



QUANTIFYING RISK, ENABLING OPPORTUNITY

Genomics, personalised medicine and insurance

Author: Emile Stipp
Date: May 2018

Advent of Omics

Determined by the genotype and phenotype (expressed genes) of a living organism



Genomics

- Analysis of genetic composition in organisms
- Most established Omics field for personalised medicine



Proteomics

- Analysis of protein expression and composition in organisms
- Largely research based and limited medical utility



Metabolomics

- Analysis of how organism handles chemical metabolites in cells, tissues and organs
- Very early stage research limited to animal studies

Determined by the genotype and phenotype of microbes residing in another living organism



Microbiomics

- Analysis of microorganism composition residing in a host organism (E.g. human beings)
- The next frontier of commercial Omics application for personalised medicine



Impact on human health and wellbeing

Omics at a point of inflection

The field of omics is at a critical inflection point



Sequencing costs are dropping

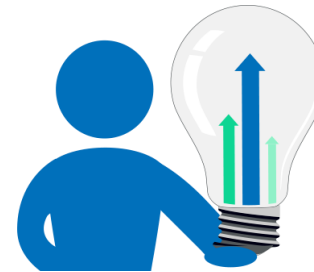


The technologies are rapidly advancing



Genetic data remains mostly unchanged for life

However, to deliver on the promise...



Actionable insights

Other
Molecular
Data

Proteomics/ Metabolomics
Epigenomic data
Microbiomics

Genotypic
Data

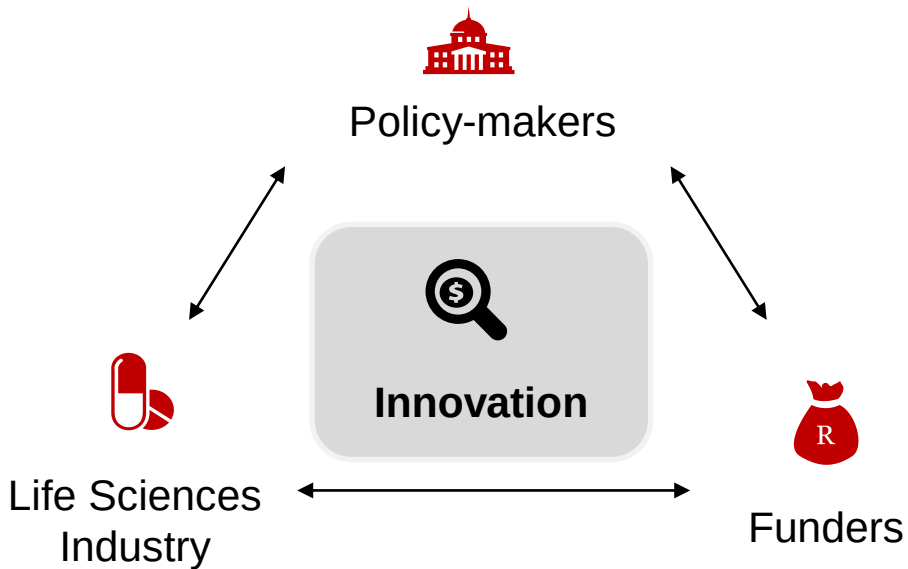
Genetic data
Specific variants

Phenotypic
Data

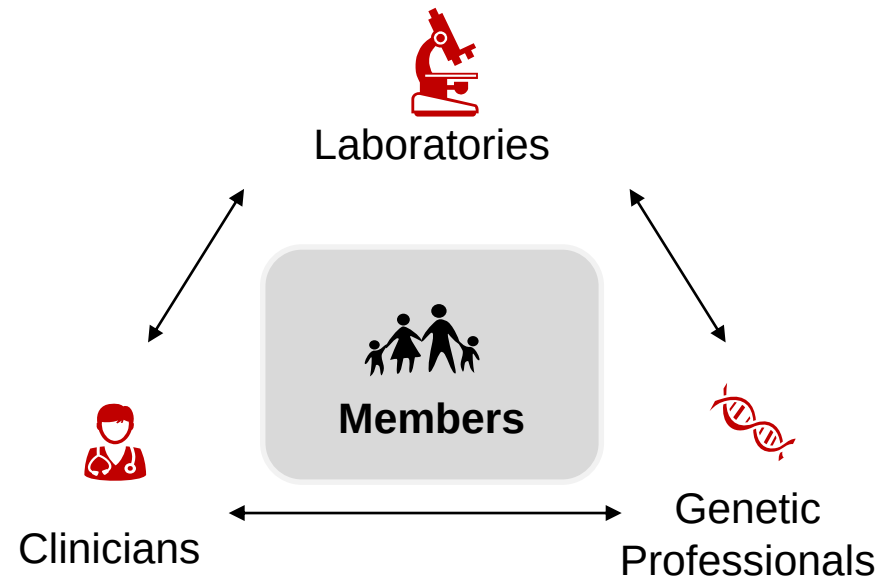
Medical records
Disease data
Device data

