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Commentary

The Terry Fox Research Institute Marathon of Hope Cancer Centres Network: A pan-Canadian precision oncology initiative

The Terry Fox Research Institute Marathon of Hope Cancer Centers Network[1,*]
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The Marathon of Hope Cancer Centres Network (MOHCCN), led by the Terry Fox Research Institute and the Terry Fox Foundation, unites researchers, clinicians, patients, funders, and other partners across Canada to accelerate precision oncology, promote collaboration and data sharing, and ultimately improve patient outcomes. This overview outlines the Network's goals, history, and challenges and opportunities. We also highlight progress toward the "MOHCCN Gold Cohort," a shared resource of clinical and genomic data from 15,000 patients.

Precision oncology in the genomic era—The Canadian context

The increasing appreciation of the complexity of cancer and of the unique molecular characteristics of individual tumors has provided momentum to the concept of precision cancer medicine. While targeted approaches such as gene panels are frequently used in clinics to inform precision cancer medicine, whole-genome and transcriptome sequencing (WGTS) and other comprehensive molecular profiling methods are gaining traction.[1] Crucially, these data types also allow for retrospective analyses of variants or other genomic aberrations newly identified as clinically relevant, which is not possible with targeted approaches.[1]

Precision oncology implementation in Canada is fragmented, since healthcare is administered by provincial and territorial governments and its delivery thus reflects jurisdiction-specific priorities. Jurisdictional and geographic barriers also mean that research efforts are often siloed in individual institutions or distinct regions. Despite such challenges, inter-provincial efforts exist, including the Canadian Profiling and Targeted Agent Utilization Trial (CAPTUR/PM.1, NCT03297606) and the pan-Canadian Precision Oncology for Young People (PROFYLE) program.

It was in this context—recognizing the need to break down data silos, motivated by the potential to enhance collaborative cancer research in Canada and driven by the promise of precision oncology to improve quality of life and outcomes for cancer patients—that the Terry Fox Research Institute launched the Marathon of Hope Cancer Centres Network initiative.

The Marathon of Hope Cancer Centres Network

Inspired by the legacy of Terry Fox, a national icon whose aim to run across Canada to raise funds for cancer research was cut short by cancer, the Marathon of Hope Cancer Centres Network (MOHCCN) is an initiative led by the Terry Fox Research Institute (TFRI) and the Terry Fox Foundation (TFF) that aims to unite Canadian cancer researchers, clinicians, patients, and other partners under a common vision of accelerating precision oncology in Canada. The Network's mission is to promote collaboration and the sharing of data, knowledge, and technology insights to advance precision cancer research and care. To achieve this, one of the Network's primary goals is to generate the MOHCCN Gold Cohort, a rich resource of paired genomic and clinical data from 15,000 cancer patients treated across Canada (described in more detail below). Understanding the challenges posed by such a multi-jurisdictional endeavor, the Network is taking a federated rather than centralized approach, building partnerships and promoting transparency while acknowledging operational differences across and within jurisdictions.

As of February 2025, the Network counts 42 member institutions across five regional consortia (Figure 1) and has funded more than 100 research projects involving more than 1,200 individuals (Table S1). To provide expert advice and guidance on areas of Network activity, 15 working groups and subgroups have also been formed to aggregate experts and thought leaders from across the country, who develop Network policies, guidelines, and standards. These documents are made freely available on the Network's website. More information about the Network's funding structure, targeting up to $300M CAD in new funds, and its scientific and professional management infrastructure can also be found on its website (accompanying materials can be found here).

The MOHCCN Gold Cohort—A new genomic resource for cancer research

Following discussions addressing gaps in precision oncology research and how to leverage strengths and capacities across Canada, the Scientific Questions Working Group brought forth recommendations that Network research and inclusion criteria for Gold Cohort cases should be centered on the following four thematic areas: (1) exploring the determinants of treatment failure of immunotherapies and precision cancer medicine, (2) investigating temporal and spatial heterogeneity, (3) evaluating the clinical validity and utility of genomics for real-time clinical decision-making, and (4) understanding the biology and multi-omic characterization of rare cancer types and subtypes.

