



A wave of change: Implementing Precision Medicine in BC

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Chief Scientific Officer and VP Sectors



Genome British Columbia

- A catalyst for the life sciences cluster on Canada's West Coast
- Our mission: to generate social and economic benefits through genomics
- Cumulative portfolio of over **\$850M** in more than **315** genomics research projects and science and technology platforms*
- We invest in research, entrepreneurship and commercialization in key sectors of economic importance to BC and Canada



Health



Forestry



Fisheries and
Aquaculture



Agrifood



Mining










Energy



Environment

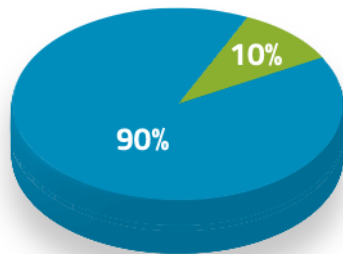
Genome BC's Portfolio

SECTOR	PROJECTS	FUNDING
 HEALTH	163	\$368.3M
 TECH PLATFORMS	48	\$119.1M
 FORESTRY	28	\$107.6M
 FISHERIES / AQUACULTURE	17	\$65.5M
 AGRIFOOD	27	\$56.0M
 MINING / ENERGY	13	\$34.7M
 ENVIRONMENT	19	\$16.1M

Crafting a pipeline for practical applications

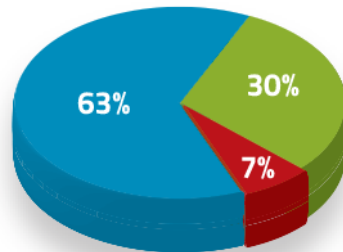
2000-2005 Plan

Building the foundation



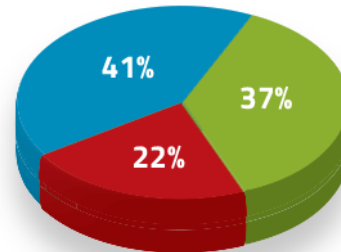
2005-2010 Plan

International recognition of excellence



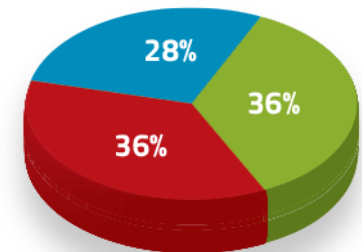
2010-2015 Plan

Strategic investment for applications



2015-2020 Plan

Balanced portfolio of discovery, strategic, and user-driven co-investment



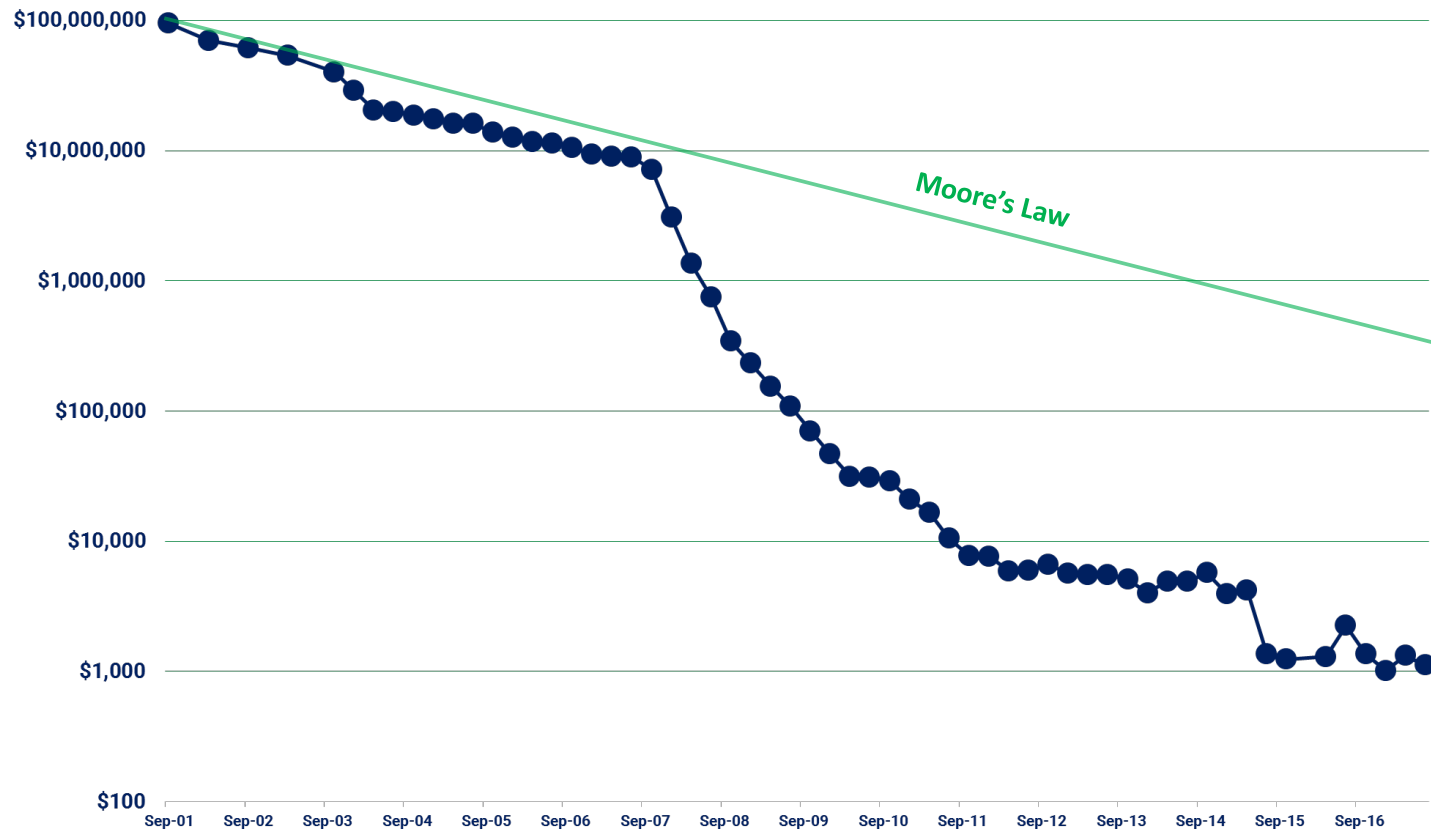
SOURCE — GENOME BC 2015-2020 STRATEGIC PLAN: "POWERING BC'S BIOECONOMY"

