A new Canadian cohort for cancer discoveries

Shelly Jamieson, CEO of the Canadian Partnership Against Cancer, and Dr Jacques Magnan, Senior Scientific Leader for the Canadian Partnership for Tomorrow Project, discuss the reasons behind the development of Canada’s largest ever population cohort.

Could you begin by introducing the Canadian Partnership Against Cancer?

SJ: The Partnership is a federally-funded organisation that acts as the steward of Canada’s national cancer strategy. The strategy seeks to reduce the incidence of cancer, lessen the likelihood of Canadians dying from cancer, and enhance the quality of life of those affected by the disease. Our work covers the spectrum of cancer control and relies on networks of advisors, academics and patients to analyse evidence and promote best practice. We also catalyse initiatives through direct investment; accelerate the integration of improvements or solutions; and help spread knowledge and best practices.

What are the main objectives of the Canadian Partnership for Tomorrow Project (CPTP), which is partially funded by the Partnership?

SJ: We recognise that we cannot meaningfully reduce the burden of cancer in Canada without a better understanding of what causes the disease in the first place. In order to effectively study the complex causes of cancer and other chronic diseases, researchers need a large pool of participants – far larger than individual Canadian provinces could recruit or maintain. CPTP will support innovative population health research by providing not only health, behavioural, lifestyle and biological data, but also the opportunity to obtain future health outcome data through re-contact with some participants.

What were the Partnership’s motivations for setting up CPTP? Does the project address an unmet need?

SJ: Canada has world-class cancer researchers and facilities and this unprecedented health research platform opens up opportunities to accelerate and improve the competitiveness of Canadian research and provide opportunities for made-in-Canada discoveries. Efforts have also been made to prepare data for collaboration with similar cohorts from around the world. Over time, it is our expectation that research conducted using this platform will help unlock the mystery as to why some people develop cancer and fuel discoveries of new methods for prevention, detection or treatment.

Are there characteristics that make CPTP particularly unique?

JM: Canada is geographically vast and has profound regional differences in incidences of various cancers and chronic diseases, so the data within the platform reflect those regional variations. Canada has well-established populations with traceable genetic origins, but also a diversity of people from different countries, so CPTP may provide interesting insight into genetic predisposition to disease. Given that CPTP contains data from nearly one in every 50 Canadians between the ages of 35 and 69, this can also offer information on unique types of exposures, which may provide opportunities to study gene-environment interactions.

As it grows, CPTP is intended to become rich in health administrative and system data that can provide further insights, since some participants have agreed to have this data linked to their health information.

How does CPTP complement the other work the Partnership carries out to reduce the incidence of cancer?

SJ: The Partnership occupies a unique position in the cancer landscape. The wide reach of its work spans the entire continuum of cancer control and touches on research, policy, data, standards of care and the patient journey, looking specifically at prevention, diagnosis and clinical care, survivorship and palliative care.

There is much that a data source like CPTP can help uncover in each of these domains. Significant links between smoking and lung cancer and heart disease and high cholesterol have been uncovered through cohort studies. Similar discoveries – or new innovations in personalised medicine or preventive measures, for example – may well be uncovered here.

With the addition of biological samples, CPTP has the potential to help shape our understanding of not only risk factors related to environment, diet or lifestyle, but can help further our understanding of the interactions between those elements and genomic factors. Ultimately, these discoveries may help us better understand how to prevent or treat cancers.
In this roundtable discussion, *International Innovation* speaks with the regional Principal Investigators behind the **Canadian Partnership for Tomorrow Project**, which is pooling cohort data from across five Canadian jurisdictions.

**Why did your region choose to become involved with the Canadian Partnership for Tomorrow Project (CPTP)?**

**PR:** We had already started a cohort in Alberta in 2000, to enrol 50,000 Albertans who had not had a diagnosis of cancer to obtain information from them about health, lifestyle and other exposures that might be important. Our aim was to follow those people over time to try to understand why some of them went on to develop cancer or other chronic diseases while others did not. This was in the hope that this would help us devise more effective prevention strategies in the future.