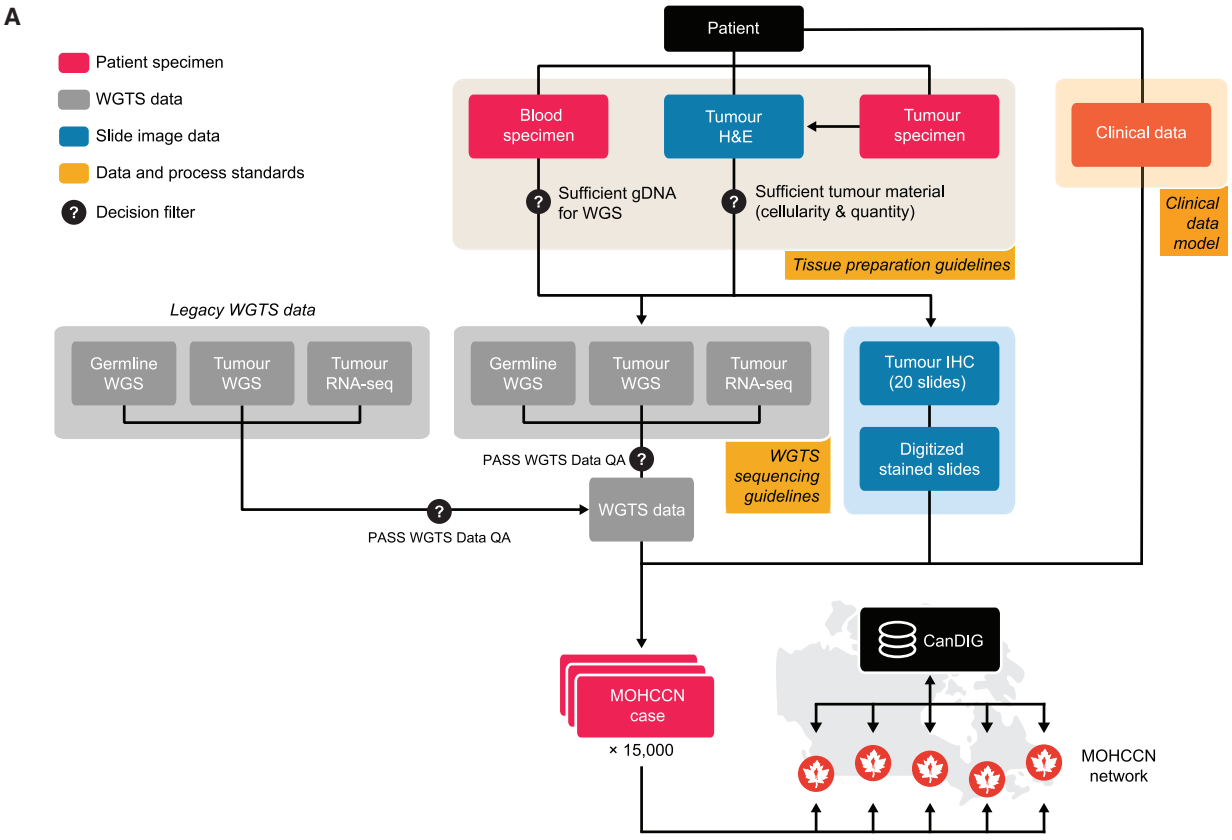
Figure 1. MOHCCN member institutions, organized by region
Current member institutions as of February 2025. Photo of Terry Fox by Gail Harvey.

Notably, these themes were not created with any particular technology in mind but were rather designed to be addressable using a wide variety of methods and techniques.

Considering factors such as data value and durability, available technologies, shareability, variable capacities for data collection at participating sites, past and current national and international cancer research initiatives, and the potential contributions the Network is poised to make, the Technology Working Group recommended that the Network ought to focus on WGTS data initially. Procedures related to biospecimen handing and data generation, processing, and analysis can be adapted to each institution's unique considerations, while collectively producing data that meet the minimum standards laid out in the MOHCCN Gold Cohort Policy, ensuring consistency and interoperability. Guidelines developed by the Technology and Biospecimen working groups include recommendations for meeting these standards and details about the processes in place at different consortia and genome centers, providing a platform to share learnings and best practices and encouraging transparency across the Network (Figure 2).