DISCOVERY

APPLIED

TRANSLATION

Cost per Genome



Breakthrough technologies in 2025

2-3 billion

More people with access to the Internet in 2025

\$5-7 trillion

Potential economic impact by 2025 of automation of knowledge work

\$100, 1 hour

Estimated cost and time to sequence a human genome in the next decade

1.5 million

Projected driver-caused deaths from car accidents in 2025, potentially addressable by autonomous vehicles

100-200%

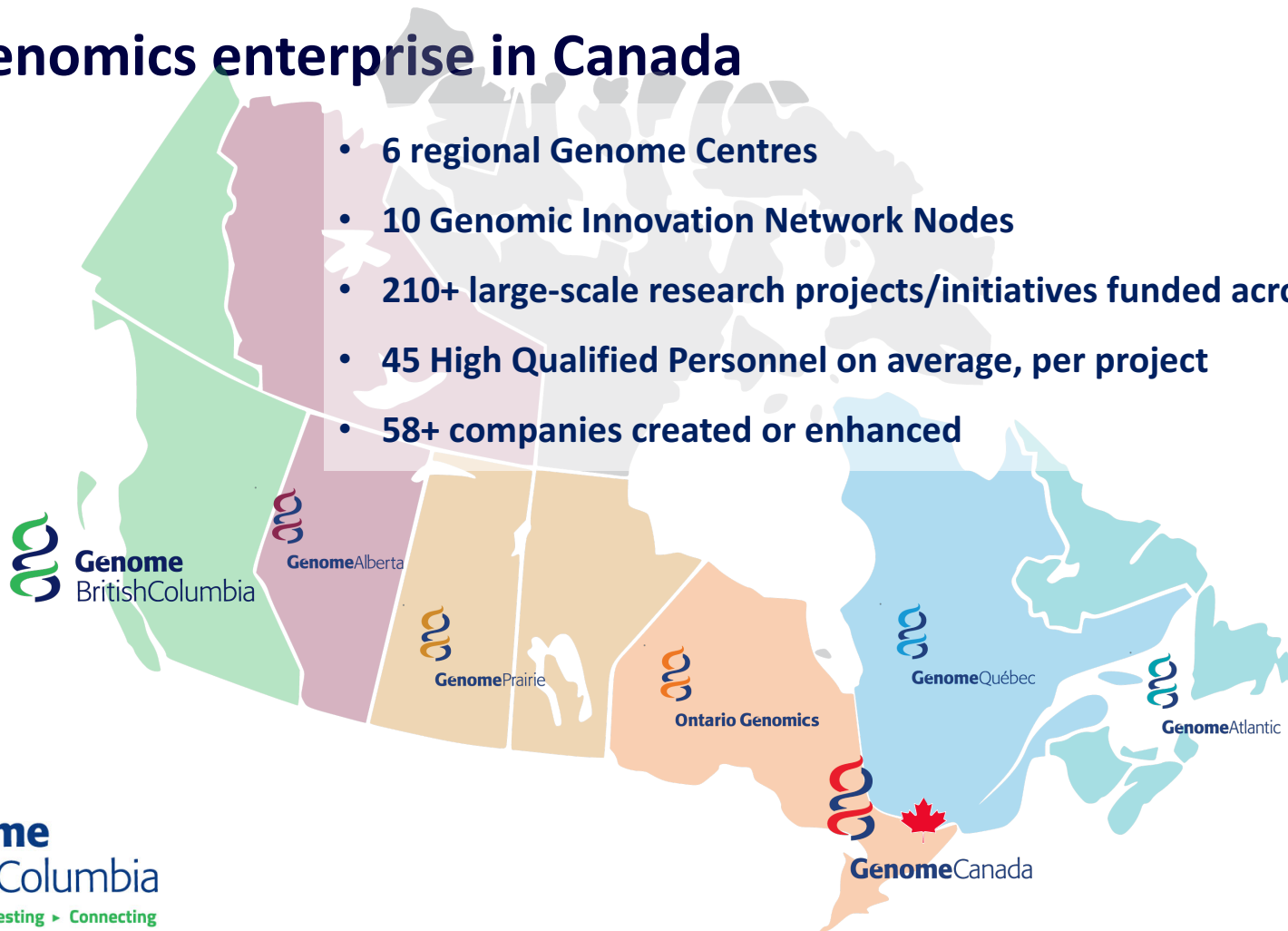
Potential increase in North American oil production by 2025, driven by hydraulic fracturing and horizontal drilling