Omics ecosystem

Research and Development

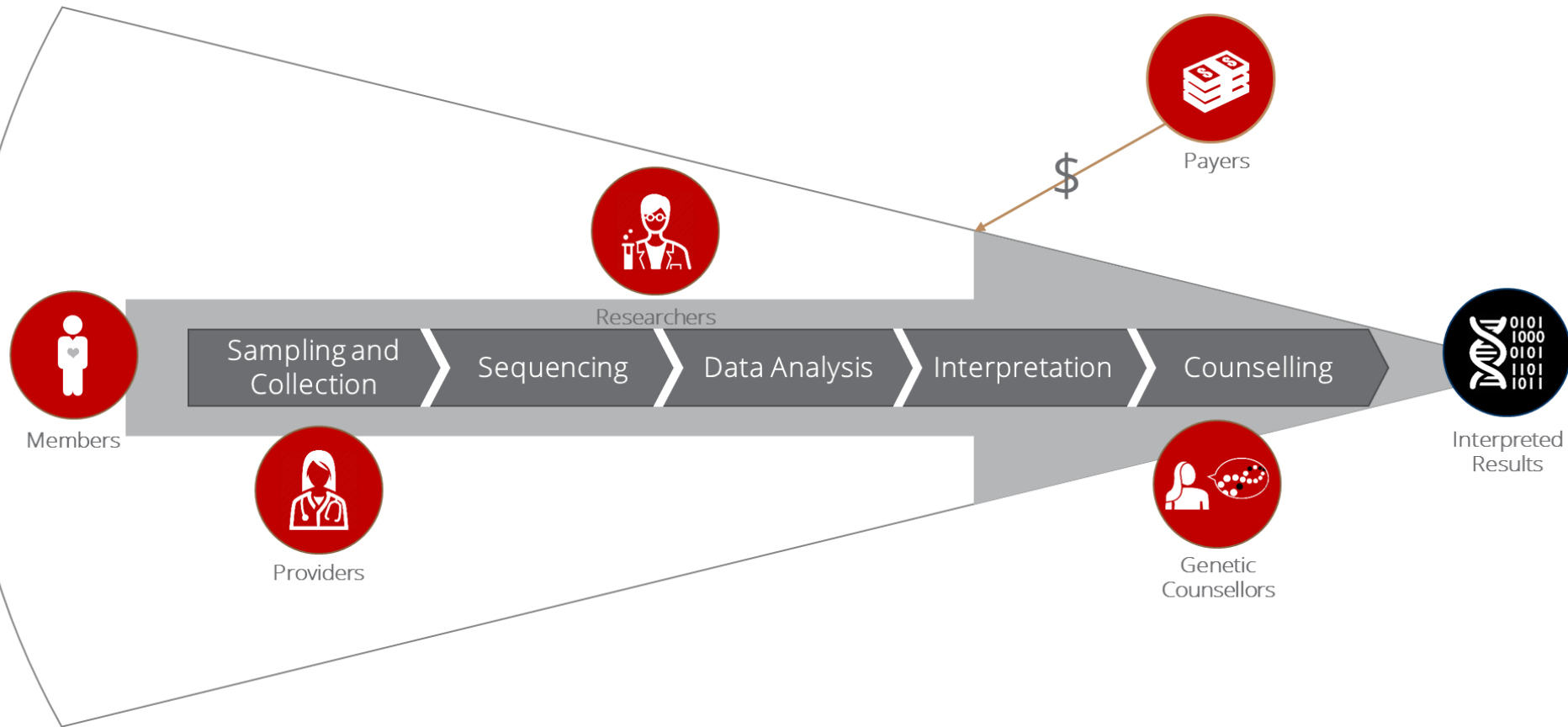


Healthcare Service Delivery



Data Flow

Journey from genetic material to clinical data



Omics providers stretch across the health ecosystem

	Omics services for Health Systems	Omics services for Health Funders	Omics services for Providers & Hospitals	Omics services for consumers
International	      	       	            	        
Local	  		      	        

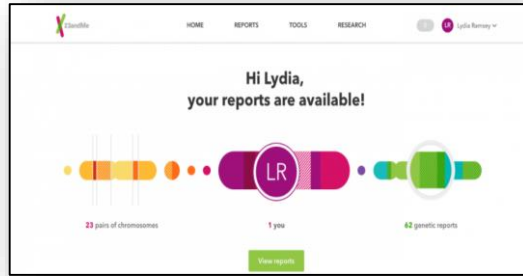
Data generation and test types

		Applicable Tests				Other Molecular Data and Phenotype
		 Whole genome	 Exome	 Gene panels	 Single genes	
Member-initiated	Curiosity Personal characteristics and attributes	Ancestry				
		Likely attributes of children				
	Wellness Responses to lifestyle and environment	Exercise Plans				
		Nutrition Plans				
Doctor-initiated	Predictive Disease likelihood and drug response	Pharmacogenomics				
		Genome				
	Clinical Genetic variants linked to diseases and potential health risks	Oncology				
		Rare disease				
			Reproduction			
		Pharmacogenomics				
		Chronic illness				



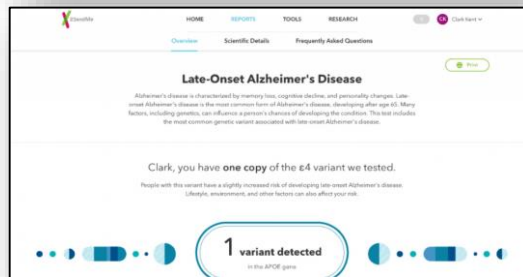
Several types of tests that use different **levels** of omics information are available to draw **clinically useful** information from

Case Study 1 – 23andMe



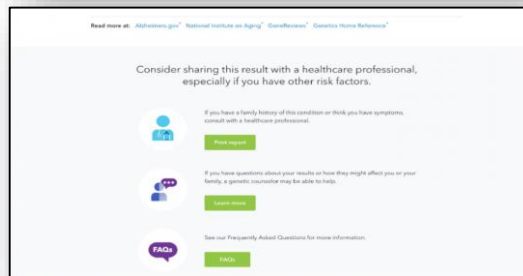
1

Reports are presented in an **easy-to-understand**, **interactive** online dashboard which is password **protected** and **encrypted**.



2

Patients are able to **choose** which health reports they would like to see, and have the option to delay seeing the report until later. **Clinical data** is also presented in a simplified, **visual** manner so they can understand this even **without a physician's support**. Links are provided to the **raw data** for further detail if needed. There are a number of **free-to-download tools and apps** which then offer **further interpretation** of this raw data



3

Finally, patients are able to easily **send results to their doctor** and/or seek **genetic counselling**, all via the platform itself. This ensures a **seamless** journey for the end-user

Case Study 2 - Syapse

The platform enables precision medicine to be incorporated into the clinical workflow:



Submit cases to a Molecular Tumour Board for review



Access structured molecular data based on genetic test results



Track clinical and operational impact of treatments

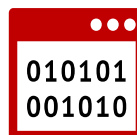


Increase access to targeted drugs based on genetic test results



Review data on clinically and molecularly similar patients to inform treatment recommendations at the point-of-care

The key differentiators are:



Clinical data is aggregated and integrated with genetic data

Oncologists access the information at the point-of-care

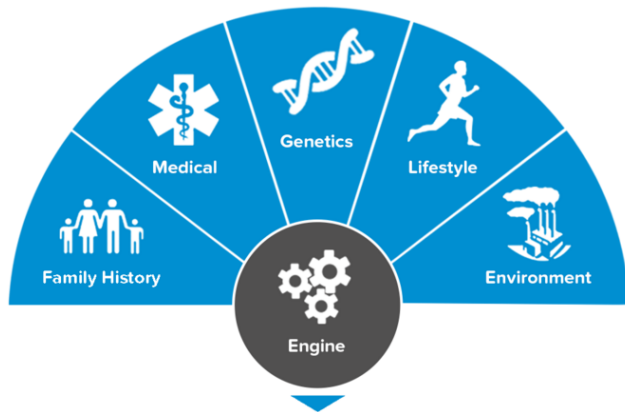
Oncologists can learn from similar cases across the network

Intermountain Hospital Network implemented the Syapse Oncology platform and realised significant results over several months:

- **92%** increase in progression-free survival
- **Decrease in the cost of care** – weekly cost per patient in the precision oncology program was \$4 665 compared to the \$5 000 cost for chemotherapy
- **82%** of patients with actionable mutations were able to **access targeted drugs** through insurance approval, appeals processes or clinical trials
- Four-fold **increase in Molecular Tumour Board submissions** through more streamlined case review processes

Case Study 3 - BaseHealth

BaseHealth analyses a wide range of data to more accurately predict disease onset...



...which can be used to tailor disease management programs that are cost-effective and patient-centred



Assess risk one member at a time, whilst also **stratifying the member base** with a more complete view of population risk, liability and opportunity management



Tailor disease management programs to target the “invisible patients” within the member base and empower case managers to have evidence-backed conversations



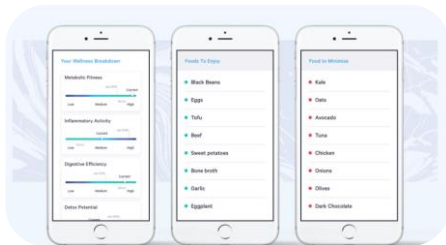
Offer physician-led **personalised health plans** for members allowing them to responsibly explore their omics data in combination with other personal health data

Accurate prediction of the **onset of 41 of the world's most common diseases** including diabetes, heart disease and some forms of cancer; as well as **27 acute and traumatic medical incident conditions**

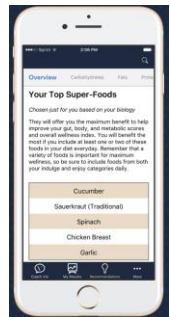
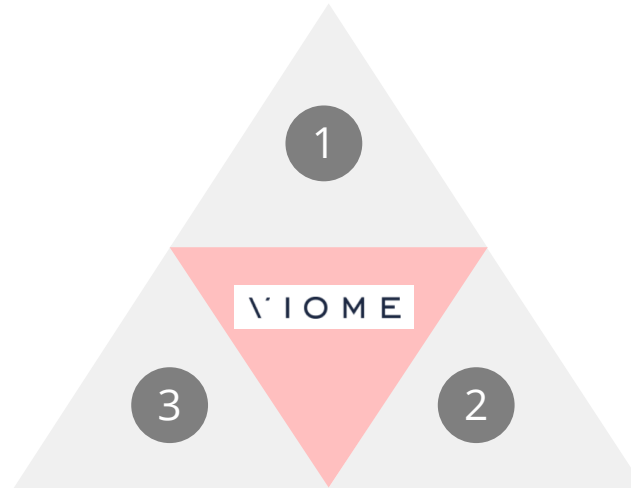
Case Study 4 - Viome



Viome analyses **all microorganisms** in the gut: bacteria, viruses, archaea, yeast, fungi, parasites and bacteriophages and their metabolites in order to **quantify their impact on human health**



Outputs from Viomes analysis enable users to have a **thorough understanding** of how their microbiome impacts what foods are **healthiest** for them and their **wider wellness**



Viome's service includes and **AI platform** that **aggregates data** in the back end and includes UX interface called Vie to guide users along their **wellness journey**

South African Providers (1 of 2)

