



ADVANCING GENOMICS EDUCATION FOR HEALTH PROFESSIONALS IN BC

EXEMPLAR PROJECT OUTCOMES



Genomics positively impacts life, every day.



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Advancing Genomics Education for Health Professionals in BC: Exemplar Project Outcomes

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Executive Summary

As part of its 2023–2026 Strategic Plan, Genome BC committed to catalyzing genomics education for health professionals, addressing critical barriers such as limited foundational knowledge, lack of clinical tools, and fragmented educational infrastructure.

Genome BC's Genomic Education for Health Professionals (GEHP) Implementation Framework, through four exemplar projects, has laid crucial groundwork for enhancing genomics literacy and integration within BC. These projects demonstrate significant progress in building capacity, improving access to genetic services, and supporting the responsible adoption of genomics in clinical care:

- 1. Genetic Assessment and Testing Services Care Pathway (Pathways BC Partnership)**

This project has significantly improved navigation and access to genetic services across BC by expanding and updating clinic profiles and launching a [comprehensive diagnostic care pathway](#) on the widely used Pathways BC platform. The added referral tools provide accessible, just in time learning resources to support clinicians' decision making with their patients. Genetics clinics can benefit from using Pathways to communicate the standard of care as more genetic services are mainstreamed.
- 2. Familial Hypercholesterolemia (FH) Education Module (ACCURATE Study)**

A [mini-education module](#), including a video and clinical resources, was developed to support clinicians in interpreting FH genetic test results. This project highlights that creating specialized educational content at the research stage has limited impact, and these resources are better used to support clinical implementation. The educational content on cascade screening and cardiogenomics video analytics also provide valuable insight to design materials as short, focused content segments, so that the content is more adaptable for use across specialties.
- 3. NP-EDGE: Genomics Education for Nurse Practitioners**

This initiative is Canada's first integrated genomics curriculum for nurse practitioners (NPs). The project's strength lies in its modular, practice-based design, which directly addresses specific competencies for the BC context. The improved genomic knowledge and confidence seen among the small cohort of learners is a testament to the program's effectiveness. This pilot provides a scalable blueprint that could serve as a foundational curriculum for other primary care providers, including family physicians and midwives. Access to the modules, and details about learning objectives are available at [Genetics and Genomics for Nurse Practitioners](#).
- 4. Pharmacogenomics (PGx) Resources for Direct-to-Consumer Testing**

This project effectively created practical, "plug-and-play" resources—handouts and conversation guides—to equip primary care providers to address the growing patient demand for information on direct-to-consumer PGx testing. By focusing on practical application and conversation support, these materials provide immediate utility for educators and clinicians alike. Find the resources at [Pharmacogenomics - Genome BC](#).

Key Opportunities for Sustainable Impact:

A coordinated provincial genomics strategy is needed to evaluate and prioritize genetic services, regardless of whether they are available through public or private pay options. This will ensure that the promising outcomes of these and many other projects can benefit patients and the health care system. While the responsibility of this is largely outside of Genome BC's purview, we look to engage the ecosystem partners on the following questions to direct further work in this area:

- **Establishing a Centralized Provincial Educational Hub:** Is there an opportunity for a dedicated repository of educational resources through a provincial health services program or an institutional supported home? Can we build in AI support to update the content and personalize the learning opportunities?
- **Create a Scalable, Interdisciplinary Curriculum:** How do we expand to create core genomics modules with discipline specific applications that are tied to changing clinical practice and provide support to healthcare providers to ensure they are competent and comfortable to participate in the mainstreaming of genetic services?
- **Ongoing Maintenance and Expanding Practical Tools:** What systemic funding models can be adapted to support the need for ongoing improvements? Under what scenarios would Genome BC consider future investment?
- **Empowering patients:** How can we build public knowledge around the benefits and limitations of genomics and highlight evidence based, public or private pay genetic services to enable patients to advocate for themselves and their families.

Through these initiatives, Genome BC has laid the groundwork for a more genomically literate and prepared health care workforce. BC's ability to remain at the forefront of precision health depends on deliberate alignment of policy and resources across health authorities, government, clinicians, educators, patients, and rightsholders to scale, embed and sustain these efforts system-wide.