16%

Potential share of solar and wind in global electricity generation by 2025

The genomics enterprise in Canada

- 6 regional Genome Centres
- 10 Genomic Innovation Network Nodes
- 210+ large-scale research projects/initiatives funded across all sectors
- 45 High Qualified Personnel on average, per project
- 58+ companies created or enhanced





Precision Health Care



Genome BC cumulative investment in **145 projects** • **53 active**
 Total **\$352.5M**: Genome BC **\$69.3M** with co-investment **\$283.2M**

Prevention

Diagnosis

Treatment

Prognosis

GENOMICS



First Nations
Biobank



Prenatal
Screening



RapidOMICS



Genomics for
Pharmacists



Biomarkers for COPD
Management

2017 Large Scale Applied Research Project Competition Stats

6/15

awards went to BC led projects

38%

of funds invested by Genome Canada and Canadian Institutes for Health Research

2/15

awards went to BC co-led projects

\$80.3M

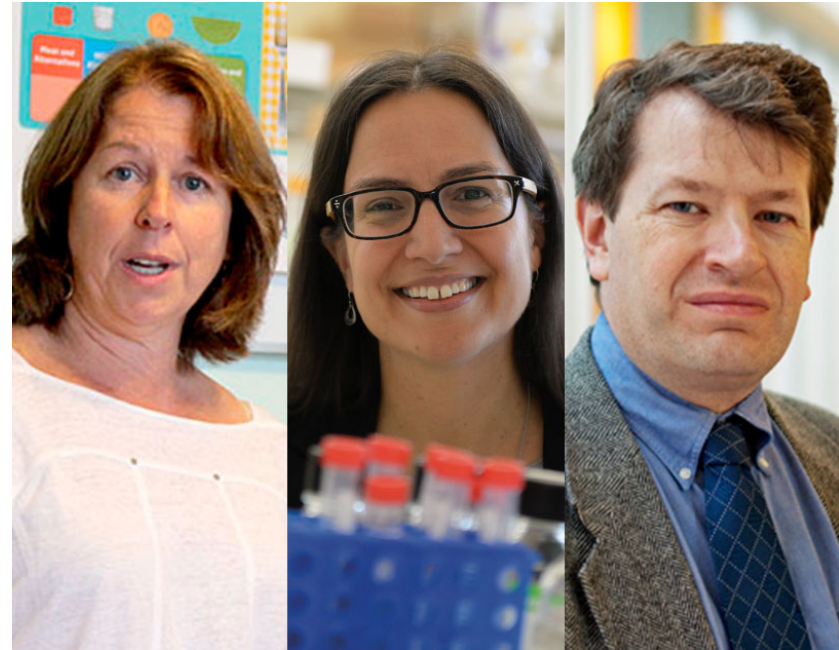
total investments when combined with Genome BC's contribution

Silent Genomes: Improving diagnostics for Indigenous children

Researchers: Laura Arbour, Nadine Caron, Wyeth Wasserman

Silent Genomes, with First Nations, Inuit and Metis partners, will address the growing “genomic divide” between Indigenous and non-Indigenous Canadians:

- Governance framework for genomic research
- Improve access to genomic diagnosis, focusing on Indigenous children across Canada
- Development of background reference genome



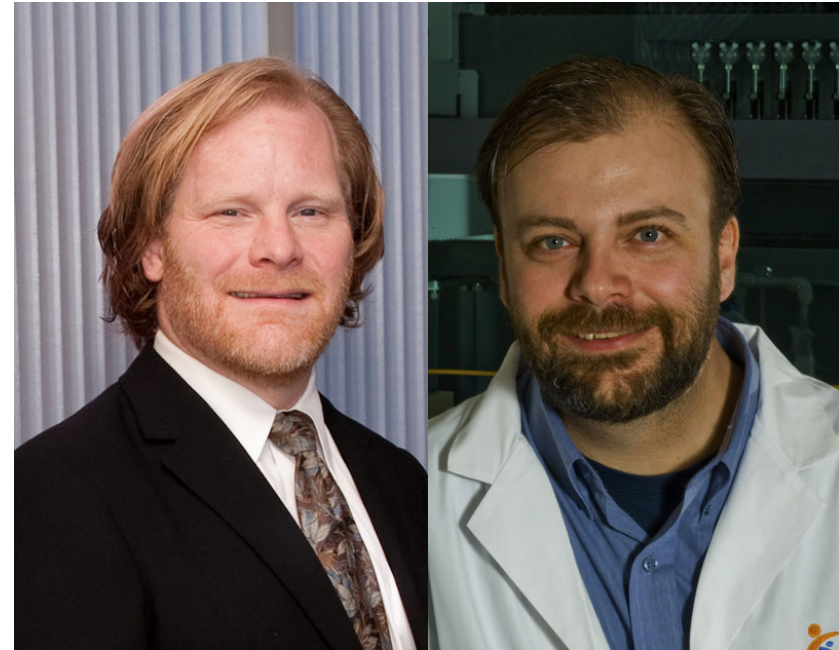
2017 Large Scale Applied Research Project Competition in Precision Health

