The Marathon of Hope Cancer Centres Network (MOHCCN)

The vision of MOHCCN is to bring together leading cancer centres across Canada to collaborate on precision medicine to benefit cancer patients and drive innovation. The goal of the Network is to apply advanced technologies such as genomics, high-powered imaging and artificial intelligence (AI) to solve complex cancer cases. The Network will generate and share molecular, clinical, and health outcomes data on its cancer patients. The Network will be anchored with at least one designated centre/consortium in each region of Canada and will also fund competitive pan-Canadian projects that will drive the practical applications of precision medicine. It is envisioned that MOHCCN will:

    i.   unite cancer centres around a national cancer strategy in precision medicine by embedding research and innovation into the cancer clinic,

    ii.   share knowledge and resources to impact the health outcomes of patients, align investments from regional foundations and the pharmaceutical sector to match the federal investment to steer activities to benefit all Canadians, and

    iii.   position Canada as a global leader in cancer research.

As the first step in establishing such a collaborative national network the three leading cancer consortia in British Columbia, Ontario and Quebec were the first to be designated as Marathon of Hope Cancer Centres and they anchor MOHCCN. Each of these consortia has demonstrated its capability to undertake precision oncology with pilot projects reviewed and approved by committees of international experts. The funding for such pilot projects has come from contributions from TFRI and the participating members of the consortia and their foundations. In 2017 a $12M pilot project to demonstrate the feasibility of collaboration in precision oncology across jurisdictional and geographic barriers between BC Cancer in Vancouver and the Princess Margaret Cancer Centre in Toronto was launched. In 2019 a $5.6 M-pilot project involving 7 different organizations resulting in the formation of the Montreal Cancer Consortium was launched. In 2022 the Prairies Consortium with 3 different provinces and 7 different organizations joined the MOHCCN after their $1.5M-pilot project. Finally, the fifth and last multi-provincial consortium, the Atlantic Cancer Consortium, was incorporated into the Network in early 2023, achieving a coast-to-coast Network that includes all Canadian provinces.

In such a manner, the structure of the MOHCCN has evolved organically over the last four years to reflect a pan-Canadian Network of participating cancer centres and institutions involving all regions of Canada. The MOHCCN appointed in February 2022 André Veillette as the Executive Director working with a Network council made up of representatives from designated centres, and stakeholders to guide the development and operation of the network. The Executive director of MOHCCN is an executive member of TFRI and helps to integrate the functioning of MOHCCN into the overall ecosystem of TFRI (see paragraph on TFRI below).
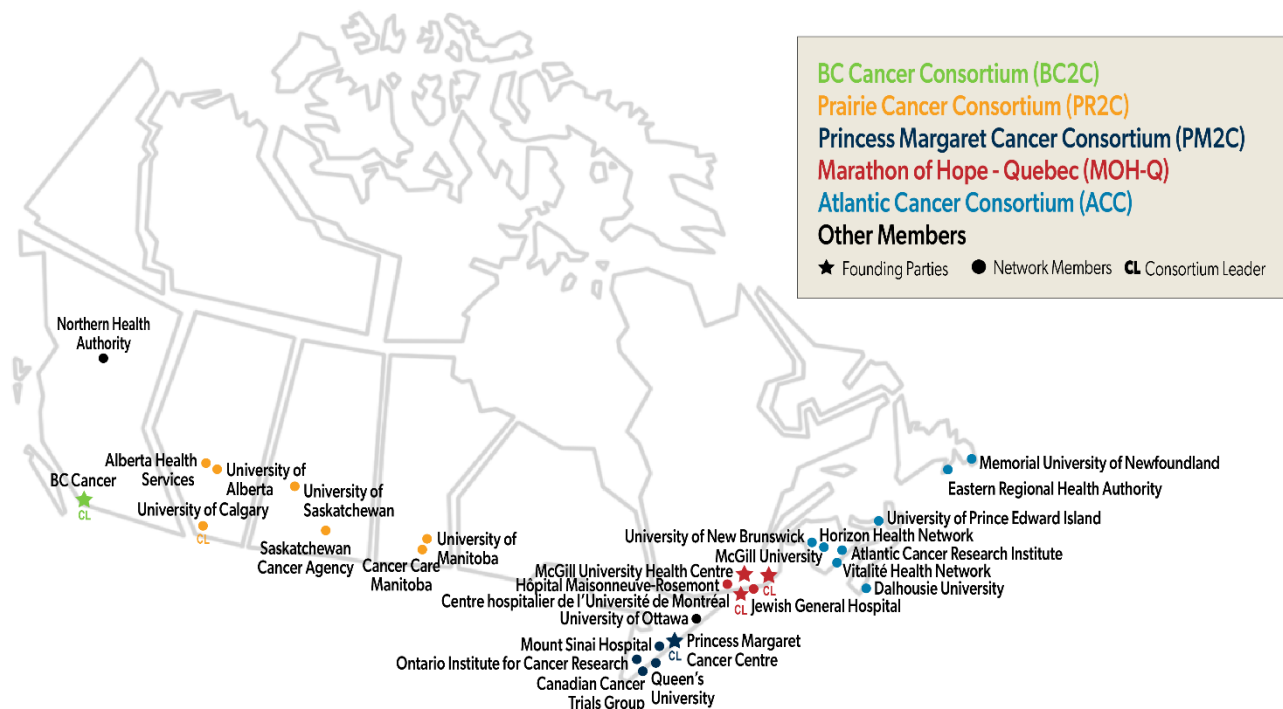
Figure 1: Structure of the Marathon of Hope Cancer Centres Network: This figure includes the five designated consortia as well as the Northern Biobank Initiative.

