of the CGP-NGS panels, as well as to genomics organizations funding and carrying out research and innovation initiatives in this space.

From a healthcare delivery lens, clinicians also play a pivotal role in advancing adoption. By engaging in research and development, collaborating with other clinical teams, and participating in targeted training, healthcare providers can accelerate the integration of CGP-NGS into routine practice. At the same time, health systems can ensure clinical teams are fully informed about new diagnostic approaches and that care sites are equipped to leverage this technology efficiently, with adequate laboratory support and minimal administrative burden. These coordinated efforts will align clinical practice with emerging genomic capabilities and maximize the positive impact of CGP-NGS on patient care.

Establishing a pan-Canadian framework and strategy on CGP-NGS delivery can remove this siloed approach and enable the building of an evidence-based platform. This strategy may also assist in increased provincial funding alignment and access for genomic testing and associated targeted therapies. A more coordinated and evidence-based approach to supporting CGP-NGS can help to deliver on the potential cost savings and benefits for patients and Canadians.

Appendix A

Methodology

Literature search

The literature review consisted of two phases. The first phase focused on a comprehensive review of academic and grey literature on the current state of CGP, NGS, and biomarkers in the cancer sphere, focusing on stage 4 (metastatic) lung, colorectal, pancreas, breast, and prostate cancers. The second phase reviewed academic literature on the benefits, utilities, and costs for the cost-benefit modelling component of this research. The literature reviews were to answer the following questions:

1. What is the current state of CGP-NGS for precision metastatic cancer treatment in Canada?
   - Are there any regional (provincial/ territorial) disparities in the testing availability of CGP for cancer?
2. What are the cost-and-benefit parameters in expanding access to CGP as a standard of care for newly diagnosed metastatic lung, colorectal, pancreas, breast, and prostate cancers in Canada?

Google and Google Scholar were used to identify academic and grey literature. Inclusion criteria focused on publications within the last 10 years to account for the rapid evolution of this topic, as well as Canadian-population-based or similar (e.g., United States, Europe) origin. A total of 183 sources were reviewed for relevancy and 100 were included in this report. The content was used to better understand the Canadian context and current landscape of CGP, NGS, and metastatic cancers; to act as a guide in developing the narrative of this report; and to provide parameter inputs for the cost-benefit model. The literature review also provided additional insight into the current knowledge gaps regarding the benefits and costs of CGP-NGS for lung, colorectal, pancreas, breast, and prostate cancer, and their related therapies.

Expert review

There were three major data gaps when constructing our model. These were real-world evidence surrounding current and emerging biomarkers for the five metastatic cancers, pan-Canadian stage-specific cancer treatment utility (type of therapy associated with each biomarker, proportion of patients who would receive each therapy), and treatment line attrition. To fill these gaps, we invited 11 Expert Reviewers who could contribute on-the-ground experience and report on these topics. Our expert panel consisted of oncologists with a specialty treating at least one of the cancers included in this model, clinical pathologists, and cancer researchers. In addition to this panel of experts, we also invited the members of our Research Advisory Board who also had a background in the three roles listed above.

We held a short meeting (about 30 minutes) with each reviewer to explain the project and ensure alignment with the topic area. From there, we provided a short document that included a list of current and emerging biomarkers from each cancer type based on our literature review for their feedback, as well as a table for them to indicate treatments for up to four lines, the proportion of patients who would receive each treatment, and the treatment line attrition.

Model methodology

Scenarios modelled

Two scenarios were modelled to compare the costs and benefits of CGP-NGS in the populations of newly diagnosed metastatic lung, colorectal, pancreas, breast, and prostate cancers from 2025–30.

- **Scenario A (universal model):** Every individual diagnosed with one of the five metastatic cancers (lung, colorectal, pancreas, breast, and prostate) received one of the four CGP-NGS panels included in this analysis. A 90 per cent sample success rate was applied across all CGP-NGS cohorts. For the remaining 10 per cent with unsuccessful samples, testing shifted to alternative methods (sequential, exclusionary, non-comprehensive, or rapid panels) with an assumed 95.5 per cent success rate.
- **Scenario B (current standard of care):** This reflects the existing publicly funded model, with an estimated 50:50 mix of CGP-NGS and alternative testing methods. The same 90 per cent success rate was applied to CGP-NGS samples, while unsuccessful samples (10 per cent) and the alternative testing group were both assumed to achieve a 95.5 per cent success rate.

(See the section, Modelling assumptions, below for a detailed description of the rates included in these scenarios.)

Time horizon

The clinical utility of CGP-NGS is advancing quickly, with actionable biomarkers and new therapeutics being approved and applied each year.[1] A single-year model would not capture the full potential of these technologies or highlight the key areas where policy and research need to focus on future planning and system readiness. To address this, we have included a six-year time horizon, from 2025 to 2030.

1 De La O and others, “Comprehensive genomic profiling of over 10,000 advanced solid tumors.”

Estimating the incidence rates

Cancer incidence for both sexes (apart from males only for prostate cancer) from 1995–2024 was retrieved using the Canadian Cancer Statistics Dashboard.[2] Trend analysis was then performed to predict incidence of lung, colorectal, pancreas, breast, and prostate cancer from 2025 to 2030 using current population projections. (See Chart 1.)

We then calculated the incidence for each modelled cancer population from 2025–30. (See Table 1a.)