Although we were already building the 50,000-strong cohort in Alberta, when the opportunity arose to join CPTP – a project that would enrol up to 300,000 Canadians – all of a sudden we were looking at a situation in which we’d have the significant statistical power needed to really get into some of the factors that influence cancer risk. We’re almost getting to a stage now where we’ll have enough power to look at genetic predisposition and environment – a task that requires big numbers and which wouldn’t be possible without CPTP.

**PA:** I’ve been involved in CARTaGENE (the Quebec population cohort) since 2009 and, together with Alberta, we were one of the original programmes to become involved in CPTP. As one of the first cohorts to exist in Canada, it made sense to partner with emerging programmes in other provinces to pool the data that we’ve been collecting. Such a strategy enables us all to be larger than the sum of our parts.

**TD:** Atlantic PATH became involved with CPTP because in Atlantic Canada we have a range of health issues, some of which are particular to Atlantic Canada and some to the rest of the country. We felt it was really important to try to understand some of the risk factors for various chronic diseases, be they social, environmental or genetic. The opportunity to get involved in a national cohort that was going to look at some of those issues across Canada, but also focus on our particular region and the particular issues that affected us, was important.

**MP:** We recognised that Ontario researchers were in need of a large, population-rich health resource of both data and biological samples in order to conduct cutting-edge research in the health research field.

**How do you anticipate the CPTP cohort will help your own research?**

**PR:** My research interest is in nutrition and activity; specifically how diet, exercise and other aspects of activity (including sedentary behaviour) can impact on long-term health. We know that body fatness and weight potentially impact on risk for certain cancers. But what are the drivers for weight? What are the drivers for body fatness? Can we understand more about how these exposures impact on risk? This
is a really exciting prospect because, if we can get this information from up to 300,000 Canadians over time and then follow those people up, it will provide real insight into modifiable risk factors. This may enable us to eventually develop better [and potentially personalised] prevention strategies.

**PA:** I’m a geneticist with a background largely in population and quantitative genetics. I’m primarily interested in population cohorts, so the resource we’ve now built through CPTP involving 300,000 participants is fantastic. As it’s a population cohort, rather than a disease cohort, we will be able to capture a genetic snapshot of what the population looks like, involving Canadians across all ethnicities. With the information and biological samples CPTP has collected from participants, we can look at the relationship between, say, genetics and the environment, and couple that with phenotypes or the clinical information or the health information that we’ve already captured from each of these participants. We’ve already started doing genome sequencing within my region in Quebec. We’ve been able to capture a real structure in genetic variation. We anticipate that, as we extend the study outside of Quebec, we’ll start capturing other kinds of structures associated with ethnicities, and that genetic variation might be structured with health profiles and the environment.

**JS:** I think the real question shouldn’t be how I will use the cohort myself, but how other researchers will. This is going to be a useful resource for researchers both in the short- and the long-term. Indeed, the benefit of the cohort will increase greatly over time. In 10 years this is going to be extremely valuable; in 20 years, this is going to be a goldmine. As our participants, who at present are primarily healthy individuals, start developing the chronic diseases and cancers that people develop as they age, this will enable researchers to investigate the causes of particular chronic diseases. So really, we can’t even begin to accurately assess the value of the CPTP cohort to research at present.

**TD:** I’m a health geographer, so I’m interested in how factors such as the environment, environmental pollution and the ‘built environment’ impact on health. I have a particular interest in the prevention of chronic diseases, including cancer. We’re not going to solve those large-scale problems just by treating more people; we must focus on preventing the diseases in the first place. As a cancer prevention specialist, the availability of information collected from individuals across all of Canada and in an integrated cohort will prove of immense importance for my research and other studies to identify some of these risk factors that might help disease prevention in the future.