Introduction

Genomic medicine has the potential to transform British Columbia's health care landscape and modernize patient care. Currently, significant barriers hinder the clinical implementation of genomics in BC, including foundational knowledge, skills and competencies of BC's health care professionals, and the need for dedicated resources to up-skill and provide ongoing education and support to the workforce. Genome BC commits to being a catalyst in the development of genomics education for health care professionals in BC.

In 2019, Genome BC collaborated with key interested and affected parties to produce an [Education Asset Map](#) that identified the fragmented network of regional and Canadian based clinical genomics education resources available to health providers. This was followed by the development of the [Genomics Education for Health professionals Implementation Framework](#) in 2021.

The framework presented key strategies and specific tactics to increase the responsible uptake of genomics through the education of health professionals. The framework also proposed exemplar projects that were aligned with the needs of genomic health care in BC and offers an opportunity to make progress towards an expanded version of the education framework. Genome BC hired a staff member to develop and manage the exemplar projects in collaboration with ecosystem partners.

This report provides an update on four Genome BC funded projects, planned and evaluated using the genomic education program logic model by Nisselle et al.¹⁻³ In addition to the specific outputs, this report presents the important outcomes and the opportunities and challenges to address for these projects to have sustainable impact. We also evaluate the tactics from the implementation framework and present several questions for the ecosystem on how to continue to overcoming barriers to enable the use of genomics in the health care system.

Exemplar #1: Partnership with Pathways BC to develop the Genetic Assessment and Testing Services Care Pathway

Project Overview

Recognizing the confusing patchwork of genetic and genomic services that developed as more specialty genetic services were established, this project addresses the key priority of supporting health professionals to provide equitable access to patients across the province. The goal is to improve the navigation of available genetic services and related point of care tools.^{4,5}

This project partnered with Pathways BC (Pathways). Pathways is a provincial platform established to help clinicians and patients navigate health services and support appropriate and consistent patient care⁶. Funded through a collaboration between Doctors of BC and the BC Ministry of Health, Pathways provides a comprehensive and trusted source of information for physicians and other health care professionals across BC. This includes a directory of specialist clinics with wait times, clinical tools such as referral forms and decision pathways, as well as patient information resources and referral forms that can be emailed directly to patients.

A key to the platform's success is the dedicated Pathways team that supports the community driven approach and users' ability to manage information in real time to communicate changes about their clinical practice. Used by nearly 100% of primary care providers and over 95% of community based specialists, Pathways has proven to be an important tool to reduce administrative burden, and support appropriate and consistent patient care, while providing data that supports quality improvement.

Engaging with clinical genetics partners was an essential first step, demonstrating the value and utility of Pathways for both the genetic specialty clinics and the broader health care professional community. Genome BC went on to expand the Pathways content to ensure a comprehensive list of clinical genetics services across the province with supporting clinical decision aids and patient resources. The focus was to highlight the assessment and testing available to clinicians for independent ordering and clarifying when, where and how to refer patients for specialty genetic assessment and testing.

Project Outputs:

Genome BC supported expansion of the genetics content available on Pathways BC including:

- 1) Updates to nine existing clinic profiles and addition of four new clinics. Ideally, each clinic profile should include:
 - Clear and easily updated inclusion and exclusion criteria, with some clinics including descriptive details on the typical patients seen for consultation
 - Accurate service provision information such as wait times, whether patients can be seen virtually and/or in person, and languages spoken
 - Process details on how to refer a patient, and what information should be included with the referral to ensure timely and appropriate triage and booking
 - Details about test ordering processes
 - Practical tools such as referral forms, patient information sheets

- 2) Creation of the [Genetic Assessment and Testing Services Care Pathway](#), a diagnostic tool launched at Genome BC's [2023 Genomics Forum - The Pathway Forward](#) that:
 - Enables clinicians to determine the appropriate genetics clinic to refer a patient for genetic counselling and assessment and/or testing
 - Provides direct links to the genetic clinic profile including eligibility criteria, and triage approach for different waitlist streams
 - Supports clinicians in providing clinical care and ordering genetic testing on their own, starting with the test menu available from the Division of Genome Diagnostics.
 - Highlights the mainstreaming process for the BC Hereditary Cancer Program
 - Provides information on how to request funding for out of province testing