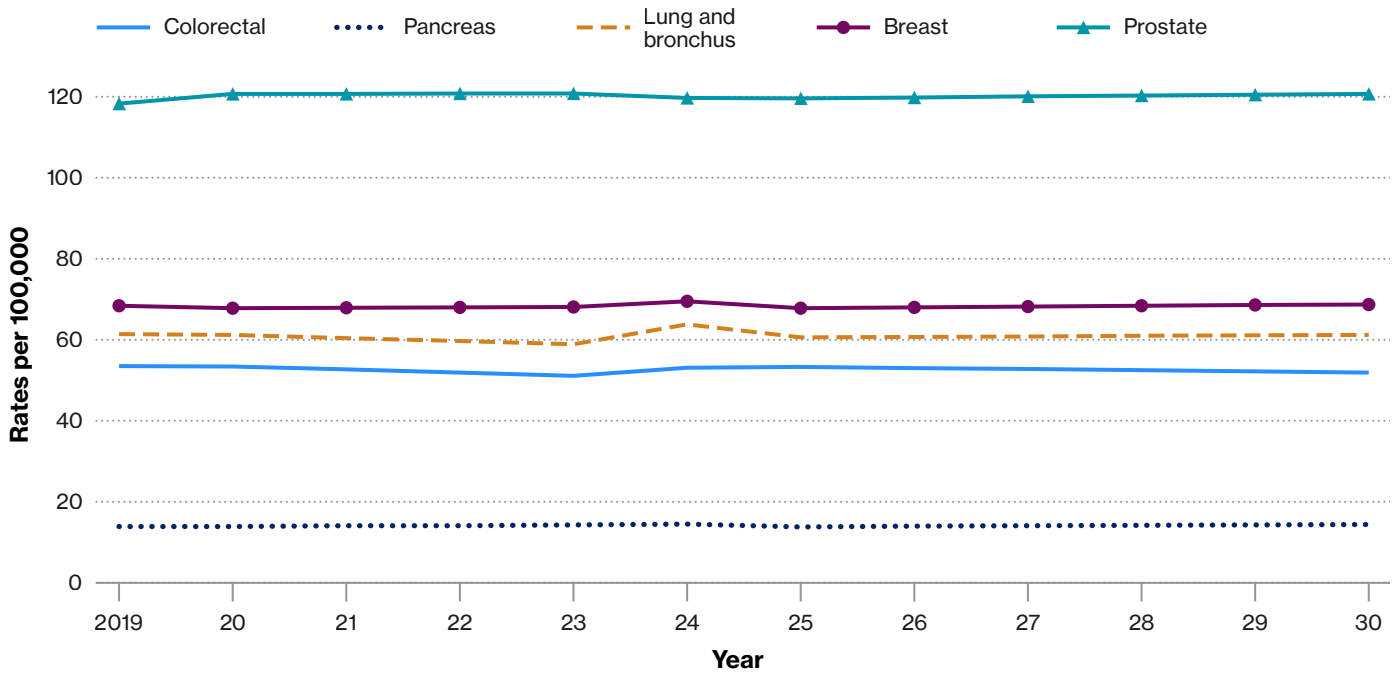
Biomarker integration

We conducted a comprehensive review of published literature and consulted Expert Reviewers to identify current and emerging biomarkers, as well as their associated rate of occurrence in metastatic lung, colorectal, pancreas, breast, and prostate cancers. Each biomarker was evaluated against two inclusion criteria: its detectability using comprehensive genomic profiling via next-generation sequencing (CGP-NGS), and its relevance to guiding current or developing targeted treatment pathways. A list of potential biomarkers was generated and underwent expert review, yielding the final list applied in the modelling. See Table 1a for a complete list of current and emerging biomarkers included in this model.

Chart 1

Age-standardized incidence rates per 100,000 people for five cancers from 2019–30

(incidence rates per 100,000 people)



Source: The Conference Board of Canada.

2 Canadian Cancer Statistics Dashboard, "Incidence."

Table 1a
Current and emerging biomarkers tested through CGP-NGS

Biomarkers with current clinical utility

Lung	Colorectal	Pancreatic	Breast	Prostate
EGFR sub./del.	KRAS wt	BRCA1 (germline)	PIK3CA	BRCA 1/2
ALK gene fusion	NRAS wt	BRCA1 (somatic)	BRCA1/2	NTRK
ROS1 gene fusion	BRAF wt	BRCA2 (germline)	NTRK	ATM
BRAF V600e sub.	HER2 (non-amplified)	BRCA2 (somatic)	ESR1 mutation	PALB2
NTRK (gene fusion)	Microsatellite instability (high)	NTRK		
c-MET amp./fusion	NTRK (gene fusion)			

Biomarkers with emerging clinical utility

Lung	Colorectal	Pancreatic	Breast	Prostate
RET gene fusion	BRAF (V600E sub)	PALB2	AKT1	HRR Genes
KRAS mut.	HER2 (amplification)	KRAS	PTEN	AR
HER2 mut.	KRAT mut	NRAS	FGFR1-4	TMP RSS2/ERG gene fusion
TMB (high)	c-MET (amplification)	BRAF	MYC	TMB (high)
	POLE (mutation)	NRG1	c-MET	
	FGFR (any alteration)	MMR/MSI	HRR (deficiency)	
		HRR genes		
		TMB		

Source: The Conference Board of Canada.

Therapy alignment

Up to four lines of treatments were matched with each current and emerging biomarker. If more than one treatment was available, an estimate was made on the proportion of the population that would receive each therapy. Additionally, treatment line attrition was applied to provide the most accurate estimate of population. The cost of each therapy was then multiplied by the population in each treatment line, which provided a total cost to treat the cohort from each biomarker. This total cost was then averaged across each tumour type to provide a single cost of treatment per patient.

Cost-and-benefit analysis

Cost calculations

For each scenario, a total cost was calculated using the sum of the following:

- the average treatment cost multiplied by the total population for each cancer type
- the panel costs multiplied by the total population
- delayed care costs associated with the turnaround time of the CGP-NGS panel
- alternative testing costs for those with an unsuccessful CGP-NGS test
- delayed care costs associated with the turnaround time of alternative testing

We then calculated the difference between Scenario A and B, which provided a per patient, per year, and total cost increase or decrease from the standard of care. (See Table 2a for a detailed list of cost-and-benefit inputs for modelling calculations.)

These values provided the overall cost difference between Scenario A and B from 2025–30, a cost difference per year for this time frame, and an overall cost difference per patient.

Table 2a
List of cost and benefit inputs for modelling calculations

Costs

Category	Group	Sub-group	Cost (CDN $)	Source
CGP-NGS Panel Costs	FoundationOne CDX (tissue)	-	$2,700.00	Roche Canada, "Foundation Medicine."
CGP-NGS Panel Costs	Oncomine Comprehensive Assay V3	• DNA and RNA isolation/quantification • NGS Panel target library amplification, library preparation (digestion, ligation, purification, quantitation, normalization), loading of sequencer • Sequencing • Quality control, quality assurance (internal quality control samples, external EQA) • Data processing and analysis, variant assessment, reporting, long-term data storage (1 year all pipeline data, 5 years' raw files), analysis software • Overhead (lab space, operations personnel, equipment maintenance, repeat tests, office costs), included at 25% of test cost before overhead	$1,322.00	Perdrizet and others, "Integrating comprehensive genomic sequencing of non-small cell lung cancer into a public healthcare system."
CGP-NGS Panel Costs	AmpliSeq Focus Panel	n/a	$1,287.87	Expert review
CGP-NGS Panel Costs	Oncomine Precision Assay	n/a	$1,005.33	Expert review
Single Gene Testing	KRAS	n/a	$250	Pataky and others, "Real-world cost-effectiveness of panel-based genomic testing to inform therapeutic decisions for metastatic colorectal cancer."
	NRAS	n/a	$269.89*	Kircher and others, "Cost Estimates and Economic Implications of Expanded RAS Testing in Metastatic Colorectal Cancer."

(... continued)

Table 2a (cont'd)
List of cost and benefit inputs for modelling calculations

Costs

Category	Group	Sub-group	Cost (CDN $)	Source
	ALK	n/a	$100.00	Sheffield and others, "Cost Savings of Expedited Care with Upfront Next-Generation Sequencing Testing versus Single-Gene Testing among Patients with Metastatic Non-Small Cell Lung Cancer Based on Current Canadian Practices."
	ROS1	n/a	$400.00	Sheffield and others.
	RET	n/a	$400.00	Sheffield and others.
	EGFR	n/a	$240.00	Sheffield and others.
	NTRK 1/2/3	n/a	$100.00	Sheffield and others.
	BRAF	n/a	$200.00	Sheffield and others.
	HER2/ ERBB2	n/a	$200.00	Sheffield and others.
	PIKE3CA	n/a	$420.16	Flodgren and others, *Molecular tests for detection of PIK3CA mutations in men and postmenopausal women with HR+/HER2–, locally advanced or metastatic breast cancer: A Health Technology Assessment 2022*. Norwegian Institute of Public Health.
	ESR1	n/a	$683.09**	Kowalchuk and others, "Estimated Cost of Circulating Tumor DNA for Posttreatment Surveillance of Human Papillomavirus-Associated Oropharyngeal Cancer"; Raei and others, "Diagnostic accuracy of ESR1 mutation detection by cell-free DNA in breast cancer."
	BRCA1/2	n/a	$474.89**	"The Screen Project."