The Terry Fox Research Institute (TFRI): Over the years TFRI has funded team science in cancer research. TFRI receives funds from the Terry Fox Foundation (TFF) from the Terry Fox runs in which more than 3M Canadians participate annually. TFRI has on average an annual budget of about $20M which we invest in discovery research, and translational research. We have advocated the Federal government that the MOHCCN is a critical component to applying effectively and efficiently the benefits of fundamental and translational research. In this manner cancer patients and the Canadian healthcare system can benefit from innovations developed from research. At the same time, in such an integrated and partnered ecosystem, data from Canadian patients can further drive research that will benefit directly the Canadian population.

In TFRI's application to the Federal government for funding, we noted that the Canadian healthcare system has real advantages for collecting and sharing health data. In the past, we have not been able to fully capitalize on them because of challenges at the jurisdictional, cultural, and geographic levels. Thus, a key objective of the MOHCCN is to consolidate and annotate data from siloed precision medicine studies across the country with related clinical data. The creation of such big data will allow the necessary evidence to support clinical decisions so that optimal treatments can be chosen for each patient in the Network. In addition, we propose to create a unique cohort of 15,000 "gold-standard" cases representative of the diversity of Canadian cancer patients. The nature of the data for these cases will have few parallels in terms of comprehensiveness or sophistication.

The 15k gold cohort will set the stage for a precision medicine learning system and its value will be validated in a number of ways. It will prove its utility when the cohort is used:

i. to predict successful treatment outcomes with non-standard-of-care therapies, to identify patients whose particular cancer could respond to a novel regimen,

ii. as a vital resource for knowledge generation and cancer research, contributing answers to questions such as why some patients respond to therapy, while others do not,

iii. to study the social and economic consequences of precision medicine at scale.

Finally, the linkage of the molecular information in cases in the cohort with the health outcomes information available through the Centres will provide vital information on health outcomes for patients treated in the 'real world' outside of clinical trials, as well as information on co-morbidities. If the 15k cohort project proves to be successful, there will be an effort to scale such a cohort to 100k cases. Four scientific questions provided guidance to the Cancer Centres on thematic areas to help focus and assemble their cases eligible for the MOHCCN Gold Cohort. As defined by the Scientific Questions Working Group, these are:

1. Determinants of treatment failure of immunotherapy/precision cancer medicine,
2. Investigation of temporal and spatial heterogeneity,
3. Evaluation of the clinical validity and utility of genomics for real-time clinical decision-making, and
4. Understanding cancer biology and multi-omics of rare subtypes.

Operational Principles of MOHCCN: When the funding for the MOHCCN was announced by the Federal government in the March 2019 budget, we started to prepare in earnest a framework for operating MOHCCN. We determined that the MOHCCN should operate according to agreed standards and guidelines recommended by nominated expert working groups. Eleven working groups have been established to date: Scientific Questions, Patients, Data Policies and Standards, Clinical Data Standards, Technology, Health Technology Assessment, IP and Commercialization, Canadian Spectrum, Return of Results, Biospecimens, and Immune profiling.

TFRI Staff facilitates all working group meetings to ensure alignment of the mandates and better integration, in addition, many members of the working groups serve on more than one working group. With representation from all the consortia, the working groups discuss feedback and finalize recommendations that generate MOHCCN policies and guidelines. These documents are presented to the Steering Committee for review and are then presented to the Network Council for endorsement. Once endorsed, the policies and guidelines are shared through the MOHCCN website with the Network.

Working Groups	Mandates	Chairs
Data policies Standards	Formulate Network Data Governance Policies (Data Sharing, Data Access, Publication).	Lincoln Stein, Steven Jones
Clinical Data Standards	Clinical data collection and standards.	Lincoln Stein
Scientific Questions	Provide overarching scientific themes to guide Network activities, with a focus on pan-Canadian cohorts.	Christian Steidl, Lilian Siu
Technology	Recommend essential technologies for standards and SOP's that support data linkage, sharing and analysis.	Marco Marra, Trevor Pugh, Ian Watson
Immune Profiling	Provide recommendations on immune profiling standards.	Ian Watson, Hanne Ostergaard
Patients	Develop engagement and advocacy components.	Nicole Beauchemin, Nathalie Lamarche
Return of Results	Develop strategies for return of results to patients, medical team and next of kin.	George Zogopoulos, Janessa Laskin
Canadian Spectrum	Develop inclusion strategies for the under-represented population.	Nadine Caron Gina Ogilvie
Health Tech Assessments	Standardization of HTA data elements and support of HTA data collection through data linkage protocols.	Dean Reiger
Biospecimens	Develop operational procedures through evaluation and harmonization of SOPs across Consortia.	Anne-Marie Mes Masson, Trevor Pugh
IP/Agreements	Formulate MOHCCN IP Structures and policy.	Lesley Rapaport

Table1: A list of MOHCCN working groups and their respective mandates and chairs.

