Personalized Medicine: CCO's Vision, Accomplishments and Future Plans

Jennifer Guo, Suzanne Kamel-Reid, Michael Rutherford, Jennifer Hart, Saul Melamed and Aaron Pollett

Abstract

Personalized medicine is a rapidly expanding field, with the potential to improve patient care. Its benefits include increasing efficiency in cancer screening, diagnosis and treatment through early detection, targeted therapy and identifying individuals with an underlying genetic risk for cancer or adverse outcomes. Through the work of Cancer Care Ontario (CCO)'s Pathology and Laboratory Medicine Program, a number of initiatives have been undertaken to support developments in personalized medicine. In keeping with the momentum of recent accomplishments, CCO has led the formation of the Personalized Medicine Steering Committee to develop a comprehensive provincial genetics strategy for the future of cancer care.

Introduction

Cancer Care Ontario (CCO) pledged to "expand our efforts in personalized medicine" as a strategic priority in the latest Ontario Cancer Plan III (Cancer Care Ontario 2011: 45). Personalized medicine is a rapidly expanding field that uses genomics to increase efficiency in cancer screening, diagnosis and treatment. Understanding the underlying genomics allows for the identification of inherited cancer syndromes, focused implementation of screening activities resulting in the early detection and prevention of cancers and the prescription of molecularly targeted treatments and standard chemotherapies that are most likely to benefit the individual patient (Butts et al. 2013; Hamburg and Collins 2010). Developments in molecular oncology have the potential to transform and enhance cancer care in the province. To ensure that Ontario's cancer system continues to be one of the best in the world, CCO is committed to leveraging state-of-the-art technologies, leading medical expertise and evidence-based best practices to promote Ontario as a leader in modern healthcare systems.

For Ontarians, personalized medicine has the potential to reduce the incidence of cancer, improve cancer survival rates and curtail costs associated with ineffective treatment and drug toxicity (Cancer Quality Council of Ontario 2011). CCO has been leading work that integrates an understanding of patients' genetic makeup and molecular changes into cancer prevention, diagnosis and treatment. Central to this work is CCO's Pathology and Laboratory Medicine Program, the clinical program that focuses on cancer diagnostic analysis and works to strengthen the quality of cancer pathology and laboratory medicine services across Ontario. This has included the provision of funding mechanisms for new genetic tests and close collaborations with Ontario's Ministry of Health and Long-Term Care (MOHLTC) to address genetics-related provincial and national policy issues. The aim is to have a system where Ontario patients have access to high quality, timely and personalized approach to cancer care.

Current Developments in Personalized Medicine in Ontario

Ontario has been investing in large-scale research and infrastructure development in industry projects, private–public partnerships and hospital initiatives in personalized medicine (Invest in Ontario 2013). These funding commitments have supported application of new technologies, such as multi-gene panel testing and next-generation sequencing (NGS) platforms. The resulting advancements have expanded the ability of laboratories in Ontario to generate genomic data far beyond the molecular analysis of a single-gene, at a scale and accelerated pace that could not have been achieved a decade ago (Mardis 2013). To expand genetic testing to accommodate the clinical need, current funding and laboratory licensing models for emerging tests need to be continually updated to keep pace with the discoveries and developments of clinically validated molecular biomarkers.

Significant work has been done to pave the way for new paradigms in genetic testing, such as the coordination of predictive testing and treatment and the concept of "companion diagnostics," or test-drug pairs. Given the efforts in widening the scope of available testing, progress towards more provincial oversight of genetic testing will be needed to ensure appropriate access and quality. Support for such initiatives will facilitate timely and efficient adoption of molecular testing into the clinical setting.

With an increased emphasis on integration of genetic testing into everyday clinical practice, healthcare providers will continue to require ongoing support, including updated practice guidelines and decision support tools, in order to effectively use these new technologies (Bonter et al. 2011; Cancer Quality Council of Ontario 2011: 9; Carroll et al. 2008). The availability of such tools will be critical for ensuring appropriate clinical utility of genetic testing as well as appropriate referral patterns to clinical geneticists and genetic counsellors.

LIST OF ACRONYMS

Acronym	Description
CCO	Cancer Care Ontario
PMSC	Personalized Medicine Steering Committee
MOHLTC	Ministry of Health and Long-Term Care
NGS	Next-generation sequencing
MOAC	Molecular Oncology Advisory Committee
ALK	Anaplastic lymphoma kinase
BRAF	B-Raf proto-oncogene, serine/threonine kinase
KRAS	Kirsten rat sarcoma viral oncogene homolog
HCSSC	Hereditary Screening Cancer Sub-Committee
HBOC	Hereditary breast and ovarian cancer syndrome
VUS	Variants of unknown significance