(... continued)

Table 2a (cont'd)
List of cost and benefit inputs for modelling calculations

Costs

Category	Group	Sub-group	Cost (CDN $)	Source
	MSI	n/a	662.63**	Hao and others, "Economic Evaluation of Universal Lynch Syndrome Screening Protocols among Newly Diagnosed Patients with Colorectal Cancer."
"Delayed care (per week) (2025 CDN$)***"	• inpatient hospitalization and surgery • physician services • diagnostic tests • prescription drugs • home and community care	Lung cancer	$355.47	De Oliveira and others, "Estimating the cost of cancer care in British Columbia and Ontario."
	• inpatient hospitalization and surgery • physician services • diagnostic tests • prescription drugs • home and community care	Breast cancer	$170.42	De Oliveira and others.
	• inpatient hospitalization and surgery • physician services • diagnostic tests • prescription drugs • home and community care	Prostate cancer	$160.42	De Oliveira and others.
	• inpatient hospitalization and surgery • physician services • diagnostic tests • prescription drugs • home and community care	Pancreatic cancer	$431.36	De Oliveira and others.
	• inpatient hospitalization and surgery • physician services • diagnostic tests • prescription drugs • home and community care	Colorectal cancer	$257.80	De Oliveira and others.

(... continued)

Table 2a (cont'd)
List of cost and benefit inputs for modelling calculations

Benefits	
Category	Benefit (CDN $)
Average total income (per year)	$52,534.66

*NOK$ converted to CDN$
**USD$ converted to CDN$
***converted from 2009 to 2025 CDN$ using Statistics Canada's Consumer Price Index
Source: The Conference Board of Canada.

Benefit calculations

The two primary benefits of this model are the total life years gained and the increased societal contribution through total income.

- Life years gained: This figure was calculated separately for each scenario and required the rate of actionable biomarker detection, the rate of matched therapy administration, and a metric of overall survival. Due to limited evidence for several cancer types included in this model, we relied on the most robust real-world data available that identified these rates for both CGP-NGS and sequential testing. This data comes from NSCLC research that has been more extensively studied than the other cancer types. These rates are the following:
  - actionable biomarker identification rate for CGP-NGS: 32 per cent[3]
  - matched therapy administration rate for CGP-NGS when a biomarker is identified: 43 per cent[4]
  - actionable biomarker identification rate for small-panel or alternative testing: 14 per cent[5]
  - matched therapy administration rate for small-panel or alternative testing when a biomarker is identified: 38 per cent[6]
  - increase in overall survival from receiving CGP-NGS: eight months[7]

- Total Income: This metric was selected to capture societal contributions beyond direct employment. Given the late stage of the cancers included in this model, many patients would not be active in the workforce. This approach aligns with methods used in previous studies on similar topics.[8] Total income includes employment income, investment income, private retirement income, other regular cash income, and government transfers (e.g., employment insurance).[9] Total income has been used in other studies assessing economic benefits related to patients outside the workforce. Given that this was a prospective study, we calculated the median total income from 2025 to 2030 while adjusting for inflation using the Consumer price Index portal.[10]

For Scenario A (universal CGP-NGS), we calculated the total population from 2025 to 2030 for each cancer type and multiplied it by the rate of actionable biomarker detection and the rate of matched therapy administration for CGP-NGS. This yielded a population figure we could then multiply by the increase in overall survival and subsequently multiply this increase in overall survival by the total income rate.

For Scenario B, we split the total population from 2025 to 2030 for each cancer type to represent the 50:50 split between CGP-NGS and standard of care. From there, we performed the same calculations as Scenario A for the CGP-NGS group. For the standard of care group, we multiplied the population by the rate of actionable biomarker detection and the rate of matched therapy administration for small-panel or alternative testing. We then multiplied this by the increase in overall survival and total income rate. Finally, we summed the total for both the CGP-NGS and standard of care calculations.

The totals from Scenario A and B were then compared to estimate the total life years gained and additional societal contribution through total income.

Modelling assumptions

The landscape of clinical CGP-NGS in Canada is evolving quickly, but it remains under-reported. That makes it challenging to find robust, accessible data for modelling. To ensure accuracy and credibility, we've taken a hybrid approach that combines peer-reviewed research with insights from subject matter experts. Furthermore, due to the variability of CGP-NGS delivery and availability across Canada, we've made several assumptions.

First, for all CGP-NGS panels, we've applied a 90 per cent success rate. This reflects samples that are carefully collected, preserved, and prepared for analysis, including those that may need to be transported to a different site. Several factors influence sample quality, such as the percentage of tumour nuclei, storage time, cancer type, and transport conditions.[11] While recent studies suggest that sample success rates can exceed 90 per cent in some cases, we recognize that these outcomes depend heavily on tumour type, collection site, personnel, transport, and storage time. For instance, a 2023 article from *Diagnostics* measured sample success between tissue from surgical specimens, biopsy, and cell blocks that were found to be 96.7 per cent, 74.3 per cent, and 71.4 per cent successful.[12] Tumour-specific sample success for each panel also varied and, in some instances, was not available in publicly available literature. The reported rate for tissue sample success is 82 percent in prostate cancer, whereas several pan-tumour studies indicate success rates <90 per cent.[13]

3 Wallenta Law and others, "Real-World Impact of Comprehensive Genomic Profiling on Biomarker Detection, Receipt of Therapy, and Clinical Outcomes in Advanced Non–Small Cell Lung Cancer."
4 Wallenta Law and others.
5 Wallenta Law and others.
6 Wallenta Law and others.
7 Wallenta Law and others.
8 Conference Board of Canada, The, "Clinical and Economic Impacts of New Therapies for Three Hematologic Cancers—March 2025."
9 Statistics Canada, "Total Income of Person."
10 Statistics Canada, "Consumer Price Index Portal."
11 Volders and others, "A nationwide comprehensive genomic profiling and molecular tumor board platform for patients with advanced cancer"; Lin and others, "Real-world pan-tumor comprehensive genomic profiling sample adequacy and success rates in tissue and liquid specimens."
12 Nibid and others, "Feasibility of Comprehensive Genomic Profiling (CGP) in Real-Life Clinical Practice."
13 Hiemenz and others, "Real-World Comprehensive Genomic Profiling Success Rates in Tissue and Liquid Prostate Carcinoma Specimens"; Volders and others, "A nationwide comprehensive genomic profiling and molecular tumor board platform for patients with advanced cancer"; Lin and others, "Real-world pan-tumor comprehensive genomic profiling sample adequacy and success rates in tissue and liquid specimens."

For these reasons, we applied a 90 per cent success rate, one that we expect to be at the lower end of the anticipated standard in the evolving landscape of these panels once further collection standardization and increased testing sites become available.