Go-PGx: Reducing adverse drug reactions (ADR) for children with cancer

Researchers: Bruce Carleton, Colin Ross

The project aims to develop genomics-based tests to determine genetic susceptibility to ADR

- Implement the tests in pediatric cancer centres across Canada
- Reduce the incidence of adverse drug reactions among children being treated for cancer
- Develop a comprehensive database linking clinical and genetic data



2017 Large Scale Applied Research Project Competition in Precision Health

CanPREVENT: Preventing rejection and premature kidney transplant loss

Researchers: Paul Keown, Ruth Sapir-Pichhadze, Timothy Caulfield, Stirling Bryan

Transplantation is the optimal treatment for patients with kidney failure, but rejection still causes premature graft loss (30%). This project aims to reduce the rejection rate by:

- Using genomic technologies to improve the matching of donors and recipients
- Monitoring the immune response for rejection
- Developing personalized drug treatment regimes for each recipient



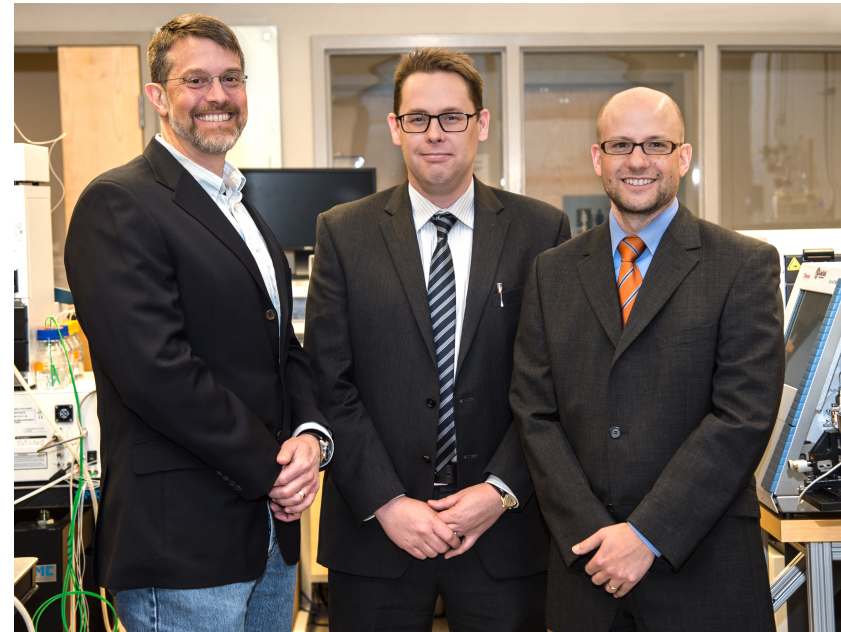
2017 Large Scale Applied Research Project Competition in Precision Health

Deciphering relapsed lymphoid cancers to improve patient management

Researchers: Christian Steidl, Marco Marra, David Scott

This project aims to improve the survival rate and quality of life of patients with relapsed lymphoid cancers by:

- Developing and implementing genomics-based clinical tests to better guide treatment decisions
- Providing decision aids for physicians and patients
- Helping policy makers in implementing personalized treatment approaches and performing cost benefit analysis



2017 Large Scale Applied Research Project Competition in Precision Health

Childhood asthma and the microbiome: The CHILD* study

Researchers: Stuart Turvey, Michael Kobor, Brett Finlay, Padmaja Subbarao

Asthma is the most common chronic disease in children and costs up to \$2 billion per year in Canada.

This project is looking to reduce asthma through prevention by:

- Identifying which infants in the CHILD study are most likely to develop asthma, based on the absence of key microbes in their stools, and
- developing ways to replace those missing microbes