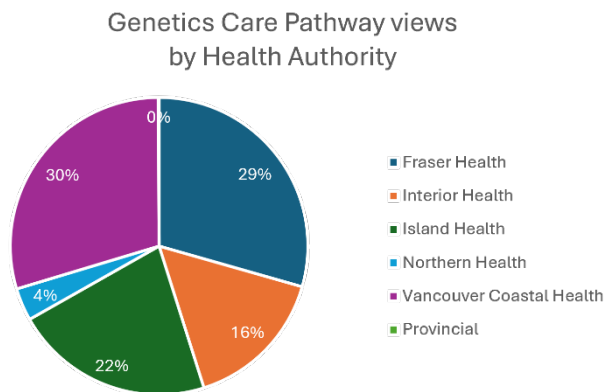
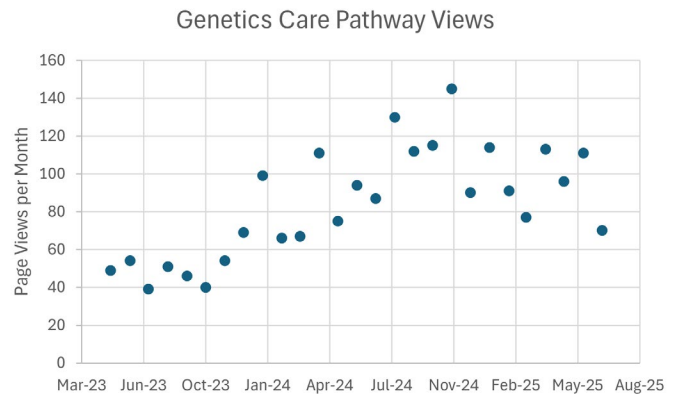
- 3) Improved education and engagement with tools to support responsible and appropriate use of genetic services including:
 - Added Genetic Education Canada: Knowledge Organization (GECKO) point of care tools that support clinicians in ordering carrier screening for hemoglobinopathies, and neurodevelopment delays to improve the quality of referrals to the Provincial Medical Genetics Program
 - Created a clinic profile specifically for BC Cancer's Hereditary Cancer Program mainstream testing program to increase visibility using the platform search engine
 - Improved accessibility to the Ministry of Health Pharmacogenomics Testing Information for Patients and Clinicians booklet
 - Supported the redesign of the UBC MED448 genetics module to use Pathways materials and the care pathway within the course materials

- 4) Recommended nine new clinician tools and three patient information sheets available on Pathways:
 - Direct-to-Consumer Genetic Testing FAQ for Healthcare Professionals (National Human Genome Research Institute)
 - Direct-to-Consumer Genetic Testing and Privacy (Office of the Privacy Commissioner of Canada)
 - Pharmacogenomics Testing Information for Providers (Government of BC)
 - Pharmacogenomics Testing Information for Patients (Government of BC)
 - Genetic Testing - Physician Options and Obligations (Canadian Medical Protective Association)
 - Hereditary Cancer – Breast, Ovary, Colon and Other Cancers Referral Info (BC Cancer)
 - Hereditary Cancer Program Mainstreaming Orientation for Direct Order Genetic Testing (BC Cancer)
 - Reproductive Genetic Carrier Screening (GECKO)
 - Genetic Carrier Screening - Hemoglobinopathies (GECKO)
 - Genetic Testing for Neurodevelopmental Disorders (GECKO)
 - Familial Hypercholesterolemia (Canadian Cardiovascular Society)
 - Familial Hypercholesterolemia Video (4 min) (Alberta Health Services)

Project Outcomes:

The Genetic Assessment and Testing Care Pathway is the first comprehensive accounting of the clinics supporting genetic assessment and testing at the provincial and regional level, with 14 clinics.

The partnership with Pathways is a successful approach to improve accessibility of genetic and genomic services for patients across BC. Since the launch of the Genetic Assessment and Testing Services Care Pathway in 2023, we have seen an increase from an average of 45 page views per month to a peak of 145 in November 2024, and now averages ~100 views per month.



Between April 2024 and March 2025, page views are from clinicians in every health authority and generally representative of the provincial population in each health authority, demonstrating provincial accessibility and need for genetic services and a growing awareness of the utility of tool.

Additional metrics of clinic pages and individual resources can inform educational and promotional efforts as more genetic services are mainstreamed. For example, after the launch of the mainstream hereditary cancer testing in March 2024, there is a sustained increase in the number of times the family history form is emailed directly to patients. Similarly, the [PEGASUS-2](#) project's decision aid for non-invasive prenatal screening is the top genetics resource with over 1,200 views from April 2024 to March 2025. Prenatal screening resources are frequently used on the Pathways platform because they are integrated into the prenatal genetic screening section of the Early Pregnancy Care Pathway. This helps maternity care providers provide consistent care for their patients.