Second, we estimated a 50 per cent split of CGP-NGS to single-gene testing as our standard of care to align with the anticipated future uptake of CGP-NGS. The current clinical and publicly funded landscape of CGP-NGS for stage 4 cancer in Canada is unclear; therefore, estimating the proportion of patients receiving these panels poses a challenge. Based on our scan of the literature and discussions with experts, it was determined that CGP-NGS panels are being used across Canada, but with large variability including the number of biomarkers being analyzed, public funding of the panel, as well as panel brand and size.

Next, several assumptions were made about the modelled treatment lines. Due to the lack of data surrounding time to treatment and mortality rate prior to receiving first-line treatment, it was assumed that 100 per cent of individuals received a first-line therapy. From there, attrition rates to second- and third-line therapies were estimated through expert review. Due to the complexities of fourth-line and subsequent therapies (such as clinical trials and palliative care), we focused our model on treatments up to and including the third line.

Finally, because CGP-NGS for NSCLC has the most robust real-world data, we used it as the reference point for key benefit calculations. This includes the rate of identifying one or more actionable biomarkers, the rate of receiving matched therapy, and overall survival for both CGP-NGS and small-panel or alternative testing.

Model limitations

This study provides the first pan-Canadian estimate of the costs and benefits of CGP-NGS across five newly diagnosed stage 4 cancers. We applied rigorous methods to ensure the data and modelling scenarios reflect real-world applicability, but several limitations should be noted.

Data availability

The availability of data regarding the clinical utility and application of CGP-NGS for newly diagnosed stage 4 cancers in Canada was notably limited. In response, we adopted a hybrid approach for this model, drawing from peer-reviewed data, expert opinions, and placeholder figures (e.g., NSCLC for benefit calculations) to estimate the costs and benefits of CGP-NGS. The following sections of our research were most affected by the lack of data:

Treatment costs

Our model used therapy costs drawn from peer-reviewed literature and reports from Canada's drug agencies. These figures offer a standardized metric across therapies, but they likely overestimate actual costs due to limited transparency in discounts negotiated through pan-Canadian Pharmaceutical Alliance price negotiations.

Lack of clinical trial inclusion in cost-and-benefit modelling

A well-documented benefit of CGP-NGS is the increased trial enrolment.[14] This allows patients to access novel therapeutics that may not be publicly available or funded. Unfortunately, we were unable to attribute a cost or benefit measure to this component due to the lack of data surrounding clinical trial eligibility and utility among our population. Therefore, if real-world evidence that included clinical trial participation were leveraged, we would anticipate the benefit to be even greater.

Patient cohort estimates

To determine the proportion of patients receiving each therapy, as well as attrition across subsequent treatment lines, we invited expert review from oncologists from each cancer specialty to provide these estimates. A notable characteristic of this approach was that therapy choices and patient numbers vary across provinces and regions, creating inconsistencies in the data points. Furthermore, there are many examples where oncologists are not determining treatment lines through biomarker identification, which compounds the uncertainty of these estimates.

Benefit calculations

As outlined in the modelling assumptions, there was insufficient data to accurately compare the rate of identifying actionable biomarkers, receiving matched therapies, and overall survival between CGP-NGS and current single biomarker testing for each stage 4 disease and panel type. NSCLC provided the most comprehensive comparison, so it served as a proxy for the other cancer types. While this introduces some limitations in terms of equivalency, it draws on data from the area with the most robust evidence. We expect advances in cancer genetics and targeted therapies and, as such, view these estimates as a reliable placeholder until more research fills the gap.

Additionally, we were unable to include certain benefits that are associated with CGP-NGS. These include increased clinical trial enrolment and increased matched therapy direction.[15] Unfortunately, we were unable to attribute a cost or benefit measure to these components due to the lack of data surrounding clinical trial eligibility, utility, and proportion of matched therapy compared with alternative testing among our population. Therefore, if real-world evidence that included clinical trial participation and matched therapy data were leveraged, we would anticipate the benefit to be even greater.

Integration of real-world hospital pricing, dosage data, and patient cohort statistics will be the gold standard of future CGP-NGS analysis. Doing so will help address these limitations and provide the most accurate estimates possible.

14 Huang and others, "Clinical value of comprehensive genomic profiling on clinical trial enrollment for patients with advanced solid tumors."

15 Zhao and others, "Utility of comprehensive genomic profiling in directing treatment and improving patient outcomes in advanced non-small cell lung cancer."

Appendix B

Bibliography

Alvarez, Ricardo H., John W. Thomas, Zachary Rockow Chalmers, Alexa Betzig Schrock, Carolina Alvarez Tapias, Garrett Michael Frampton, Kim Kramer, and others. "Comparison of comprehensive genomic profiling (CGP) and hotspot next generation sequencing (NGS) assays in identifying treatment options for care of patients with metastatic cancer in the community setting." *Journal of Clinical Oncology* 34, no. 15, suppl: e23120–e23120 (2016). https://doi.org/10.1200/JCO.2016.34.15_suppl.e23120.

American Cancer Society. "Invasive Breast Cancer (IDC/ILC)." Accessed June 12, 2025. https://www.cancer.org/cancer/types/breast-cancer/about/types-of-breast-cancer/invasive-breast-cancer.html.

American Cancer Society. "Lung Cancer Statistics | How Common Is Lung Cancer?" Accessed June 12, 2025. https://www.cancer.org/cancer/types/lung-cancer/about/key-statistics.html.

American Society of Clinical Oncology. "ASCO Overview." Accessed September 5, 2025. https://www.asco.org/about-asco/asco-overview.

Basharat, Sinwan, Kelly Farah, and Jennifer Horton. *An Overview of Comprehensive Genomic Profiling Technologies to Inform Cancer Care: Emerging Health Technologies*. CADTH Horizon Scan. Ottawa: Canadian Agency for Drugs and Technologies in Health, August 2022. http://www.ncbi.nlm.nih.gov/books/NBK603368/.

Basharat, Sinwan, and Kelly Farah. "An Overview of Comprehensive Genomic Profiling Technologies to Inform Cancer Care." *Canadian Journal of Health Technologies* 2, no. 8 (2022): 8. https://doi.org/10.51731/cjht.2022.414.

BC Cancer. *Cancer Genetics and Genomics Laboratory – BC Cancer*. n.d. Accessed June 11, 2025. https://cancergeneticslab.ca/.

Ben-Shachar, Rotem, Kaveri Nadhamuni, Luis E. Raez, Mark Carty, Akash Mitra, Halla Nimeiri, Ira Klein, Rafi Pelossof, and Daniel Morgensztern. "Real-World Adherence Patterns of Comprehensive Genomic Profiling to Biomarker Recommended Therapies in Patients With Advanced Non–Small Cell Lung Cancer." *JCO Oncology Practice* 0, no. 0 (2025): OP-24-00880. https://doi.org/10.1200/OP-24-00880.

Breadner, Daniel, David M. Hwang, Don Husereau, Parneet Cheema, Sarah Doucette, Peter M. Ellis, Shaqil Kassam, and others. "Implementation of Liquid Biopsy in Non-Small-Cell Lung Cancer: An Ontario Perspective." *Current Oncology* 31, no. 10 (2024): 6017–31. https://doi.org/10.3390/curroncol31100449.

