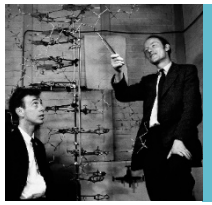
2018 Bio Future Forum

The 100,000 Genomes Project – realising the potential of population data

November 2018

Sir John Chisholm, Chair, Genomics England

UK Commitment to Genomics is long and deep



Francis Crick and James Watson first discover the double helix structure of DNA in 1953.

First draft of the human genome announced by President Clinton and PM Blair in 2000. The Sanger Centre in the UK was alone responsible for 30% of that draft.

In 2006 the MRC and the Wellcome Trust announced the creation of a cohort of 500,000 well people aged between 45 and 60 years, called UK Biobank. Deep data has been collected including medical incidents, primary records, images, and genotypes.

In 2017 it was announced that these would be extended to whole genomes.

In 2012 PM Cameron announced that the UK would be the first country to use routine health records to link with 100,000 whole genomes.

A company, Genomics England, was created to manage the 100,000 Genomes Project.

Genomics England's Mission

I was tasked by the Prime Minister to:

1. Create the infrastructure to introduce genomic medicine to the NHS
2. Build a genomic/clinical dataset capable of enabling important health discoveries
3. Accelerate commercial investment in the genomics industry in the UK
4. Carry public support

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1. Carry Public Support

Put patients at the centre

This is all about patients and participants having the confidence to knowingly and willingly offer their data

1. **Consent** must be obtained after explaining in straight forward terms and must be honest, thorough, efficient, and positive.

2. **Processes** must be courteous and respectful and deal with the difficulties such as samples or relatives as smoothly as possible.

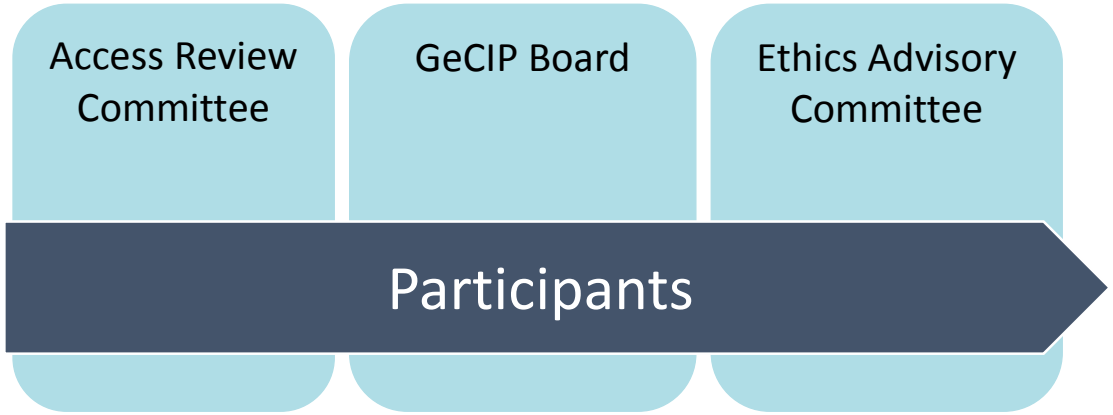
3. Worries such as **data security**, data sharing, and feedback issues must be acknowledged and faced openly.

4. Participants must be kept in touch and **informed of progress**.

5. And we have learned that the only way to win support in the face of hard issues is to **listen** to participant concerns, design process to deal with them, and stick to them no matter what difficulties that gives you.

Participant Panel

- Role of the Panel is to ensure the interests of participants are always at the centre of the 100,000 Genomes Project.
- They do this by:
- Making sure experiences of participants are at the heart of the project.
- Responding to feedback.
- Overseeing who should have access to participant data.
- Representing the views of participants to the Board, the executives, and the public.