The introduction of Pathways to the clinical staff at specialty genetics clinics is working to reduce administrative burden, which allows for increased time supporting patient care. As clinics expand the information available on their profiles, including waitlist times, they can expect to receive less inappropriate referrals and questions about eligibility. They should also receive more complete referral information which allows for timely and appropriate triage.

Pathways also allows genetic specialists to locate specialists and services across the province, facilitating appropriate follow up care closer to home for their patients.

Opportunities to reach sustainable impact

This project demonstrates the benefits of using Pathways infrastructure and workflow as a tool to navigate genetic and genomic testing available in BC. By working with Pathways, an established platform with staff, resources, and clinician familiarity, there is an opportunity to improve the delivery of care within genetics and in collaboration with other specialties. Additionally, the platform is designed to track analytics and can be easily updated to benefit the rapid advancements in genetic assessment. However, this can only be sustainable with coordinated effort from the ecosystem to:

- Maintain the genetic services profiles, clinician tools and patient handouts
- Create new point of care tools that highlight responsible use of genomics, whether through testing available in BC labs or through out of province providers
- Update the care pathway as clinical services change to improve transparency and accessibility of genetic services available in BC
- Use the care pathway and related resources in teaching opportunities including classes, rounds, etc.
- Support the development of provincial strategies and guidelines about the use of genetics and genomics that will be necessary to sustain these initiatives

Exemplar #2: Mini-education module on familial hypercholesterolemia integrated into ACCURATE study genetic test report

Project Overview:

The second exemplar project was designed as a companion tool to “[The Advancing Cardiac Care Unit-based Rapid Assessment and Treatment of hypercholesterolemia \(ACCURATE\) study](#)”

Familial hypercholesterolemia (FH) is a relatively common inherited condition affecting roughly 1 in 300 people in Canada⁷. BC is the only province without publicly funded genetic testing for FH and as a result, many patients remain undiagnosed and may not receive optimal medical care, with missed opportunities for early interventions⁸. The ACCURATE study⁹ led by Dr. Liam Brunham, partially funded through Genome BC’s Genesolve program, piloted the implementation of genetic testing for FH in BC. Testing was introduced during the routine care of patients admitted to acute cardiac care with an early onset heart attack at Vancouver General Hospital and St. Paul’s Hospital. The results of the FH genetic test were returned directly back to the assigned specialist and the primary care provider, without any prior knowledge that the patient was receiving genetic testing for FH.

This project aimed to co-design materials that could be provided with the genetic testing report to support clinicians to interpret and use the results in patient care. This would support the project goal to change the way physicians treat these patients and ultimately improve patient outcomes.

Project Outputs:

The primary output was a mini-education module on genetic testing for FH comprised of a video and website with links to FH Resources. We produced a six-minute video branded for the ACCURATE study that was distributed to clinicians through a QR code in the test results. The QR code directed clinicians to www.genomebc.ca/fh-accurate. The video focused on three learning objectives:

- 1) Describe the benefits of genetic testing for FH diagnosis & treatment
- 2) Interpret the test results
- 3) Use the results to manage patient care

WATCH OUR VIDEO ON HOW TO USE



THE REPORTS HERE!

In addition to the video, the website includes links to clinical guidelines, point of care tools and patient resources for quick access. While the mini-education module was not approved for a continuing education credit, a learner reflective activity was included to facilitate the evaluation of learning for self-reported activities.

The scope of this project later expands to support and promote available genetic testing for cardiac conditions for patients across BC. This resulted in additional outputs including:

- The mini-education module rebranded for the FH Registry, another research study where patients can access genetic testing for FH, on a matching website www.genomebc.ca/fh-resources
- An eight-minute educational video co-created with Cardiac Services BC (CSBC) on the importance of cascade screening to identify at risk family member for inherited cardiac conditions using a case study for hypertrophic cardiomyopathy (HCM)
- A webinar titled "[Heart-to-Heart: Discussing the Future of Cardiovascular Genetics Care in BC.](#)" The webinar promoted the educational materials and plans for cardiac genomics from both the policy and clinical aspects of this field
- The addition of point of care tools for inherited cardiac conditions to Pathways. The tools, created by GECKO, provide information on HCM, Factor V Leiden, and heritable thoracic aortic disease and aim to improve the quality of referrals to the cardiac specialty clinics who support patients with these conditions

Project Outcomes:

Distribution of the mini-education module via the QR code on the test results proved ineffective, with only four people watching the video, even though results containing the QR code were distributed to over 150 physicians. The main reason for this is that to fit distribution into the clinical workflow, the report had to be redesigned into a fax-friendly format that could then be uploaded into the EMR. This decreased the information provided with the QR code such that there was no context for why the physicians would use the QR code.