2017 Large Scale Applied Research Project Competition in Precision Health

GenCOUNSEL: Optimizing genetic counselling for clinical implementation

Researchers: Alison Elliott, Bartha Knoppers, Larry Lynd, Jehannine Austin

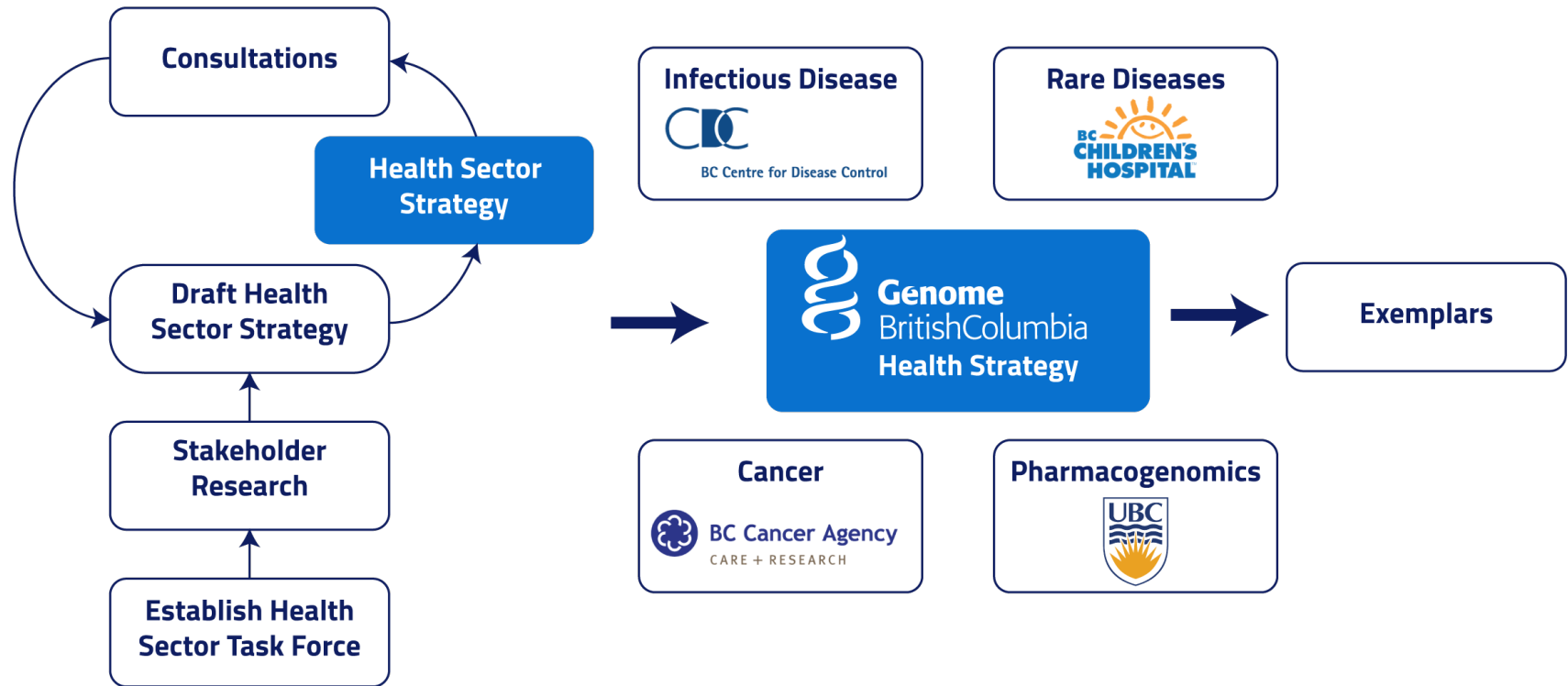
GenCOUNSEL is the first project to assess the genetic counselling issues associated with the clinical use of genome-wide sequencing. It aims to:

- Create an understanding of current and future needs for genetic counselling
- Develop best practices for the delivery of genetic counselling
- Improve access to genetic counselling
- Develop a framework for the legal recognition of genetic counsellors in Canada



2017 Large Scale Applied Research Project Competition in Precision Health

Genome BC Health Strategy (Phase I)



From years to days: RapidOmics

Researchers: Jan Christilaw, Jan Friedman, Alison Elliott and Horacio Osiovi

Genetic disorders are a leading cause of infant mortality and make up a large percentage of the patients in BC NICU's.

An accurate and rapid diagnosis can guide treatment decisions but this is currently a significant challenge.

RapidOmics: pilot study

- exome sequencing 25 trios (baby + parents)
- provide results in 5-7 days

This proof-of-concept could replace hundreds of different tests, improving outcomes and saving the system money.



Leading the world in HIV/AIDS research

Researchers: Julio Montaner and Richard Harrigan

In Canada over 70,000 people are infected with HIV and nearly \$1 billion is spent on HIV drug cocktail therapies each year.

The BC Centre for Excellence in HIV/AIDS (BCCfE) is leading the world to reduce HIV/AIDS global burden by 90 % in 2030.

Genome BC is supporting the BCCfE in developing an HIV drug-resistance test, real-time drug resistance surveillance and better methods for personalizing treatment of HIV based on each patient's unique DNA.



The Personalized Onco-Genomics (POG) Program

Researchers: Janessa Laskin and Marco Marra

This BC Cancer Agency project looks at the specific mutations that cause cancer.

350 patients have received personalized treatment, based on their DNA representing 50 different cancer types.