Canada's Drug Agency. *Pharmacoeconomic Review-Capivasertib (Truqap)*. Canada's Drug Agency, 2025. https://www.ncbi.nlm.nih.gov/books/NBK612201/.

Canadian Cancer Statistics Dashboard. "Incidence." Accessed June 12, 2025. http://cancerstats.ca/Login/Index.

Canadian Cancer Statistics Dashboard. "Mortality." Accessed August 28, 2025. http://cancerstats.ca/Login/Index.

Čerina Pavlinović, Dora, Jelena Šuto Pavičić, Antonela Njavro, Nikša Librenjak, Ilijan Tomaš, Robert Šeparović, Stjepko Pleština, Zarko Bajić, Natalija Dedić, and Eduard Vrdoljak. "Precision Oncology in Clinical Practice: Two Years of Comprehensive Genomic Profiling in Croatia." *Journal of Personalized Medicine* 15, no. 2 (2025): 59. https://doi.org/10.3390/jpm15020059.

Chakravarty, Debyani, and David B. Solit. "Clinical cancer genomic profiling." *Nature Reviews: Genetics* 22, no. 8 (2021): 483–501. https://doi.org/10.1038/s41576-021-00338-8.

Conference Board of Canada, The. "Clinical and Economic Impacts of New Therapies for Three Hematologic Cancers – March 2025." Ottawa: The Conference Board of Canada, March 27, 2025. https://www.conferenceboard.ca/product/clinical-and-economic-impacts-of-new-therapies-for-three-hematologic-cancers_mar2025/.

De La O, Jean-Paul, Jess R. Hoag, Angela K. Deem, Min Wang, Arthur Starodynov, Sameer S. Udhane, Janine R. LoBello, and others. "Comprehensive genomic profiling of over 10,000 advanced solid tumors." *Oncotarget* 16 (July 2025): 587–603. https://doi.org/10.18632/oncotarget.28757.

De Oliveira, Claire, Reka Pataky, Karen E. Bremner, Jagadish Rangrej, Kelvin KW Chan, Winson Y. Cheung, Jeffrey S. Hoch, Stuart Peacock, and Murray D. Krahn. "Estimating the cost of cancer care in British Columbia and Ontario: a Canadian inter-provincial comparison." Healthcare Policy 12, no. 3 (2017): 95. https://pubmed.ncbi.nlm.nih.gov/28277207/.

European Society for Medical Oncology. "About ESMO." Accessed September 5, 2025. https://www.esmo.org/about-esmo.

Flodgren, G. M., V. Hamidi, E. J. Meneses, and J. Bidonde. *Molecular tests for detection of PIK3CA mutations in men and postmenopausal women with HR+/HER2–, locally advanced or metastatic breast cancer: A Health Technology Assessment 2022.* Norwegian Institute of Public Health, 2022.

Frampton, Garrett M., Alex Fichtenholtz, Geoff A. Otto, Kai Wang, Sean R. Downing, Jie He, Michael Schnall-Levin, and others. "Development and validation of a clinical cancer genomic profiling test based on massively parallel DNA sequencing." *Nature Biotechnology* 31, no. 11 (2013): 1023–31. https://doi.org/10.1038/nbt.2696.

Friedman, Alix. "Hadassah Medical Center and Roche Israel Collaborate to Offer Israel's First Personalized Cancer Treatment Based on Genomic Profiling." Hadassah, September 11, 2023. https://www.hadassah.org/press-release/hadassah-medical-center-and-roche-israel-collaborate-to-offer-israels-first-personalized-cancer-treatment-based-on-genomic-profiling.

Fumagalli, Caterina, Elena Guerini-Rocco, and Massimo Barberis. "Making the Most of Complexity to Create Opportunities: Comprehensive Genomic Profiling and Molecular Tumor Board for Patients with Non-Small Cell Lung Cancer (NSCLC)." *Cancers* 13, no. 4 (2021): 609. https://doi.org/10.3390/cancers13040609.

Ganesh, Karuna, and Joan Massagué. "Targeting metastatic cancer." *Nature Medicine* 27, no. 1 (2021): 34–44. https://doi.org/10.1038/s41591-020-01195-4.

Goossens, Nicolas, Shigeki Nakagawa, Xiaochen Sun, and Yujin Hoshida. "Cancer biomarker discovery and validation." *Translational Cancer Research* 4, no. 3 (2015). https://doi.org/10.3978/j.issn.2218-676X.2015.06.04.

Gui, Philippe, and Trever G. Bivona. "Evolution of metastasis: new tools and insights." *Trends in Cancer* 8, no. 2 (2022): 98–109. https://doi.org/10.1016/j.trecan.2021.11.002.

Hanna, Nasser H., Andrew G. Robinson, Sarah Temin, Sherman Baker Jr., Julie R. Brahmer, Peter M. Ellis, Laurie E. Gaspar, and others. "Therapy for Stage IV Non–Small-Cell Lung Cancer With Driver Alterations: ASCO and OH (CCO) Joint Guideline Update." *Journal of Clinical Oncology* 39, no. 9 (2021): 1040–91. https://doi.org/10.1200/JCO.20.03570.

Hao, Jing, Dina Hassen, James M. Gudgeon, Susan R. Snyder, Heather Hampel, Marc S. Williams, Ravi N. Sharaf, and others. "Economic Evaluation of Universal Lynch Syndrome Screening Protocols among Newly Diagnosed Patients with Colorectal Cancer." *J. Pers. Med.* 11, no, 12 (2021); 1284. https://doi.org/10.3390/jpm11121284

Health Quality Ontario. "Plasma-Based Comprehensive Genomic Profiling DNA Assays for Non-Small Cell Lung Cancer." Health Quality Ontario: November 2024. Accessed June 11, 2025. https://www.hqontario.ca/Evidence-to-Improve-Care/Health-Technology-Assessment/Reviews-And-Recommendations/Plasma-Based-Comprehensive-Genomic-Profiling-DNA-Assays-for-Non-Small-Cell-Lung-Cancer.

Hernando-Calvo, Alberto, Paul Nguyen, Philippe L. Bedard, Kelvin K. W. Chan, Ramy R. Saleh, Deirdre Weymann, Celeste Yu, and others. "Impact on costs and outcomes of multi-gene panel testing for advanced solid malignancies: a cost-consequence analysis using linked administrative data." *eClinicalMedicine* 69 (March 2024). https://doi.org/10.1016/j.eclinm.2024.102443.

Hiemenz, Matthew C., Ryon P. Graf, Kelsie Schiavone, Lukas Harries, Geoffrey R. Oxnard, Jeffrey S. Ross, and Richard S. P. Huang. "Real-World Comprehensive Genomic Profiling Success Rates in Tissue and Liquid Prostate Carcinoma Specimens." *The Oncologist* 27, no. 12 (December 2022): e970–72. https://doi.org/10.1093/oncolo/oyac181.

Huang, Richard SP, Jessica K. Lee, and Katherine T. Lofgren. "Clinical value of comprehensive genomic profiling on clinical trial enrollment for patients with advanced solid tumors." The Oncologist (2024): oyae293. https://pubmed.ncbi.nlm.nih.gov/39471423/.