In contrast, the mini-educational module branded for the FH Registry received 181 video views. This module had a wider distribution, with multiple points of access including:

1. QR code and link printed in test results
2. Weblinks added on FH Canada and GECKO sites, common sites clinicians visit to get information about FH and genetics
3. Indexed on search engines

While the mini education module for the FH Registry was able to reach more people, there was mixed engagement with the video content. The average user watched just over half the video, with ~15% viewers engaged for less than 30 seconds. Only ~33% of viewers finished the full video. The second half of the video focuses on the actions to be taken after genetic testing including cascade screening, so depending on how the content is distributed, there may be a benefit in sharing multiple smaller videos rather than indexing a larger video.

	Views	Unique Viewers	Avg % Watched
ACCURATE Report (private)	4	1	63%
FH Registry (public)	181	76	53%
Video stats using Vimeo analytics: From Jan 1, 2023 through January 31, 2025			

Getting physicians' attention to complete the learning opportunity proved difficult without going through the process of having the education evaluated as a continuing medical education credit. The one physician who completed the learning reflection agreed that the video met or exceeded the learning objectives, taught them something new, and would be used to support patient education and changes to their practice. This mirrors comments from participants when the team showed the video during seminars. Additional assessment of the module will be collected by the ACCURATE study as part of the project post-results follow up.

The Cascade Screening for Inherited Conditions education video is being distributed to HCM patients in family letters once a likely disease causing variant is identified. This aims to empower patients with knowledge about the benefits of family screening. This video is equally valuable to inform primary care providers as patients are encouraged to consult their doctor with the letter for guidance and to arrange necessary follow up screenings. This educational content will also contribute to education initiatives in the, [“Mainstreaming” genetic testing for non-ischemic cardiomyopathy in Western Canada project](#)”. Importantly, this video or even parts of it, can be used to support cascade screening across all specialties.

The webinar attracted 101 participants with approximately 33% healthcare providers, 9% public sector, 14% academics and 30% public/patient in attendance. The diversity of attendees sparked lively discussions centred around encouraging referrals for genetic assessment, necessary changes to support increased demand for genetic assessment and testing, and a call to action for patients to engage with government to advocate for genetic testing to be available for FH in BC. The webinar also prompted follow up conversations to better understand the potential changes needed to lab services to address gaps in access to clinically indicated cardiogenomic testing and support mainstreamed testing.

Opportunities to reach sustainable impact

This project developed educational content to address basic genomic fluency for FH genetic testing and cascade screening of family members. This content could be part of a larger educational module to support cardiac genetic services. However sustainable impact of this content can only be realized when clinical access to testing for FH is available in BC.

Other options for material dissemination need to be identified to mitigate demands on physicians' time and attention. Successful strategies include electronic medical record software prompts¹⁰ that require physicians to access educational content before opening the test report and using Pathways to indicate when clinically available materials can be shared.

We continue to collaborate with the ACCURATE study team and CSBC to ensure that these outputs are used to enhance healthcare provider skills, as work continues to move from the current fragmented approach to delivering genetics care within cardiology to the vision of a coordinated provincial cardiovascular genetics program. CSBC is currently updating their website, with the intent to include materials from this project and provide additional opportunities for healthcare providers to access cardiogenomics education and referral support.

Exemplar #3: Funding a pilot project for genomics education for family nurse practitioners (NPs)

Project Overview

The GEHP Implementation Framework identifies the need for foundational tools in genomics literacy to fit the practical needs of health professionals. This requires building capacity among educators and educational leaders in genomics. The vision was to work with existing educational opportunities that address key deficiencies in basic genomic knowledge and deliver and evaluate the program with the intention to improve and expand.

