BACKGROUNDER

BC researchers using securely integrated health and genomic information to improve disease prediction and patient care

Every patient has a story, yet no single source of health information tells the whole story. Genome BC's Data Access, Integration and Analysis 2 (DAIA2) program supports six research projects that will use Health Data Platform BC to securely analyze existing genomic information alongside clinical and administrative health data.

By bringing these different sources of information together, researchers can investigate questions that would be difficult or impossible to answer using a single dataset. The projects aim to generate British Columbia-specific evidence that could support earlier diagnosis, more personalized care and better health outcomes.

The program will:

- Investigate disease risk, progression, treatment response and healthcare use across a range of health conditions
- Address clinical needs and generate evidence that could benefit British Columbia's healthcare system
- Inform future clinical care, public health planning and health-system decisions

The six funded projects are:

Integrated Multi-Omics to Predict and Understand IBD

Project leader: Dr. Deanna Gibson
Institution: University of British Columbia

This project aims to predict and ultimately help prevent inflammatory bowel disease flare-ups by examining how diet interacts with gut microbes and the body.

Inflammatory bowel disease (IBD), including Crohn's disease and ulcerative colitis, is a lifelong condition with unpredictable symptoms. Many patients continue to experience recurring flares despite treatment. The burden is also growing among immigrant communities, including South Asian populations, but current care cannot reliably predict when a flare will occur or identify which food-related exposures contribute to disease activity.

The research team will analyze stool and blood samples from people with IBD and healthy participants, including recent immigrants, alongside detailed dietary information. Using a multi-omics approach, researchers will study gut bacteria, their activity and the small molecules they produce. These findings will be securely linked with provincial health records through Health Data Platform BC, and machine learning will be used to identify relationships among diet, microbial activity and clinical outcomes.

The project is expected to develop biomarker panels and predictive models that could warn of upcoming flares and identify people at higher risk. The findings could support more personalized and equitable care, reduce hospitalizations and improve quality of life for people living with IBD.

Prenatal Exposure to Wildfire Disasters and Their Association with Early Childhood Health

Project leader: Dr. Michael Kobor
Institution: University of British Columbia

This project will investigate how exposure to wildfire smoke during pregnancy may influence children's health and development.

Pregnancy is a sensitive period of rapid development, but relatively little is known about how wildfire disaster and smoke exposure before birth may impact children as they grow. Most existing research has focused on adults, leaving important questions about its effect on the incidence of respiratory illness, allergies and developmental outcomes in early childhood.

The team will study 1,200 children born in British Columbia. Researchers will use birth parent residential postal codes during pregnancy to estimate wildfire smoke and disaster exposure, then analyze routinely collected newborn dried blood spots for DNA methylation, genetic variation and indicators of inflammation. These data will be securely linked with provincial health records through Health Data Platform BC so children's health and development can be followed over time. This work compliments ongoing research on wildfire exposure and early childhood health funded by Genome BC in 2025.

The findings could help inform public health guidance and clinical care for pregnant people and infants during wildfire season, improve preparedness and support a more resilient health system in British Columbia.

Multi-Omic Biomarkers for Personalizing Care in Chronic Obstructive Pulmonary Disease

Project leaders: Dr. Janice Leung and Dr. Don Sin
Institution: University of British Columbia

This project will search for biological changes in the airways that could help predict who is at risk of developing severe chronic obstructive pulmonary disease or experiencing serious flare-ups.

Chronic obstructive pulmonary disease (COPD) is a serious and incurable lung condition. People living with COPD may experience sudden flare-ups that lead to hospitalization and increase the risk of death, yet clinicians still lack reliable tools to predict who will deteriorate or which high-risk individuals will develop the disease.

Researchers will analyze airway samples collected over more than a decade through the St. Paul's Hospital Bronchoscopy Registry. The samples will be linked with longitudinal health records through Health Data Platform BC. The team will examine the airway microbiome, gene activity and DNA methylation to understand why some people deteriorate faster than others. The work will also include emerging risk groups, including people who vape, smoke cannabis or live with HIV.

The project aims to identify airway-based biomarkers and develop prediction tools that could support earlier intervention and more personalized care, while helping inform public health strategies and reduce pressure on the healthcare system.