The MOHCCN Clinical Data Model was designed to draw on fields and vocabularies used in other standards and uses standard vocabulary where possible to maximize interoperability. It focuses largely on clinical data related to the donor and the sequenced specimen. To expand and complement the MOHCCN Clinical Data Model, work is ongoing to pilot the collection of additional data points, including economic, sociodemographic, and patient-reported outcome elements.

The MOHCCN Gold Cohort adopts broad inclusion criteria to ensure a diverse and representative sample of Canadian cancer patients. The dataset includes



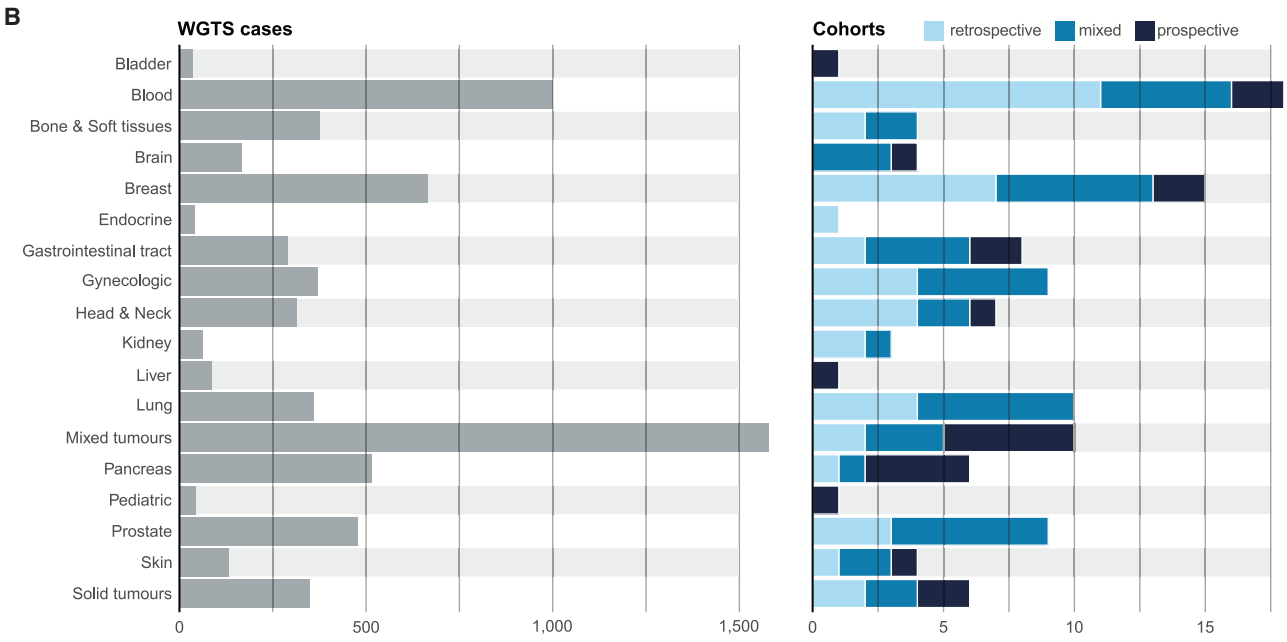


Figure 2. MOHCCN Gold Cohort data

(A) Schematic outlining the MOHCCN Gold Cohort data requirements. Legacy data are admissible if they meet the minimum requirements defined in the Gold Cohort Policy. Completed data are ingested into local CanDIG nodes, where a federated architecture allows them to be queried and analyzed by members across the country without leaving their site of origin. Access is managed by the MOHCCN Data Access Committee, and Network members agree to the MOHCCN Researcher Code of Conduct. WGS, whole-genome sequencing.

(legend continued on next page)

both retrospective and prospective cases and both fresh-frozen (FF) and formalin-fixed paraffin-embedded (FFPE) samples. The dataset also contains cases from a range of cancer types and stages, with primary, recurrent, and metastatic cancers represented (Figure 2). For example, as of the time of writing, profiled cases include >900 advanced cancer cases (including metastatic disease) and >700 cases from rare cancer types. The Network maintains a dashboard on its main webpage that provides an overview of progress and available cases, which is updated monthly.