The plan aims to develop a project that would build capacity for increased genomic health care delivery in BC with training tools based on practice based competencies, using innovative educational technology. This project:

1. Works to create, develop and deliver a sustainable program for genomic education for at least one health professional discipline in BC that supports primary care
2. Implements a flexible design that can be iteratively updated and/or modified to support a broader range of health care professions, beyond the initial targeted group
3. Identifies relationships and synergies to support future growth and development opportunities to benefit relevant health professionals across BC

Rather than Genome BC leading the co-design of precision medicine modules, the opportunity arose to fund a pilot project to integrate genomics education into the new Master of Nursing – Nurse Practitioner program at Thompson Rivers University (TRU) with expertise from the University of British Columbia (UBC) Department of Medical Genetics and the Faculty of Education. The [“Pilot genomic education for family nurse practitioners”](#), or NP-EDGE was launched in 2023 as the first initiative in Canada to integrate precision health concepts and genomics education into nurse practitioner training for both students and faculty.

Project Outputs

The project designed 10 modules guided by internationally established genetic and genomic competencies and framed to fit the practice context unique to BC. Modules were beta and pilot tested with NP faculty and practicing NPs, with feedback incorporated before releasing modules to students. The project also held focus groups and interviews to determine additional supports for capacity building after graduation.

The content starts with introducing key concepts in human genetics and understanding how genetic variation can lead to health effects in the patient and potentially other family members, before addressing specific areas of clinical practice. The modules include:

- Foundational Genomics 101 and Family History Case Studies
- Indigenous Health Care: Genetic and Genomic Considerations
- Physical Exam Screening for Genetic Conditions
- Ethical Issues in Genetics
- Introduction to Prenatal Screening in BC
- Newborn Screening

- Pharmacogenomics and Pharmacogenetics
- Cardiogenomics
- Mental Health mini-module

Additional information about the learning objectives of each module and how to test the content can be found at the [Genetics and Genomics for Nurse Practitioners](#) website.

Genome BC facilitated a project advisory committee to provide strategic advice to both the project team and Genome BC. This included how to best meet the needs of NPs in the adoption of genomics, as well as strategies and opportunities for collaboration and dissemination within the contexts of the BC health system. Members of the committee included NPs in practice, government representatives from the Ministry of Health and Ministry of Post-Secondary Education and Future Skills, and health care educators.

Project Outcomes

The NP-EDGE project provides a targeted web-based asynchronous educational intervention for nurse practitioners relevant to the Canadian and BC health system. It leverages existing point of care tools designed by GECKO, Genome BC and others within the Canadian health system to provide recent and relevant practice tools that can be used in practice now. This project directly responds to the growing demand for genetic education in nursing including in a recent position statement from the Canadian Association of Nurses in Oncology.¹¹ A recent survey also showed that over 50% of Canadian nurses are keen to learn about genomics if educational opportunities are provided.¹²

This project is also evaluating learners' genomics knowledge and confidence using genomics after taking the modules. This is much needed research into the effectiveness of integrating genomics education within nursing¹³. In program assessments, the small cohort of students from TRU who accessed the learning modules scored better on the Genomic Knowledge Scale¹⁴ and 57% described higher levels of confidence in putting genomics into practice compared to 27% for students who did not complete the modules. Students highlighted that topics like pharmacogenetics fill important gaps in the curriculum, helping them to better understand how drugs fail patients and they continue to ask for additional clinical case examples. Evaluating the change in genomics knowledge and confidence using genomics is underway for new cohorts of nurse practitioner learners including students in other programs and those already in practice. The NP-EDGE modules will continue to be used in the NP program at TRU and will be rolled out in the NP program at the University of Northern British Columbia (UNBC) in September 2025.

Furthermore, this pilot project has identified barriers of a research organization funding educational initiatives. For example, we identified that curriculum content is often governed by separate institutional policies from research and thus requires separate contracts to manage the intellectual property considerations for the content.

Opportunities to Reach Sustainable Impact

There is significant potential for these materials to be used as a continuing education opportunity for nurse practitioners already in practice beyond TRU and UNBC. It joins the recently developed Genomics Nursing Toolkit¹⁵ and textbook¹⁶ to support the need for educational resources to enhance the genomic literacy of Canadian nurses.

The outputs of this project also provide an important starting point for interdisciplinary health professionals in practice and training going forward. As the content is focused for primary care providers, it is under review by the Canadian College of Medical Geneticists for its potential to be accredited as foundational knowledge for family physicians and midwives in its current form. Additional modules could also be added to educate health providers as efforts to mainstream genetic testing in oncology, cardiology and other specialties continue to move ahead.