CCO's Accomplishments to Advancing Personalized Medicine

CCO contributes to the quality of medical genetics laboratory testing by advising the MOHLTC on emerging issues in molecular oncology and leading initiatives that support biomarker testing and up-to-date clinical criteria for genetic testing in cancer patients. In 2008, CCO struck the Molecular Oncology Task Force to develop an assessment of the province's genetic testing and counselling services in the field of oncology. The Task Force's report, Ensuring Access to High Quality Molecular Oncology Laboratory Testing and Clinical Cancer Genetic Services in Ontario (Cancer Care Ontario 2008), led to the formation of the Molecular Oncology Advisory Committee (MOAC) in 2010. MOAC is an advisory panel of leaders in medical and laboratory genetics. It plays an integral role in implementing provisions to ensure quality assurance and cost-effectiveness for strengthening molecular oncology laboratory and clinical cancer genetic services in Ontario. As of the writing of this article, MOAC has provided recommendations to MOHLTC that have led to CCO providing funding oversight for testing of several biomarkers, including ALK, BRAF and KRAS. MOAC's sub-committee, the Hereditary Cancer Screening Sub-Committee (HCSSC), is collaborating with CCO's Cancer Screening Program to support initiatives that screen for persons with known inherited cancer syndromes, such as hereditary breast and ovarian cancer syndrome (HBOC) – caused by alterations in the BRCA1 and BRCA 2 genes – and Lynch syndrome – caused by alterations in the MLH1, MLH2, MSH6 and PMS2 genes. In addition, the HCSSC is currently leading work in the development of an advice document to provide recommendations for clinical best practice to help drive consistency for identifying, analyzing and reporting genetic variants of unknown significance (VUS) in relation to testing for HBOC and Lynch syndrome. Other initiatives include the formation of ad hoc working groups that provide evidence-based and clinical expert advice to address pressing issues, such as the HER2/Neu Expert Panel Working Group. This expert panel provided recommendations for the testing of HER2 – a gene that when overexpressed promotes growth of breast cancer cells, while Herceptin – a targeted therapy against HER2 – was undergoing the approval process in Ontario (Cancer Quality Council of Ontario 2011: 22).

CCO's Approach to Personalized Medicine

CCO established the Personalized Medicine Steering Committee (PMSC), consisting of oncology and pathology experts from across Canada, to advise on Ontario's strategy for personalized medicine in cancer care. Leveraging regional expertise, national leaders in the field, international networks and existing models of best practices, PMSC will provide leadership, guidance and input to advance personalized medicine into mainstream

medical practice, while working in alignment with MOAC, the Pathology and Laboratory Medicine Program and MOHLTC-supported working groups external to CCO.

Expected outcomes of PMSC's strategy for Ontario will include:

- Providing a proactive and comprehensive plan for the province to guide best practices in personalized medicine, such as incidental findings, VUS and use of information technologies.
- Supporting guideline development and knowledge transfer for healthcare providers to apply genomics as a central part of providing quality care to cancer patients.
- Collaborating with national and international groups to coordinate efforts to further best practice in personalized medicine.

Concluding Remarks

Knowledge of genomic data is already being used by physicians to direct patients into screening and surgical risk reduction programs, advance new treatments that aim to inhibit the molecular target or genetic variant in the cancer cell genome of specific cancers and avoid costly treatments with limited benefits and possible side effects.

Ontario is moving towards a more comprehensive strategy to integrate the application of personalized medicine into mainstream medical practice for oncology. The strategy will include an approach to molecular diagnosis that spans from individual risk assessment to tumour analysis to disease management in the clinical setting.

This will require renewed focus to key policies, planning and approaches to genetics in the oncology field to enable the province's pathology and laboratory medicine programs to move cancer care beyond conventional standard guidelines and practices. The PMSC will embark on the next step to developing a strategy that will drive Ontario's approach in personalized medicine and bring the benefits of personalized medicine into clinical practice. HQ

About the Authors

Jennifer Guo, MIPP, is the Policy Research Analyst, Pathology and Laboratory Medicine Program at Cancer Care Ontario.

Suzanne Kamel-Reid, PhD, DABMG, FACMG, is Professor of Laboratory Medicine and Pathobiology, University of Toronto; Affiliate Scientist, The Ontario Cancer Institute; Head, Clinical Laboratory Genetics; and Director, Molecular Diagnostics, The University Health Network. She is Co-Chair of the Cancer Care Ontario Molecular Oncology Advisory Committee, a member of the Ontario Personalized Medicine Network, a member of the Ontario Ministry of Health Genetics Testing Advisory Committee and a member of the Ontario Genetics Secretariat Executive.

Michael Rutherford, MD, PhD, FRCPC, is a Staff Pathologist and Director of the molecular diagnostics laboratory at Health Sciences North and Assistant Professor at the Northern Ontario School of Medicine.

Jennifer Hart, MPA, is the Manager, Pathology and Laboratory Medicine Program at Cancer Care Ontario. Prior to joining CCO, Jennifer's career focused on health-service integration, tobacco control and education.

Saul Melamed, MBA, is the Director, Clinical Programs – Diagnosis and Treatment at Cancer Care Ontario.

Aaron Pollett, MD, MSc, FRCPC, is the Provincial Head, Pathology and Laboratory Medicine Program at Cancer Care Ontario. He is an Anatomic Pathologist and Co-Director of the Division of Diagnostic Medical Genetics at Mount Sinai Hospital and an Associate Professor in the Department of Laboratory Medicine and Pathobiology at the University of Toronto.

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