Network priorities

Stimulating knowledge and data sharing within and across jurisdictions

One of the main objectives of the MOHCCN is to promote and enable data sharing between cancer research and care centers within and between jurisdictions, across Canada and beyond, following the principles of the Toronto Statement.[2] Gold Cohort data will be the first to be shared, helping to inform and build the infrastructure and resources needed to facilitate and increase data sharing more broadly. Data sharing requirements and access procedures are outlined in the MOHCCN Data Access and Use Policy. To begin establishing data sharing methods specific to MOHCCN, the Network is working with the Canadian Distributed Infrastructure for Genomics (CanDIG)[3] platform team to customize their existing software to enable ingestion of Gold Cohort data from participating member institutions.

Canada is a confederation of provinces that each have their own health data privacy legislation, and so the Network is taking a federated approach to data sharing. This means that data can be queried and analyzed without leaving their site (province) of origin, helping to overcome some of the limitations imposed by jurisdiction-specific health data sharing regulations. This approach is being facilitated in part by CanDIG, which has established federated data sharing within its network (Figure 2). The work done to date has led to a better understanding of the fundamental ethical and legal challenges and compliance barriers that exist for data sharing within and outside of Canada, and the Network is beginning to address these challenges in part through the TFRI's Digital Health and Discovery Platform.

Building capacity

By bringing together research institutes, hospitals, and health networks of various sizes and with a range of capacities across Canada, the Network has galvanized sharing of knowledge and resources and empowered institutions to increase their research capacity. The MOHCCN is also investing in specific capacity-building initiatives in institutions across the country, including ones focused on technology development and ones that promote multi-center collaborations. Given Canada's land area and unevenly distributed population, capacity building is critical to bring precision oncology research and care to cancer patients across the country.

Part of the Network's capacity building strategy lies in training early-career researchers and clinician-scientists, who will be central to carrying a collaborative and innovative culture of cancer research and care into the future. This is being done through, for example, career development awards (30 awarded to date across two programs), mentorship opportunities, and inclusion of early-career investigators into Network working groups to promote equitable learning opportunities and incorporate early-career voices and perspectives in Network activities.

Fostering patient-centered research

The MOHCCN Patient Working Group (PWG) brings together more than 30 cancer patients, survivors, and caregivers dedicated to helping advance precision oncology. The group has two main mandates: (1) to help guide Network activities to ensure they address and respond to the needs and priorities of those with lived or living cancer experience and (2) to develop a pan-Canadian education campaign related to precision oncology and share patient, survivor, and caregiver perspectives more widely in the research and clinical communities as well as with the broader public.

Members of the PWG are becoming increasingly integrated within the wider Network, for example joining other working groups, attending scientific meetings, and co-chairing the Network's virtual seminar series. They are also disseminating educational materials related to precision oncology, in part through the Network's Patient Hub. A major achievement of the PWG to date has also been the Patient Voices in Research initiative—an innovative funding program conceived, designed, and adjudicated by members of the PWG. This program, which to the best of our knowledge is a first of its kind, is a tangible example of the role the PWG has in driving patient-centric research innovation through the Network.

Promoting health equity

Genomics research systemically suffers from a lack of diversity and under-representation of individuals of non-European ancestry, undermining the ability to generalize research findings to the broader populations that the research ultimately aims to serve, including in the field of precision oncology.[4] Underrepresentation of racialized and minority groups is due in large part to structural and systemic racism within the research and health fields.[5] When used to inform clinical decisions, biased genomic data and research findings lead to a skewed body of knowledge and, eventually, to inequitable care, further propagating discriminatory pathways.

To enable research and future cancer care approaches that are inclusive, representative, and fair, MOHCCN-enabled research, including the Gold Cohort dataset, must therefore reflect the breadth of populations in Canada. The Canadian Spectrum Working Group was formed to create strategies to include equity-deserving communities and populations within Network activities. These include, but are not limited to, individuals from racial and ethnic minorities, rural and remote populations, newcomers to Canada, and individuals with rare cancers,

(B) Bar plots showing the number of cases profiled (left) and the number of cohorts contributing cases (right) from different cancer sites (as of December 2024). Cancer types and subtypes represented to date within each cancer site can be found on the Network's website. Data were drawn from the cohort level rather than the individual case level; the "mixed tumours" category thus represents cohorts with cases from more than one category (including cohorts that are open to all cancer types), and the "solid tumours" category represents cohorts with cases across various solid tumors.

as defined in the Underserved and Underrepresented Populations Guideline.