The next phase: More patients, more cancers

Doctors can then customize treatment options to target those mutations, increase efficacy and reduce overall cost



BC pharmacists leading precision medicine

Researcher: Corey Nislow

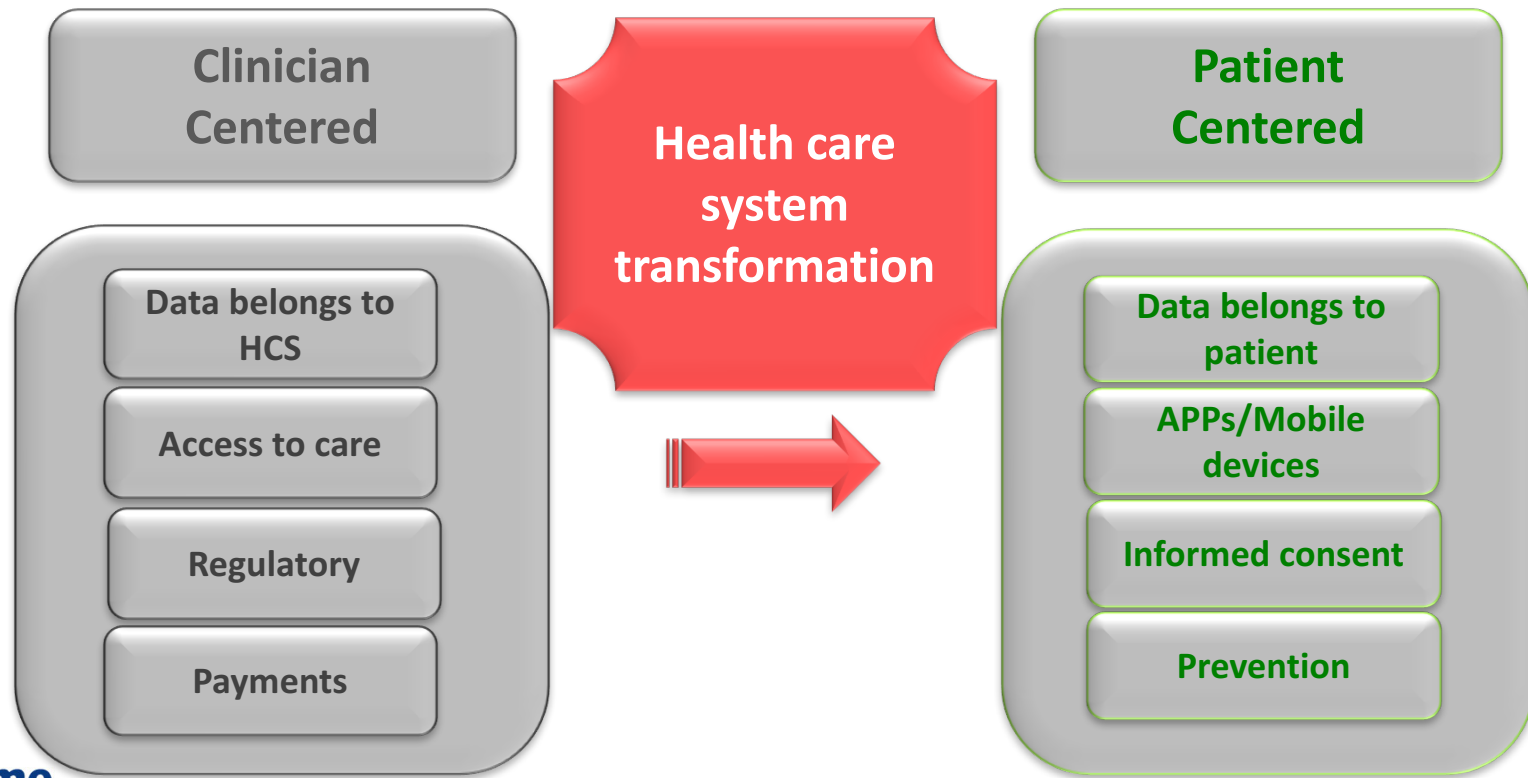
Approximately 50% of all emergency department visits each year are due to adverse reactions to medications in adults aged 50 and over.

Across BC, 33 community pharmacies have taken part in North America's first project to implement pharmacogenomics allowing them to:

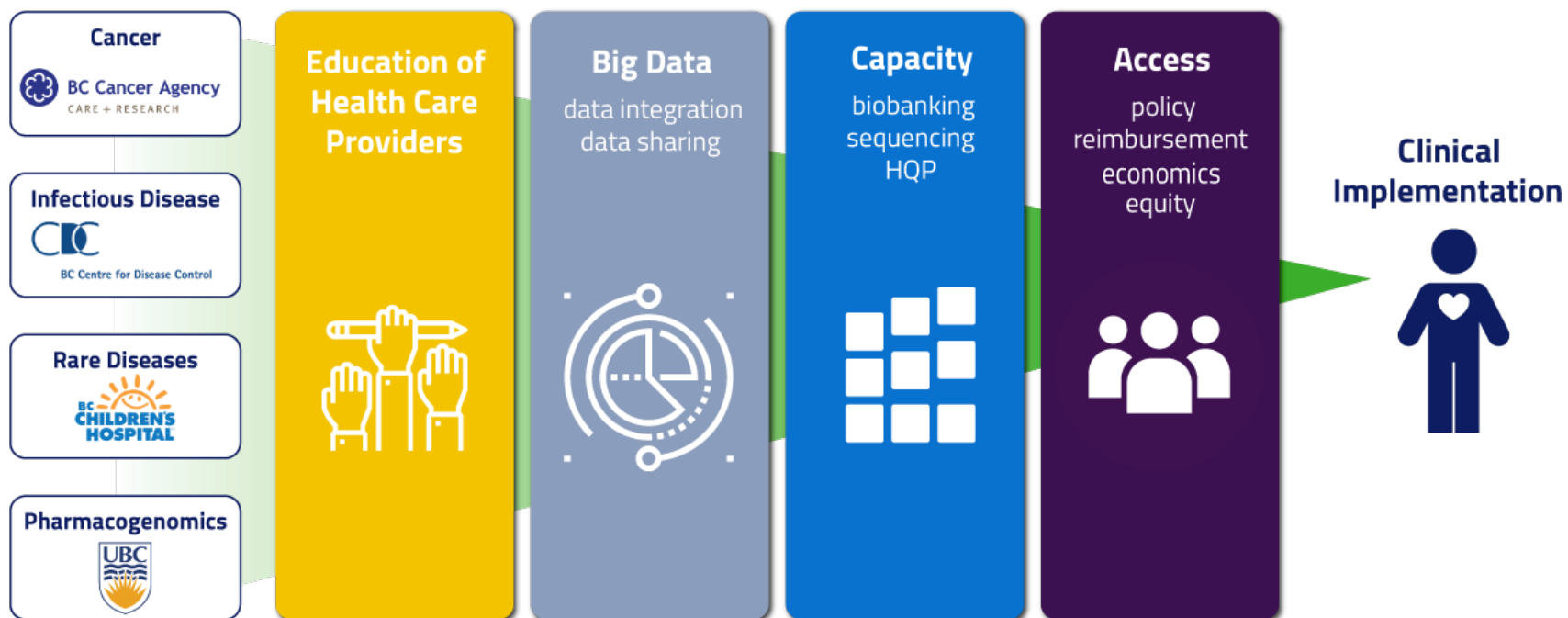
- Extract DNA from saliva, sequence and analyze the DNA
- Prescribe the right drug to the right patient at the right time and the right dose based on their genomic information