**MP:** I’m interested in studying lifestyle, environmental and genetic causes of various cancers. I’m particularly excited about the potential within CPTP to look at obesity associations. Unlike most cohorts, CPTP is collecting data on body fat percent, which is really the best indicator of obesity. I think the insights from CPTP in this regard will be very important, and could profoundly improve our understanding of how obesity affects our cancer risk.
Two in five Canadians will be diagnosed with cancer at some point in their lives; indeed, the disease is the leading cause of death in Canada, followed closely by chronic conditions such as heart and lung disease. As life expectancy in Canada is currently on the rise, the incidence of such diseases is also expected to increase. As such, these health conditions represent a pressing public health priority.

Although much cutting-edge research aimed at identifying relevant risk factors and prevention strategies has been carried out in Canada, it has often been limited to small-scale, individual projects aimed at identifying the health impacts associated with a single, specific factor. If significant progress is to be made, then large-scale, longitudinal cohort studies are needed. It is only by accessing data on such a scale that researchers will be able to elucidate the complex and interacting impacts of various health, lifestyle, environmental and behavioural factors on the development of cancer and chronic conditions.

**Population-Wide Partnership**

It was for this reason that the Canadian Partnership Against Cancer established the Canadian Partnership for Tomorrow Project (CPTP) in 2008. As the largest population health research platform in the country (and the Partnership’s single largest investment to date), CPTP aims to bring together rich data from more than 300,000 Canadians aged between 35 and 69. “It is important that we have numerous people involved in this kind of research, because it’s only by having a critical mass of information that we can put data together and see which factors are having an effect on disease,” explains Jane Kaye, member of the UK10K Ethics Advisory Group and Chair of the International Scientific Advisory Board for CPTP. “This is the only way we can really understand why some people develop cancer and others do not.”

To achieve its ambitious goal, the Partnership has helped form, fund or facilitate work with regional cohort studies that reflect Canada’s diverse geography and population – Atlantic PATH in Atlantic Canada; BC Generations Project in British Columbia; CARTaGENE in Quebec; Ontario Health Study in Ontario; and The Tomorrow Project in Alberta – as well as world-leading experts in data harmonisation, biobanking and the ethics and legal aspects of cohort studies. The result is a large, unified cohort with the potential to make a much greater impact than any single regional cohort.

**Rich Data**

Nearly all of the CPTP participants have two things in common: they have never received a cancer diagnosis prior to enrolling in the study, and they have agreed for their data to be linked with their administrative health records in the future, as well as to the possibility of being recontacted by their regional cohort at a later date. “Linkage to health administrative data will enable researchers to study a variety of diseases in addition to cancer and bring data regarding clinical procedures, hospital visits, etc., into their research projects,” reveals Principal Investigator of the Ontario Health Study Dr Mark Purdue. “It will really increase the value of the resources for scientists.” This openness to re-contact is also important for ensuring there is room for the project to expand in the future; for example, participants could be recontacted with requests for additional data of research interest, such as information relating to nutrition, exercise, mental and cognitive health, or occupational and residential history.

All CPTP participants completed a core questionnaire upon recruitment, which provides detailed information on health, lifestyle and disease history. Additionally, large subsets of consenting CPTP participants have also provided bio-samples and visited assessment centres to provide physical measurements.
As the largest population health research platform in the country, the Canadian Partnership for Tomorrow Project aims to bring together rich data from more than 300,000 Canadians aged between 35 and 69, all of which were obtained by standardised methods. Over time, as participants age and experience changes in their health status, the cohort will become increasingly valuable to researchers, who will be able to use the data provided by participants to identify possible causative factors.

**SIGNIFICANT OUTCOMES**

CPTP has already succeeded in achieving its goal of enrolling 300,000 participants and, at present, two-thirds of the data obtained from the core questionnaires have been pooled. Researchers can request access to data relevant to their research interest through the CPTP Portal. Naturally, this has not been accomplished without encountering some challenges along the way, as Dr Jacques Magnan, the Partnership’s Senior Scientific Leader for Research and CPTP, outlines: “Supporting information access and sharing within and beyond each province; developing and supporting prospectively standardised approaches to the collection of data, physical measures and samples; developing the agreements necessary to supporting such a large-scale collaborative effort... all of these were considerable hurdles”.