Closing the gap between research and clinical care

Central to the MOHCCN's mission of accelerating precision oncology is to promote the integration of research into clinical care through evidence-based interventions and treatments. One example is returning comprehensive genomic profiling results to patients and their oncology teams, an area of investigation for the Return of Results Working Group. Recently, the Prospective Enrolment Working Group was also formed to develop a nation-wide prospective profiling study. This study, in development as of the time of writing, will expand on existing trials such as the Personalized OncoGenomics (POG) program (NCT02155621) and MOHCCN-Ontario (NCT05403177) to increase prospective enrollment into the Network, enable the development of molecular tumor boards in participating centers, and bring research-based care to more patients across Canada.

In addition to projects contributing data to the Gold Cohort, the MOHCCN is also supporting special initiatives related to the continuum of precision oncology research. This includes, for example, projects focused on health technology assessment (HTA) methods, patient-centered outcomes, breaking down of inter- and intra-jurisdictional health data silos, and economic and quality evaluations specific to precision oncology. With these initiatives and its broader activities, the MOHCCN aims to enable the collection, curation, and responsible distribution of data that can inform real-world evidence and contribute to learning healthcare systems.[6]

Concluding remarks

Since launching in 2021, the MOHCCN has grown rapidly and has enabled an unprecedented level of collaboration and teamwork amongst Canadian cancer researchers, clinicians, patients, administrators, funders, and other partners. Beyond this first phase, the Network will continue providing a framework for innovative collaborative cancer research across Canada and beyond to accelerate precision medicine for cancer and improve patient outcomes. This will include an increasing focus on prospective profiling and evidence-based use of genomic profiling to inform cancer care, supported by robust multidisciplinary research and evolving, high-quality datasets.

The MOHCCN joins large-scale cancer genomics initiatives such as TCGA/ICGC,[7] the American Association for Cancer Research (AACR)'s Project GENIE (Genomics Evidence Neoplasia Information Exchange),[8] The Hartwig Medical Foundation,[9,10] the Cancer Programme of the UK's 100,000 Genomes Project,[11] and the 2025 French Genomic Medicine Initiative (PFMG2025).[12] Many Network members were and are involved in such initiatives, helping position the Network to leverage the knowledge, learnings, and data generated through other world-leading efforts to maximize the quality and impact of its Gold Cohort dataset and to support the success of the Network more broadly.

Once complete, the Gold Cohort dataset will be one of the most comprehensive resources of linked cancer genomic and clinical data in the world, providing a breadth of data comprising whole genomes from matched tumor and normal samples along with tumor transcriptomes; high-quality, detailed clinical data; and in some cases additional companion data types from a demographically and clinically diverse cohort of cancer patients. This scale and scope will make it complementary to other large-scale whole-genome sequencing datasets[7,9–11,13] as well as to other multi-omic datasets such as the proteogenomic data created by the National Cancer Institute's Clinical Proteomic Tumor Analysis Consortium (CPTAC).[14] Importantly, Canada's diverse demographics and the Network's cross-country reach provide a unique opportunity to reach diverse populations and promote the inclusion of historically underrepresented individuals within the Gold Cohort, which will make it an important resource to help address diversity and equity in cancer genomics.[15]

The Gold Cohort and the MOHCCN initiative more broadly presents a model for a distributed national cancer genomics program that enables broad partnerships across jurisdictions. Its solutions may thus be portable and generalizable to other nations and/or jurisdictions, providing a roadmap for similar initiatives both in Canada and worldwide.

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DECLARATION OF INTERESTS

The Terry Fox Research Institute Marathon of Hope Cancer Centres Network declares no competing interests. See Table S1 for declarations of interest from listed Network collaborators.

SUPPLEMENTAL INFORMATION

Supplemental information can be found online at https://doi.org/10.1016/j.ccell.2025.03.014.

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