The success of these educational materials can only be achieved by establishing a permanent home for the materials and clearly designating responsibility for ongoing updates and maintenance, subject matter experts and learning specialists using innovative approaches to education. We can look to regional initiatives maintained by Melbourne Genomics and national initiatives like the Genomics Education Program embedded into the UK's National Health System as examples of how BC and Canada can consider implementing and sustaining such educational endeavours.

To create a successful educational initiative, there needs to be systemic foundations built within Canada to support education in the rapidly evolving innovations of health that include genomics and precision health, real-time monitoring, virtual care and AI. Current educational funding models do not consider the need for continuous updates or the specialized skills and increased salary for the instructors. This has resulted in many programs-- including the UBC Graduate Certificate in Genomic Counselling and Variant Interpretation-- to be cancelled. Recent work to identify and develop digital literacy competencies across health professions in Canada could serve as a model for genomics.

Exemplar #4: Direct to consumer pharmacogenomic testing resources for patients & healthcare providers

Project Overview

While there is a lot of research underway to understand how best to implement pharmacogenetic (PGx) testing, there are limited reliable resources currently available for clinicians. In BC, the Pharmacogenomics testing information for providers¹⁷ and patients¹⁸ guidance documents that provides recommendations for establishing policies, regulations and procedures, and that PGx testing generally available to patients today is through direct-to-consumer testing.

Even though PGx testing is not yet publicly funded, primary care providers are being approached by patients with reports in hand and are expected to use this information to guide drug choice and receive the “right drug at the right time” as marketed by direct-to-consumer companies.

In collaboration with members from the “[Pharmacogenomic testing for people with major depression: A study of implementation strategies](#)” project team, this project aimed to co-design materials for clinicians to support conversations with their patients to answer questions like:

- Who should get PGx testing?
- What makes a good PGx test?
- How to use PGx results for dosing decisions?
- How do patients access/pay for testing?

Project Outputs

This project created novel, reliable and up to date resources to support clinicians to have conversations with their patients including:

- Information sheets for [clinicians](#) and [patients](#)
- An updated [list of testing](#) available to Canadians
- [Conversation summary guides](#) to support clinicians in answering patient’s questions: “Should I get PGx testing?” and “How can we use this PGx testing I received?”
- Video scripts for simulated conversations between a primary care provider and patients asking, “Should I get PGx testing?” and “How can we use this PGx testing I received?”

Project Outcomes

This project has created patient and clinician handouts and a list of current testing options that provide answers to the core questions around the basics of pharmacogenetic testing, what makes a good test, and how patients can access and pay for testing using direct to consumer companies. These handouts are available on Pathways, referenced as a resource in the BC Ministry of Health PGx guidance documents, and are included as additional resources for the NP-EDGE PGx module.

Through this process we connected with a small but diverse group of providers (psychiatrists, primary care providers, genetic counsellors, and pharmacists) to identify whether the material

met the intended learning objectives, what information is essential information to include in a simulated conversation video, conversation guide and what information was best provided as a handout. Genome BC staff along with friends and family of the expert team provided a window into the “patient” perspective of the usefulness and suitability of the information.

The conversation guides are designed to highlight the key points for practitioners to follow on their own without the video and some primary care providers like this format over the video. These have been recommended to Pathways as a resource.

Opportunities to reach sustainable impact

The patient and provider handouts fill an unmet need for having content that is not paid or endorsed by a for profit company, while providing a list of companies that provide the service in Canada. The content provides key information patients need to make an informed decision about PGx. The handout and provider list may also benefit extended health insurance companies in their decision-making process and/or they could provide the handouts as resources for their clients. As with the cardiogenomics educational materials, these pilot materials would only become sustainable with clear direction as to the implementation of pharmacogenomics within our health system. This includes not only the process for obtaining testing, but clear definition of practice within the relevant health providers, and resources available to support the usage.

Lessons learned from the Implementation Framework

The Implementation Framework presented key strategies and specific tactics to support the long term goal of increasing the responsible use of genomics in health care. While these tactics are generally reflected in each of the exemplar projects, we evaluate whether each were used as envisioned and the relevance to future work.