COPD at the Crossroads of Genes and Environment

Project leaders: Dr. Min Hyung Ryu and Dr. Kate Johnson
Institution: University of British Columbia

This project will test whether inherited genetic risk can improve the prediction of serious COPD outcomes beyond the clinical tools used today.

Clinicians currently rely largely on symptoms and medical history to assess which people with COPD are most likely to experience repeated lung attacks, hospitalizations or other serious outcomes. These measures do not fully explain why some people worsen faster than others.

The team will examine polygenic risk scores, which combine the small effects of many genes into a single measure of inherited risk. Researchers will use genome-wide information from the Canadian Cohort Obstructive Lung Disease study, which has followed about 1,500 participants since 2009, including more than 400 from British Columbia. Genetic risk scores will be securely linked with provincial health records through Health Data Platform BC to study exacerbations, hospitalizations, mortality and healthcare use over time.

The research will provide the first British Columbia-based evidence on whether genetic risk information improves the prediction of COPD outcomes. It could support earlier identification of people at higher risk, more proactive care and better planning of health services.

Genetic Susceptibility, Healthcare Use and the Multiple Sclerosis Prodrome (GENESIS-MS)

Project leader: Dr. Helen Tremlett
Institution: University of British Columbia

This project will investigate whether genetic risk and patterns of healthcare use can help identify multiple sclerosis years before symptoms become apparent.

Research has shown that people who later develop multiple sclerosis (MS) often use healthcare services more frequently for 5-15 years before clinical symptom onset or diagnosis. This suggests a long prodromal period (when early warning signs or symptoms of an illness first appear) when the disease may already be developing but cannot yet be reliably recognized.

GENESIS-MS will analyze DNA from 1,411 participants in the BC Generations Project, including people with MS, people with a family history of MS and individuals without MS. Researchers will calculate polygenic risk scores and securely link them with long-term health records held in Health Data Platform BC. This will allow the team to examine how inherited risk relates to doctor visits and prescription use before symptoms appear.

By identifying genetic and healthcare patterns associated with the MS prodrome, the project could support earlier recognition, inform future prevention strategies and improve the timing of care and treatment.

VECTOR: Variants Evaluated for Cardiometabolic and Pharmacogenomic Tiers of Risk

Project leader: Dr. Teresa Tsang
Institution: University of British Columbia

This project will evaluate where genomic information can improve the prediction and management of cardiovascular and metabolic disease in routine care.

People with similar clinical profiles can experience very different cardiovascular and metabolic outcomes. Genomic testing may help explain these differences, but its use in routine care remains limited by uneven access and a lack of evidence showing where genetic information provides meaningful clinical value.

VECTOR builds on the province-wide MOSAIC study, which is enrolling 8,000 participants undergoing routine heart imaging across multiple health authorities. The project will combine whole genome sequencing, echocardiography measurements and blood-based markers, then securely link genetic findings with longitudinal clinical and administrative data through Health Data Platform BC. Researchers will assess variants related to heart disease, metabolic conditions and medication response alongside disease progression, hospital admissions and treatment outcomes.

The project aims to produce British Columbia-specific evidence showing where genomics can support earlier diagnosis, more targeted treatment and more efficient use of health resources. It will also help establish a scalable foundation for integrating genomics into future care pathways.

About DAIA2

The Data Access, Integration and Analysis 2 program supports research that uses Health Data Platform BC to responsibly integrate genomic information with provincial health data. By enabling approved researchers to study these sources together in a secure environment, DAIA2 helps generate evidence that can inform better healthcare for people across British Columbia.

About Genome British Columbia

Genome BC is a not-for-profit organization that has advanced genomics research and innovation for more than 25 years, growing a world class life sciences sector in BC and delivering sustainable benefits for British Columbia, Canada and beyond. Genome BC has attracted over $1.2 billion in direct co-investment to the province, which has contributed to funding more than 650 genomics research and innovation projects. These initiatives enhance healthcare and address environmental and natural resource challenges, improving the lives of British Columbians. Genome BC also integrates genomics into society by supporting responsible research and innovation and fostering an understanding and appreciation of the life sciences among educators, students and the public.
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