Hung, Ling-Jen, Chen-Yang Huang, Kai-Che Tung, Jen-Shi Chen, Wen-Kuan Huang, Chih-Chung Hsu, Yueh-Fu Fang, and others. "Comprehensive genomic profiling in multiple cancer types: A comparative analysis of the National Biobank Consortium of Taiwan and clinical practice cohorts." *Journal of the Formosan Medical Association*, available online, September 7, 2024. https://doi.org/10.1016/j.jfma.2024.09.001.

Husereau, Don, Eva Villalba, Vivek Muthu, Michael Mengel, Craig Ivany, Lotte Steuten, Daryl S. Spinner, and others. "Progress toward Health System Readiness for Genome-Based Testing in Canada." *Current Oncology (Toronto, Ont.)* 30, no. 6 (2023): 5379–94. https://doi.org/10.3390/curroncol30060408.

Husereau, Don, Eva Villalba, Vivek Muthu, Michael Mengel, Craig Ivany, Lotte Steuten, Daryl S. Spinner, and others. *Towards the Routine Use of Genome-Based Testing in Canada's Largest Regions: A State of Readiness Progress Report*. 2023. https://www. resilienthealthcare. ca/partner-projects/nz6kgde0aj66f6k8x7z7gthhf8xvb6.

Ida, Hanae, Takafumi Koyama, Takaaki Mizuno, Kuniko Sunami, Takashi Kubo, Kazuki Sudo, Kayoko Tao, and others. "Clinical utility of comprehensive genomic profiling tests for advanced or metastatic solid tumor in clinical practice." *Cancer Science* 113, no. 12 (December 2022): 4300–4310. https://doi.org/10.1111/cas.15586.

Illumina. "AmpliSeq for Illumina Focus Panel | Combined DNA and RNA Workflow." Accessed September 16, 2025. https://www.illumina.com/products/by-type/sequencing-kits/library-prep-kits/ampliseq-focus-panel.html.

IWK Health. "Clinical Genomics." Halifax: IWK Health. Accessed June 11, 2025. https://iwkhealth.ca/health-professionals/clinical-genomics.

Johnston, Karissa M., Brandon S. Sheffield, Stephen Yip, Pardis Lakzadeh, Christina Qian, and Julian Nam. "Costs of in-house genomic profiling and implications for economic evaluation: a case example of non-small cell lung cancer (NSCLC)." *Journal of Medical Economics* 23, no. 10 (2020): 1123–29. https://doi.org/10.1080/13696998.2020.1789152.

Kaminski, Allysen, Elizabeth A. Szamreta, Ruchit Shah, Ning Ning, Jyoti Aggarwal, Arif Hussain, and Gboyega Adeboyeje. "Barriers to next-generation sequencing despite increased utilization: U.S. physician survey results." *Journal of Clinical Oncology* 39, no. 15_suppl (2021): e18754–e18754. https://doi.org/10.1200/JCO.2021.39.15_suppl.e18754.

Kircher, Sheetal M., Nisha Mohindra, and Halla Nimeiri. "Cost estimates and economic implications of expanded RAS testing in metastatic colorectal cancer." *The oncologist* 20, no. 1 (2015): 14–18.

Kowalchuk, Roman O., Benjamin C. Kamdem Talom, Kathryn M. Van Abel, Daniel M. Ma, Mark R. Waddle, and David M. Routman. "Estimated Cost of Circulating Tumor DNA for Posttreatment Surveillance of Human Papillomavirus-Associated Oropharyngeal Cancer." JAMA Network Open 5, no. 1.

Lawrence, Michael S., Petar Stojanov, Paz Polak, Gregory V. Kryukov, Kristian Cibulskis, Andrey Sivachenko, Scott L. Carter, and others. “Mutational heterogeneity in cancer and the search for new cancer-associated genes.” *Nature* 499, no. 7457 (2013): 214–18. https://doi.org/10.1038/nature12213.

Lee, Eun Mi, Paula Jiménez-Fonseca, Rocio Galán-Moral, Sara Coca-Membribes, Ana Fernández-Montes, Elena Sorribes, Esmeralda Garcia-Torralba, and others. “Toxicities and Quality of Life during Cancer Treatment in Advanced Solid Tumors.” *Current Oncology* 30, no. 10 (October 19, 2023): 9205–16. https://doi.org/10.3390/curroncol30100665.

Lin, Douglas I., Lincoln W. Pasquina, Estefany Mavares, Julia A. Elvin, and Richard S. P. Huang. “Real-world pan-tumor comprehensive genomic profiling sample adequacy and success rates in tissue and liquid specimens.” *The Oncologist* 30, no. 2 (February 2025): oyae258. https://doi.org/10.1093/oncolo/oyae258.

Ma, Liwei, Huiling Guo, Yunxiang Zhao, Zhibo Liu, Chenran Wang, Jiahao Bu, Ting Sun, and Jianwei Wei. “Liquid biopsy in cancer: current status, challenges and future prospects.” *Signal Transduction and Targeted Therapy* 9, no. 1 (2024): 336. https://doi.org/10.1038/s41392-024-02021-w.

Marra, Marco. “Driving Cancer Research with Comprehensive Data Types That Are Complete, Accurate, Permanent and Accessible.” Expert story. BC Cancer Consortium, August 28, 2024. https://www.marathonofhopecancercentres.ca/impact/story/driving-cancer-research-with-comprehensive-data-types-that-are-complete--accurate--permanent-and-accessible.

Narrandes, Shavira, and Wayne Xu. “Gene Expression Detection Assay for Cancer Clinical Use.” *Journal of Cancer* 9, no. 13 (2018): 2249–65. https://doi.org/10.7150/jca.24744.

National Cancer Institute, NCI Dictionary of Cancer Terms. “Genomic characterization.” nciAppModulePage. February 2, 2011. https://www.cancer.gov/publications/dictionaries/cancer-terms/def/genomic-characterization.

Nesline, Mary K., Vivek Subbiah, Rebecca A. Previs, Kyle C. Strickland, Heidi Ko, Paul DePietro, Michael D. Biorn, and others. “The Impact of Prior Single-Gene Testing on Comprehensive Genomic Profiling Results for Patients with Non-Small Cell Lung Cancer.” *Oncology and Therapy* 12, no. 2 (2024): 329–43. https://doi.org/10.1007/s40487-024-00270-x.

Nibid, Lorenzo, Giovanna Sabarese, Daniela Righi, Silvia Maria Rossi, Giorgia Merlini, Pierfilippo Crucitti, Bruno Vincenzi, Giuseppe Tonini, and Giuseppe Perrone. “Feasibility of Comprehensive Genomic Profiling (CGP) in Real-Life Clinical Practice.” *Diagnostics* 13, no. 4 (2023): 782. https://doi.org/10.3390/diagnostics13040782.

Nicholas, Champica, Andrea Beharry, Anna M. Bendzsak, Kassandra R. Bisson, Keith Dadson, Shaan Dudani, Marco Iafolla, and others. “Point of Care Liquid Biopsy for Cancer Treatment—Early Experience from a Community Center.” *Cancers* 16, no. 14 (2024): 2505. https://doi.org/10.3390/cancers16142505.