Tactic One: Work with existing projects or opportunities towards the development of point of care decision making support

This tactic was essential to the success of each of the exemplar projects. Partnerships with research and clinical teams established educational goals to support the development of clinical practice guidelines that set the foundation to more easily translate existing research projects into practice. Learning from these projects, Genome BC is taking the opportunity to review our funding programs and guidelines to support the development of similar educational components in relevant projects in the future. Furthermore, the partnership with Pathways has documented current clinical genetics and genomics practices that provide the foundation for provincial guidelines that are easily accessible across the range of health professionals and is agile to support ongoing mainstream implementation efforts.

Tactic Two: Build long term capacity with organizations with an education mandate

The original goal of this tactic was to build genomics education leaders across health professions in BC. The UBC Centre for Health Education and Scholarship was proposed as a potential partner, however our goals did not align as we were focused on improving genetics specifically, rather than medical education in general. Instead, the NP-EDGE project looked to build genomics education leaders within the expanding nurse practitioner program, that is growing by 10% per year to help address BC's shortage of primary care providers. This tactic continues to be relevant as we look to increase the confidence and competence in genomics across health professions. For example, there could be opportunity to develop pharmacists as leaders in pharmacogenomics with the expanded scope of practice in BC. Similarly, the growing priority around team based care provides potential opportunities to build interprofessional genomics education leaders, with the establishment of the UBC Gateway Centre for Innovation in Collaborative Health Education and Team Based Care, and the new SFU Medical School.

Tactic Three: Catalyze innovations in genomics education technology

Pathways BC platform is an available tool within the BC health system that embodies the third tactic to catalyze innovations in genomics education technology to ensure that tools can be easily updated, accessible and scalable. Similarly, the NP-EDGE program was piloted with TRU's open Moodle platform to allow for asynchronous, modular learning to enhance learner experience. Future iterations would benefit by integrating AI within the training platform to provide personalized curriculum as well as continuous updates of the materials as clinical practice changes.

Ongoing challenges and future opportunities

The landscape of genetic and genomic clinical services in BC will continue to evolve; optimizing the appropriate use of genetics and genomics requires easily accessible and accurate tools for healthcare professionals to navigate the services available. The Genetic Care Pathway, the educational videos and handouts, NP-EDGE modules and other materials from partners like GECKO provide the beginnings of the essential tools clinicians need when navigating genetics care for their patients. As services expand across BC and the framework for mainstream clinical genetic testing is being discussed¹⁹ these tools will need to be updated, adapted and expanded.

A provincial-level strategy is needed to formalize this roadmap of when and how the various models of mainstreamed services are used. A centralized and provincial educational hub or “home” will need to be identified to assume ongoing responsibility for developing, providing and maintaining the resources necessary for non-genetics providers to navigate test selection, results disclosure and/or follow up steps post disclosure. As clinicians follow this roadmap, educational materials from these exemplar projects will not only support clinical decision making but also building genetics expertise – much of which is applicable across speciality areas (eg. cascade screening). Genome BC is proud to be a stimulus for this important work. While at the core, this work is consistent with Genome BC’s values and strategic plan, this work falls outside of our primary mandate of supporting genomics research and innovation.

Other notable opportunities:


1. Create scalable, interdisciplinary curriculum to provide health providers with standardized resources to support mainstream genetic services.
 - For example, clinicians that complete the [Project ECHO training](#) can order testing through the Ontario Epilepsy Genetic Testing Program. The NP-EDGE modules provide a framework for basic genomics literacy and additional modules could be developed or repurposed for additional indications.
2. Maintain and expand practice tools to support the use of genetics and genomics.
 - There is opportunity to generate case examples for common or notable indications, like the NHS GeNotes²⁰ and “In the Clinic” resources or BC Cancer’s mainstreamed hereditary cancer testing materials. These resources provide a clinical example, details on when to consider diagnostic genetic testing, which clinicians can order testing, where they can order testing from, and how to report the results to the patient that can be used as guides by those already in practice and as teaching tools for students.
3. Empower patients to be an active part of the process.
 - Generate a patient facing version of the Genetic Assessment and Testing Care Pathway that educates patients around relevant genetic assessment and supports conversations about appropriate care with their health providers.

To harness the benefit of a synergized effort to create a sustainable program, it is critical to coordinate support and direction from all parties including interdisciplinary health providers, laboratory services, health authorities and government. Genome BC looks forward to working with our partners to build out a network to support long term capacity building, systemic process changes and clinical guidelines to support the responsible use of genomics in BC.

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