Future linkage with The Digital Health and Discovery Platform (DHDP): The DHDP is a separate federal government-funded, TFRI-led network that will develop and provide the data analysis platform for the Marathon of Hope Cancer Centres Network and other data sources. The DHDP artificial intelligence software will help unlock data-driven discoveries for cancer and other diseases. This software will be available to participating sites across Canada and contain specific tools that ensure privacy, security, accessibility and traceability of data. The federated data governance framework means data does not move from its home location but allows researchers to build sophisticated machine learning models and learn collectively from data without ever sharing sensitive patient information.

The MOHCCN gold standard cohort data will be made available through DHDP. The goal is to provide a network effect to accelerate the pace of discovery and the potential for commercialization. One use case for DHDP is: projects seeking to identify cancer cases of interest for specific research questions by sending queries to DHDP which compiles the results and then sends the data models developed back to each requestor for testing and validation. In this way, raw data does not leave the hospital and cross Provincial jurisdictional boundaries. Other use cases are also under development. The engineering work to develop and deploy the platform is provided by a separate $49M agreement with the federal government's Innovation, Science and Economic Development department as part of its 'Strategic Innovation Fund' program. Natalie Szudy is TFRI's interim Executive Director who will oversee the development and operation of the DHDP.
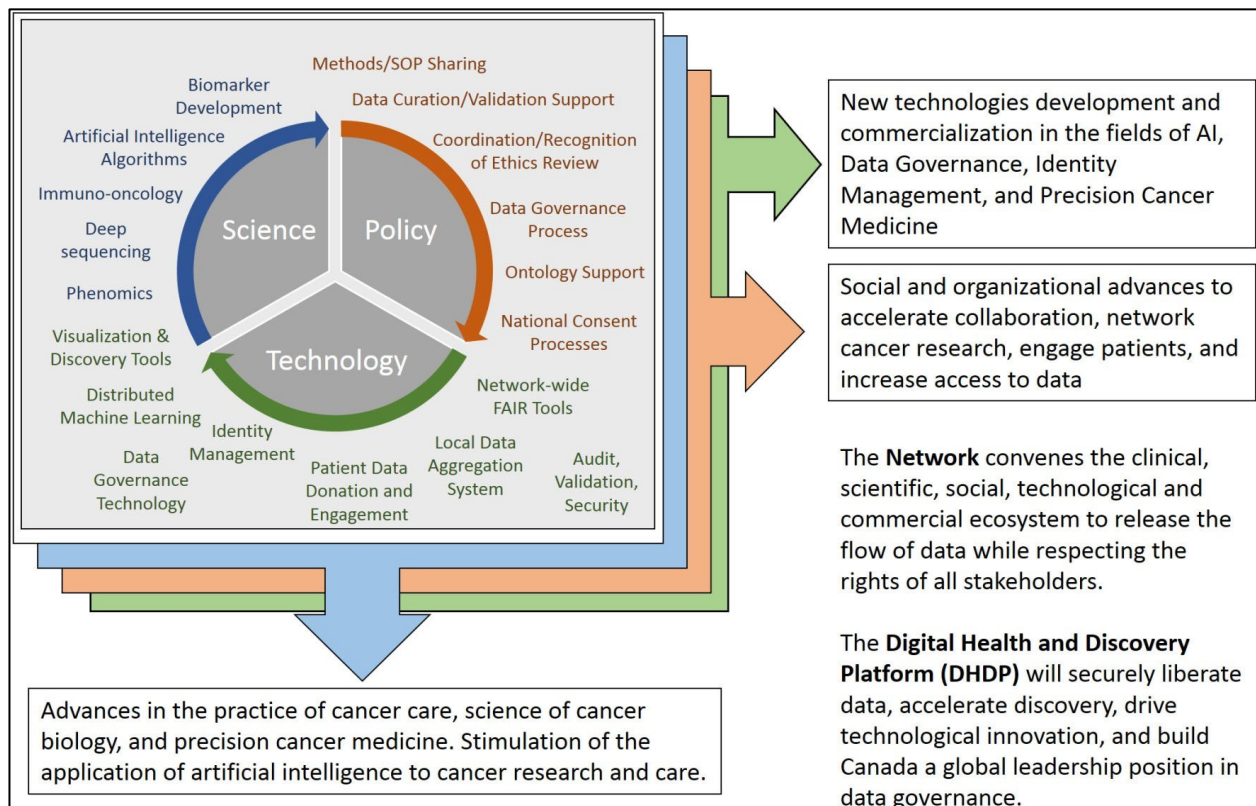

Figure 2: The three stacks of the DHDP (science, policy, and technology) and its network effect to accelerate the pace of discovery.