Olsen, Matias, Jan-Philipp Beck, Rianne Ernst, and Wouter van Straaten. *The Untapped Potential of Comprehensive Genomic Profiling*. 2025. https://www.lungcancereurope.eu/wp-content/uploads/2025/03/Launch-of-the-ECGP-Recommendations-1.pdf.

“Oncomine Comprehensive Assay v3 - Thermo Fisher Scientific - CA.” Accessed September 16, 2025. https://www.thermofisher.com/ca/en/home/clinical/preclinical-companion-diagnostic-development/oncomine-oncology/oncomine-cancer-research-panel-workflow/oncomine-comprehensive-assay.html.

“Oncomine Precision Assay on the Genexus System - CA.” Accessed September 16, 2025. https://www.thermofisher.com/ca/en/home/clinical/preclinical-companion-diagnostic-development/oncomine-oncology/oncomine-precision-assay.html.

Ontario Institute for Cancer Research. “Canadian Government-Sponsored Collaboration Targets Standardized Cancer Testing.” *Ontario Institute for Cancer Research*, July 30, 2019. https://oicr.on.ca/canadian-government-sponsored-collaboration-targets-standardized-cancer-testing/.

Pankiw, Maya, Christine Brezden-Masley, and George S. Charames. “Comprehensive genomic profiling for oncological advancements by precision medicine.” *Medical Oncology* 41, no. 1 (2024): 1. https://doi.org/10.1007/s12032-023-02228-x.

Pataky, Reka E., Deirdre Weymann, Ian Bosdet, Stephen Yip, Stirling Bryan, Mohsen Sadatsafavi, Stuart Peacock, and Dean A. Regier. “Real-world cost-effectiveness of panel-based genomic testing to inform therapeutic decisions for metastatic colorectal cancer.” *Journal of Cancer Policy* 41 (September 2024): 100496.

Perdrizet, Kirstin, Tracy L. Stockley, Jennifer H. Law, Adam Smith, Tong Zhang, Roxanne Fernandes, Muqdas Shabir, and others. “Integrating comprehensive genomic sequencing of non-small cell lung cancer into a public healthcare system.” *Cancer Treatment and Research Communications* 31 (January 2022): 100534. https://doi.org/10.1016/j.ctarc.2022.100534.

Raei, Maedeh, Keyvan Heydari, Mohammad Tabarestani, Alireza Razavi, Fatemeh Mirshafiei, Fatemeh Esmaeily, and others. “Diagnostic accuracy of ESR1 mutation detection by cell-free DNA in breast cancer: a systematic review and meta-analysis of diagnostic test accuracy.” *BMC cancer* 24, no. 1 (2024): 908.

Rare Cancers Australia. *Advancing Genomic-Led Cancer Care in Australia*. February 2025. https://www.rarecancers.org.au/wp-content/uploads/2025/02/RCA5251-Advancing-Genomic-led-Cancer-Care-in-Australia_FA2.pdf.

Regier, Dean A., Rosalie Loewen, Brandon Chan, Morgan Ehman, Samantha Pollard, Jan M. Friedman, Sylvia Stockler-Ipsiroglu, and others. “Real-world diagnostic outcomes and cost-effectiveness of genome-wide sequencing for developmental and seizure disorders: Evidence from Canada.” *Genetics in Medicine* 26, no. 4 (April 2024): 101069. https://doi.org/10.1016/j.gim.2024.101069.

Roche Canada. “Foundation Medicine: When making treatment decisions, knowledge is power.” Accessed September 16, 2025. https://www.rochecanada.com/solutions/diagnostics-solutions/foundation-medicine/.

Sarantis, Panagiotis, Evangelos Koustas, Adriana Papadimitropoulou, Athanasios G. Papavassiliou, and Michalis V. Karamouzis. “Pancreatic ductal adenocarcinoma: Treatment hurdles, tumor microenvironment and immunotherapy.” *World Journal of Gastrointestinal Oncology* 12, no. 2 (February 15, 2020): 173–81. https://doi.org/10.4251/wjgo.v12.i2.173.

Satam, Heena, Kandarp Joshi, Upasana Mangrolia, Sanober Waghoo, Gulnaz Zaidi, Shravani Rawool, Ritesh P. Thakare, and others. “Next-Generation Sequencing Technology: Current Trends and Advancements.” *Biology* 12, no. 7 (2023): 997. https://doi.org/10.3390/biology12070997.

Sheffield, Brandon S., Kiefer Eaton, Bruno Emond, Marie-Hélène Lafeuille, Annalise Hilts, Patrick Lefebvre, Laura Morrison, and others. “Cost savings of expedited care with upfront next-generation sequencing testing versus single-gene testing among patients with metastatic non-small cell lung cancer based on current Canadian practices.” *Current Oncology* 30, no. 2 (2023): 2348–65.

Snow, Stephanie, Christine Brezden-Masley, Michael D. Carter, Neesha Dhani, Cassandra Macaulay, Ravi Ramjeesingh, Michael J. Raphael, Monika Slovinec D’Angelo, and Filomena Servidio-Italiano. “Barriers and Unequal Access to Timely Molecular Testing Results: Addressing the Inequities in Cancer Care Delays across Canada.” *Current Oncology* 31, no. 3 (2024): 1359–75. https://doi.org/10.3390/curroncol31030103.

Statistics Canada. “Consumer Price Index Portal.” May 28, 2019. https://www.statcan.gc.ca/en/subjects-start/prices_and_price_indexes/consumer_price_indexes.

Statistics Canada. “Total Income of Person.” May 18, 2016. https://www23.statcan.gc.ca/imdb/p3Var.pl?Function=DEC&Id=100736.

Stewart, Andrea. “2024 NHIS Full-Year Health Insurance Estimates Early Release: Public Coverage Fell While Private Coverage and Uninsurance Held Steady.” Survey Data Season, July 02, 2025. Accessed September 23, 2025. https://www.shadac.org/news/2024-nhis-survey-data-health-insurance-estimates.

Subbiah, Vivek, and Razelle Kurzrock. “Imperative of Comprehensive Molecular Profiling as Standard of Care for Patients With Rare Cancers.” *JCO Oncology Practice* (2025): OP-25-00064. https://doi.org/10.1200/OP-25-00064.

Tanabe, Hiroki, Katsuyoshi Ando, Keitaro Takahashi, Tomomi Kamanaka, Sayaka Yuzawa, Junko Kikuchi, Yoshihito Ohhara, and others. “Clinical utility of comprehensive genomic profiling test for colorectal cancer: a single institution prospective observational study.” *Journal of Cancer Research and Clinical Oncology* 151, no. 9 (September 2025): 253. https://doi.org/10.1007/s00432-025-06295-7.

Teuwen, Laure-Anne Marie Nicole, Evelyne Roets, Pieter D’Hoore, Patrick Pauwels, and Hans Prenen. “Comprehensive genomic profiling and therapeutic implications for patients with advanced cancers: The experience of an academic hospital.” *Journal of Clinical Oncology* 41, no. 16_suppl (2023): e15162–e15162. https://doi.org/10.1200/JCO.2023.41.16_suppl.e15162.