Transformational potential of Pharmacogenomics



Crosscutting areas to accelerate implementation



GENESKOOOL



**Online Interactive
Classroom Activities**



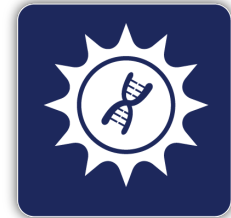
**In-class
Workshops**



**Campus
Field Trips**



**Travelling
Suitcase Exhibits**

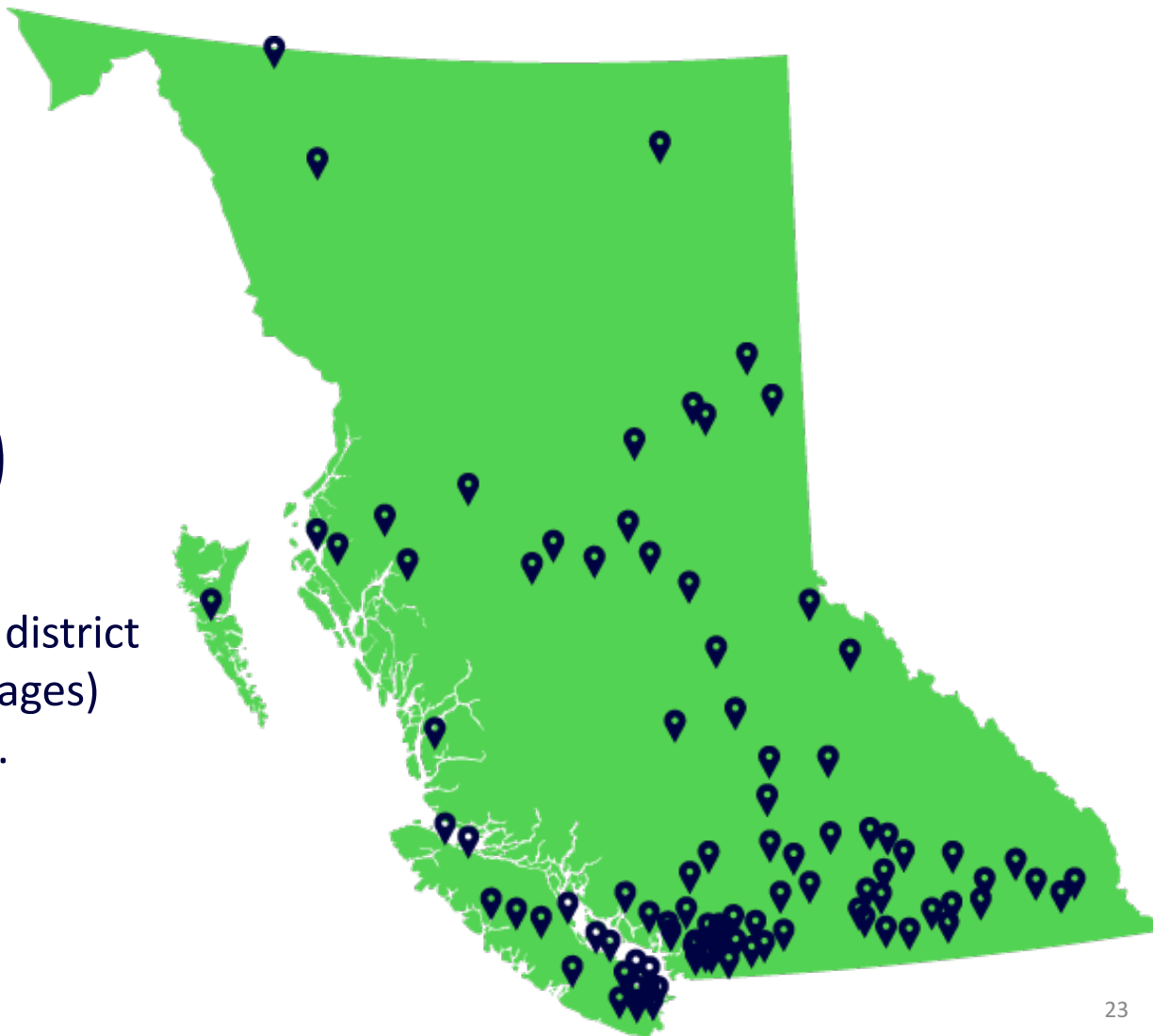


**Summer Science
Program for Teens**

GENESKOOOL

57%

of all BC communities (cities, district municipalities, towns and villages) are reached by our programs.



Genome
British Columbia

Leading > Investing > Connecting



Global Alliance
for Genomics & Health



- GA4GH aims to establish a common framework to enable effective and responsible sharing of genomic and clinical data; Can-SHARE will further the objectives of this Global Alliance
- Working Groups are Data, Clinical, Security, Regulatory and Ethics
- Demonstration Projects use and improve tools and solutions created by Task Teams
- Canadian-led Demonstration Projects are:



Participating countries:

Estonia

Sri Lanka

Thailand

Chile

Korea

China

Malaysia

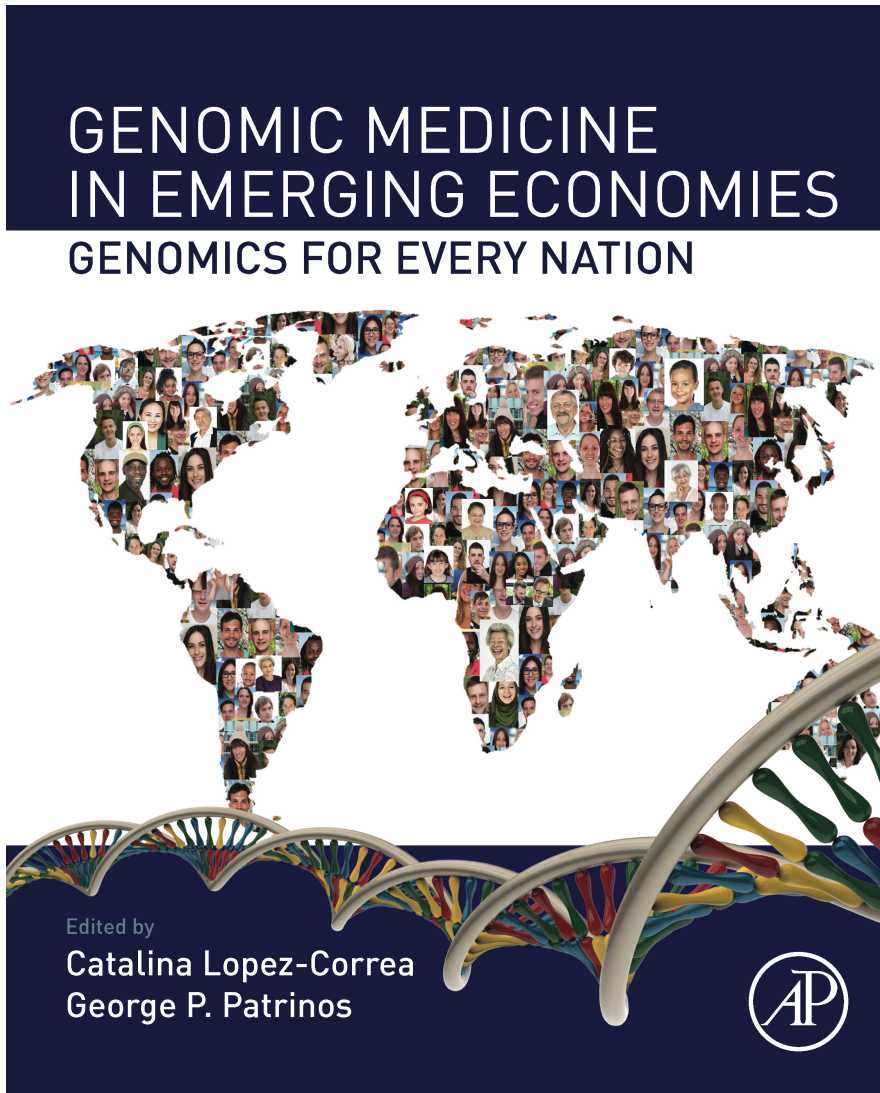
India

Colombia

Argentina

Greece

.... and many more





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