					
Test categories	Curiosity Personal characteristics and attributes	- Kinship tests - Baby gender - Ancestry	Kinship tests	- Kinship tests - Baby gender - Ancestry	
	Wellness Responses to lifestyle and environment	- Wellness and Lifestyle DNA diet and Healthy weight test - SkinCare DNA test	GenePro – genetic testing for personalized nutrition and lifestyle guidance	- DNA health - DNA diet - DNA oestrogen - DNA sport	- Healthy weight - Diet and healthy weight - SkinCare - Sport injury screen - Wellness screen
	Predictive Potential risk of disease or drug response	- Celiac disease genetic testing - Genetic Health Testing - Lactose Intolerance	- Allergic reactions - Food-sensitivity - Lactose intolerance - Coronary artery disease risk	DNA oestrogen	- Celiac disease - Lactose intolerance - Genetic predisposition test (34 diseases) Screening for: - Cardiovascular - Demyelination - Breast cancer - Iron disorder - Prescriptions
	Other services	- Genetic counselling - DNA banking		- Bioresponse DIM - Genetic counselling - DNA banking	Genetic counselling

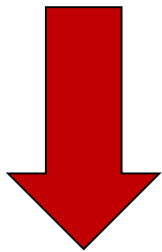
South African Providers (2 of 2)

					
Test categories	Curiosity Personal characteristics and attributes			• Parentage tests	• Kinship tests • Ancestry test
	Wellness Responses to lifestyle and environment	• Health and nutrition	• Wellness • Diet • Skincare • Sport		
	Predictive Potential risk of disease or drug response	• Preimplantation testing • Prenatal testing • Newborn screening		• Cytogenetics and molecular cytogenetics • Molecular genetic tests • Chimerism/STR test	• Genetic diseases (26 diseases)
	Other services	• Dietitian/ health coach visits • GP consultation			

Omics impact on the insurance industry

Costs are decreasing

\$US 2.7 bn in 2003

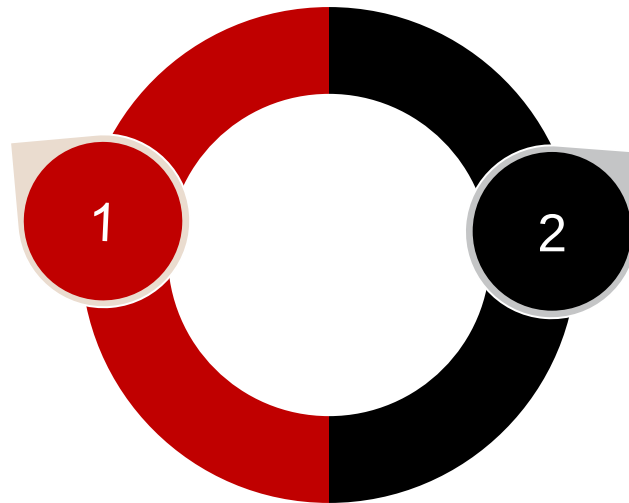


\$US <200 in 2018

Application scope

Applications:

- Clinical diagnostics
- Drug discovery
- Biomarkers for identifying disease
- Pharmacogenomics



Industry trends indicate that insurance policyholder genomes will soon be sequenced and other omics are rapidly developing

Omics and insurance in the future

General Challenges of Personalised Medicine

- Genomic / omic **literacy** (of doctors, patients, and where relevant, insurers)
- Different personal **decisions** (do you **want** to know?)
- Discrimination (**who** should know?)
- Privacy and security (who can be **trusted** to know?)
- Which organisations have the **Big Data capacity** to handle this?

Impact of Personalised Medicine on Insurance

- Risks of **anti-selection**....
- vs risks of **discrimination** against policyholders
- **Interpretation** with incomplete data (e.g. lifestyle / behaviour data?)
- The **consequences** of increased **longevity**, and the **accuracy** of **long term projections**
- **Earlier identification** of disease
- Higher / lower **cost of treatment**?



- Learn from **past experience** – e.g. AIDS epidemic modelling in early 90s
- Be **informed** about **technological** and **clinical developments**
- Think hard about **ethics, privacy and risks**



QUANTIFYING RISK, ENABLING OPPORTUNITY

Genomics, personalised medicine and insurance

Author: Emile Stipp
Date: May 2018