Tjota, Melissa Yuwono, Jeremy P. Segal, and Peng Wang. “Clinical Utility and Benefits of Comprehensive Genomic Profiling in Cancer.” *The Journal of Applied Laboratory Medicine* 9, no. 1 (2024): 76–91. https://doi.org/10.1093/jalm/jfad091.

University of Laval. “Genomics Center.” *Centre de Recherche du CHU de Québec-Université Laval.* Québec City, n.d. Accessed June 11, 2025. https://www.crchudequebec.ulaval.ca/en/platforms-and-services/genomics-center/.

Volders, Pieter-Jan, Philippe Aftimos, Franceska Dedeurwaerdere, Geert Martens, Jean-Luc Canon, Gabriela Beniuga, Guy Froyen, and others. “A nationwide comprehensive genomic profiling and molecular tumor board platform for patients with advanced cancer.” *npj Precision Oncology* 9, no. 1 (2025): 66. https://doi.org/10.1038/s41698-025-00858-0.

Wallenta Law, Jeanna, Bela Bapat, Connor Sweetnam, Hina Mohammed, Ashleigh McBratney, Monika A. Izano, Molly Scannell Bryan, and others “Real-World Impact of Comprehensive Genomic Profiling on Biomarker Detection, Receipt of Therapy, and Clinical Outcomes in Advanced Non–Small Cell Lung Cancer.” *JCO Precision Oncology* 8 (August 2024): e2400075. https://doi.org/10.1200/PO.24.00075.

Wang, Minghui, Yanhong Shang, Zhen-gang Yuan, Qing Hao, Zhizheng Wang, Dong You, Yang Liu, and others. “Comprehensive genomic profiling in solid tumors: Enhancing treatment selection and prognosis.” *Journal of Clinical Oncology* 42, no. 16_suppl (2024): e13631–e13631. https://doi.org/10.1200/JCO.2024.42.16_suppl.e13631.

Warkentin, Matthew T., Yibing Ruan, Larry F. Ellison, Jean-Michel Billette, Alain A. Demers, Fei-Fei Liu, and Darren R. Brenner. “Progress in cancer control leads to a substantial number of cancer deaths avoided in Canada.” *JNCI Cancer Spectrum* 7, no. 6 (December 2023): pkad105. https://doi.org/10.1093/jncics/pkad105.

Weymann, Deirdre, Nick Dragojlovic, Samantha Pollard, and Dean A. Regier. “Allocating healthcare resources to genomic testing in Canada: latest evidence and current challenges.” *Journal of Community Genetics* 13, no. 5 (2022): 467–76. https://doi.org/10.1007/s12687-019-00428-5.

Weymann, Deirdre, Janessa Laskin, Steven J. M. Jones, Robyn Roscoe, Howard J. Lim, Daniel J. Renouf, Kasmintan A. Schrader, and others. “Early-stage economic analysis of research-based comprehensive genomic sequencing for advanced cancer care.” *Journal of Community Genetics* 13, no. 5 (2022): 523–38. https://doi.org/10.1007/s12687-021-00557-w.

Zhao, Shen, Zhonghan Zhang, Jianhua Zhan, Xin Zhao, Xinru Chen, Liyun Xiao, Kui Wu, and others. “Utility of comprehensive genomic profiling in directing treatment and improving patient outcomes in advanced non-small cell lung cancer.” *BMC Medicine* 19, no. 1 (2021): 223. https://doi.org/10.1186/s12916-021-02089-z.

Acknowledgements

This research was conceptualized and prepared with expert knowledge and financial support from the Colorectal Cancer Resource & Action Network. We would like to thank CCRAN staff who have supported this important work:

- **Filomena Servidio-Italiano**, President and CEO
- **Cassandra Macaulay**, Chief Research Officer
- **Shalini Gambhir**, Research Officer
- **Meital Itzkovich**, Manager, Administration & Events
- **Himanshi Singhvi**, National Programs Officer

Many colleagues contributed to bring this research to life. Eddy Nason, Director, MPhil, provided overall leadership for the project, contributing to its direction, framing, and critical review. Chris Viel, Senior Research Associate, MHSc, was the lead researcher on this project. Bambi Tinuoye, Research Analyst, MHIS, and Aranie Vijayaratnam, Research Analyst, MSc, supported the execution of the work. We thank Maaike deVries, Senior Research Associate, PhD, Leslie Twilley, Chief Research Officer, PhD, and Michael Burt, Vice-President, MA, for reviewing and providing feedback on drafts of this report. Mallory Eliosoff designed this impact paper.

We also wish to thank the members of the Research Advisory Board and Expert Reviewers who supported this research:

Research Advisory Board:

- **Dr. Lisa Dickson**, Patient Advocate
- **Fred Horne**, Canadian Health Policy Consultant
- **Don Husereau**, Adjunct Professor of Medicine, The University of Toronto
- **Dr. Jason Karamchandani**, President, Canadian Association of Pathologists
- **Sapna Mahajan**, Director of Research and Innovation (Health Lead), Genome Canada
- **Dr. Michael Raphael**, Medical Oncologist, Odette Cancer Centre, Sunnybrook Health Sciences Centre
- **Suzanne Wood**, Patient Advocate

We are deeply saddened by the loss of RAB members Suzanne Wood and Lisa Dickson during the course of this project. Their contributions in advancing this research were invaluable. We honour their legacy and their dedication to improving outcomes for people facing cancer today and in the future.

Expert Reviewers:

- **Dr. U. Emmenegger**, Medical Oncologist, Odette Cancer Centre, Sunnybrook Health Sciences Centre
- **Dr. Lilian Hanna**, Medical Oncologist, Verspeeten Family Cancer Centre, London Health Sciences Centre
- **Dr. Sandeep Sehdev**, Medical Oncologist, The Ottawa Hospital
- **Dr. Arif Ali Awan**, Medical Oncologist, The Ottawa Hospital
- **Dr. Mita Manna**, Medical Oncologist, Saskatoon Cancer Centre, Saskatchewan Cancer Agency
- **Dr. Brandon Sheffield**, Diagnostic and Molecular Pathologist, William Osler Health System
- **Dr. Danny Vesprini**, Radiation Oncologist, Odette Cancer Centre, Sunnybrook Health Sciences Centre
- **Dr. Robert Grant**, Medical Oncologist, Princess Margaret Cancer Centre
- **Dr. Shaqil Kassam**, Medical Oncologist, Southlake Regional Cancer Centre
- **Dr. Michela Febbraro**, Medical Oncologist, Algoma District Cancer Program
- **Dr. Steven Narod**, Canada Research Chair in Breast Cancer, Dalla Lana School of Public Health

Precision in Practice: Costs and Benefits of Comprehensive Genomic Profiling for Five Stage 4 Cancers
The Conference Board of Canada

To cite this research: Conference Board of Canada, The. *Precision in Practice: Costs and Benefits of Comprehensive Genomic Profiling for Five Stage 4 Cancers.* Ottawa: The Conference Board of Canada, 2025.

Where insights meet impact

The Conference Board of Canada

Publication P-01733-H4Y4M9
Price: Complimentary

conferenceboard.ca