Overall, the individuals behind CPTP are confident that their efforts will pay off, and that ultimately this cohort – which is of unsurpassed size and richness (in terms of epidemiological, clinical and biological data) in Canada – will become a leading light in longitudinal cancer and chronic disease research. Potential outputs include the identification of biological markers to facilitate early disease detection and improve diagnosis; the effective assessment of public health policies aimed at modifying risk factors; increased understanding of the role played by various genomic components in disease and health, which may pave the way for the development of novel therapies; and a greater insight into the factors that cause cancer and chronic diseases to vary across different geographic areas and populations.

Furthermore, the insights generated by the CPTP cohort are likely to have implications that extend beyond Canada’s borders. In addition to the fact that many of the findings to emerge as a result of CPTP will be applicable to healthcare and scientific understanding across the world, the development of this cohort will also strengthen Canada’s status as a centre for cancer, chronic disease and population research on the global stage. “CPTP serves as proof that Canada is investing heavily into health research infrastructure, and that the resources available to our scientists can lead to cutting-edge discoveries that are on a par with health researchers worldwide,” Purdue confirms.

Furthermore, in order to foster global collaborations, CPTP has worked with leading international experts in data harmonisation and bio-sample repository and joined P3G – an international organisation that supports national research initiatives to collect data variables in a way that allows them to be compared and harmonised with data from elsewhere in the world.

Given CPTP’s longitudinal nature, it is likely that the future development of novel technologies and techniques will enable researchers to use CPTP data in ways that we cannot yet anticipate. What is clear, though, is that CPTP is likely to generate insights that will have significant positive impact, both for individuals living with or at risk of certain illnesses and for medical research and health policy professionals.
OBJECTIVES
The Canadian Partnership Against Cancer has facilitated the building of Canada’s largest population health cohort to help researchers unlock the mystery as to why some people develop cancer and other chronic diseases and, in time, uncover new means of prevention, detection and treatment.

PARTNERS
BC Generations Project
Alberta Tomorrow Project
Ontario Health Study
CARTAGENE
Atlantic PATH (Partnership for Tomorrow’s Health)

FUNDING
Canadian Partnership Against Cancer
British Columbia Cancer Foundation
Alberta Innovates-Health Solutions
Alberta Cancer Foundation
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SHELLY JAMIESON is Chief Executive Officer of the Canadian Partnership Against Cancer. She also serves on the Board of Directors of High Liner Foods, the Finance Committee of the Toronto 2015 Pan Am/Parapan Am Games and the Board of Health Quality Ontario. Prior to joining the Partnership in 2012, she held Ontario’s highest-ranking civil servant role as Secretary of Cabinet, Head of the Ontario Public Service and Clerk of the Executive Council. For her work, she has been inducted into the Hall of Fame of Canada’s Top 100 Most Powerful Women and awarded the Queen’s Diamond Jubilee Medal.

IN ADDITION...
135,000 have provided venous blood samples
100,000 have provided urine samples
18,000 have provided unique bio-samples (e.g. saliva and blood spots)
30,000 have provided toenail clippings

FINALLY...
90,000 have visited assessment centres to provide physical measures such as:
• Height
• Weight
• Waist and hip circumference
• Body mass index (BMI) and body composition

1 in 50 Canadians within that age bracket (35-69).

A CLOSER LOOK AT THE CANADIAN PARTNERSHIP FOR TOMORROW PROJECT COHORT

International Innovation presents a comprehensive insight into the diverse types of data being collected by the Canadian Partnership Against Cancer and its project partners.

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300,000 have provided information relating to their:
• Social demographics and ethnic background
• Education level and employment status
• Personal and family disease histories
• Cancer screening history
• Sex, gender and reproductive health
• Medication use
• Sleep patterns
• Sun exposure
• Diet and nutrition
• Alcohol use
• Tobacco use/exposure to second-hand smoke
• Physical activity level
• Height, weight and waist circumference

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The Canadian Partnership for Tomorrow Project has built a cohort involving 300,000 participants aged 35-69.