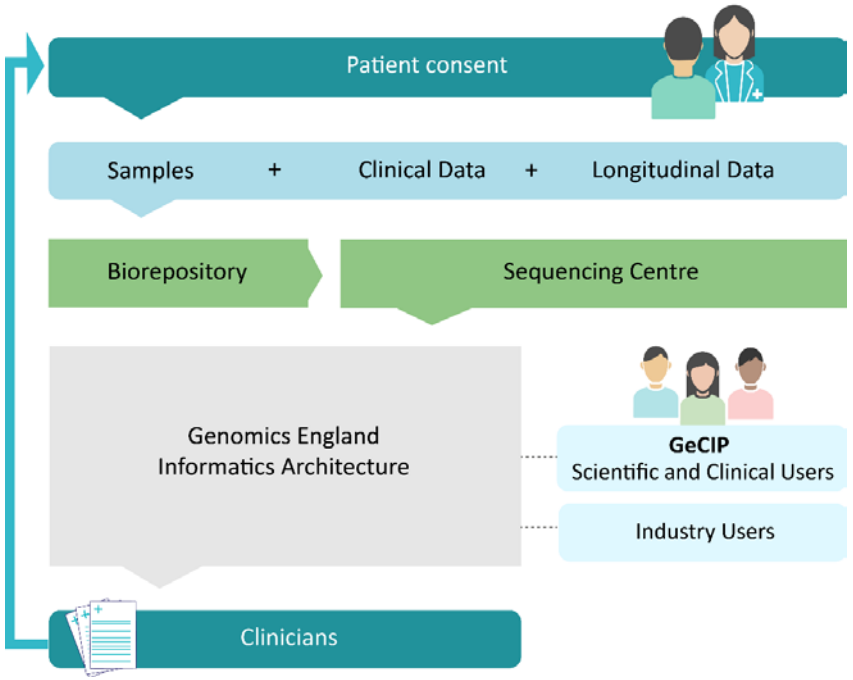
Public commitments

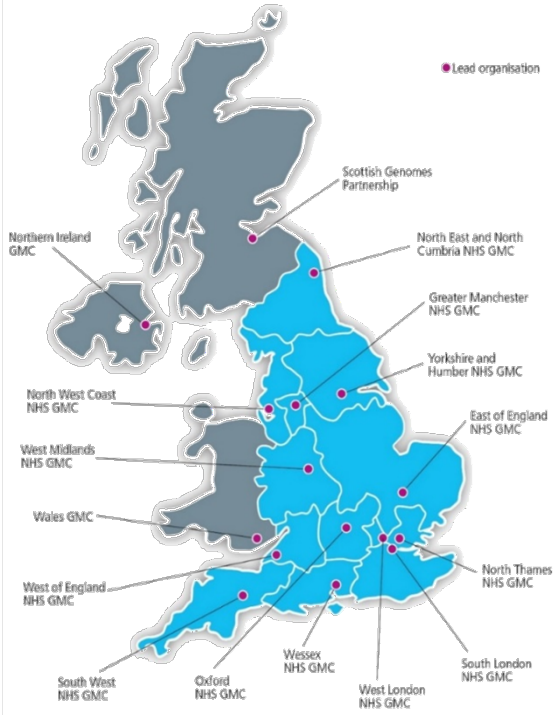
- Your data will **never leave the NHS**.
- Your data will only be used in identifiable form in relation to your direct care. **For all research purposes it will be used in de-identified form**.
- While it is impossible to provide an absolute guarantee, your data will be **guarded with the utmost diligence** and we will always inform you if there has been any event that could be of possible concern to you.
- Your data will only be accessed **according to the consent you have given** us.
- **Anyone who accesses your data will have been through a scrutiny process** examining the person, their organisation, and the task they want your data for.
- If you ask for it we will be able to provide **a list of those who have accessed** your data.
- **You may withdraw your consent at any time**. In that case your data will no longer be available in the research environment, but those analyses that have already used your data can continue to use their processed results.
- **If you require it we will give you a copy of your data for you to use for your own purposes.**

2. Create and prove the infrastructure to systematise Genomic Medicine in the NHS

How the 100,000 Genome Project Worked

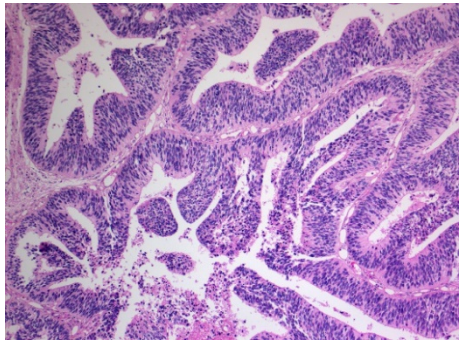
- Private company, 100% owned by the Department of Health, under ***Independent Board***
- Close ***Partnership*** with NHS who commissioned recruitment and feedback via NHS Genomic Medicine Centres covering over 85 hospitals and 50 million people
- Built single ***Centralised*** platform for informatics, sample storage and whole genome sequencing
- Industry and academic research collaboration in a ***Single, Safe*** environment
- Evidence based process to establish consistent ***Standards and Protocols***





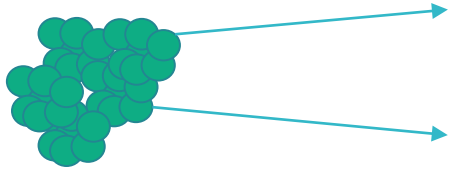
Whole genome diagnoses requires new Standards and Protocols, e.g. Pathology

This requires a transformation of routine health practice, which is now underway



- Tumour samples are traditionally preserved in formalin then fixed in paraffin (FFPE) to preserve cellular architecture for diagnosis under the microscope
- DNA extracted from samples treated like this is damaged and broken

The new protocol



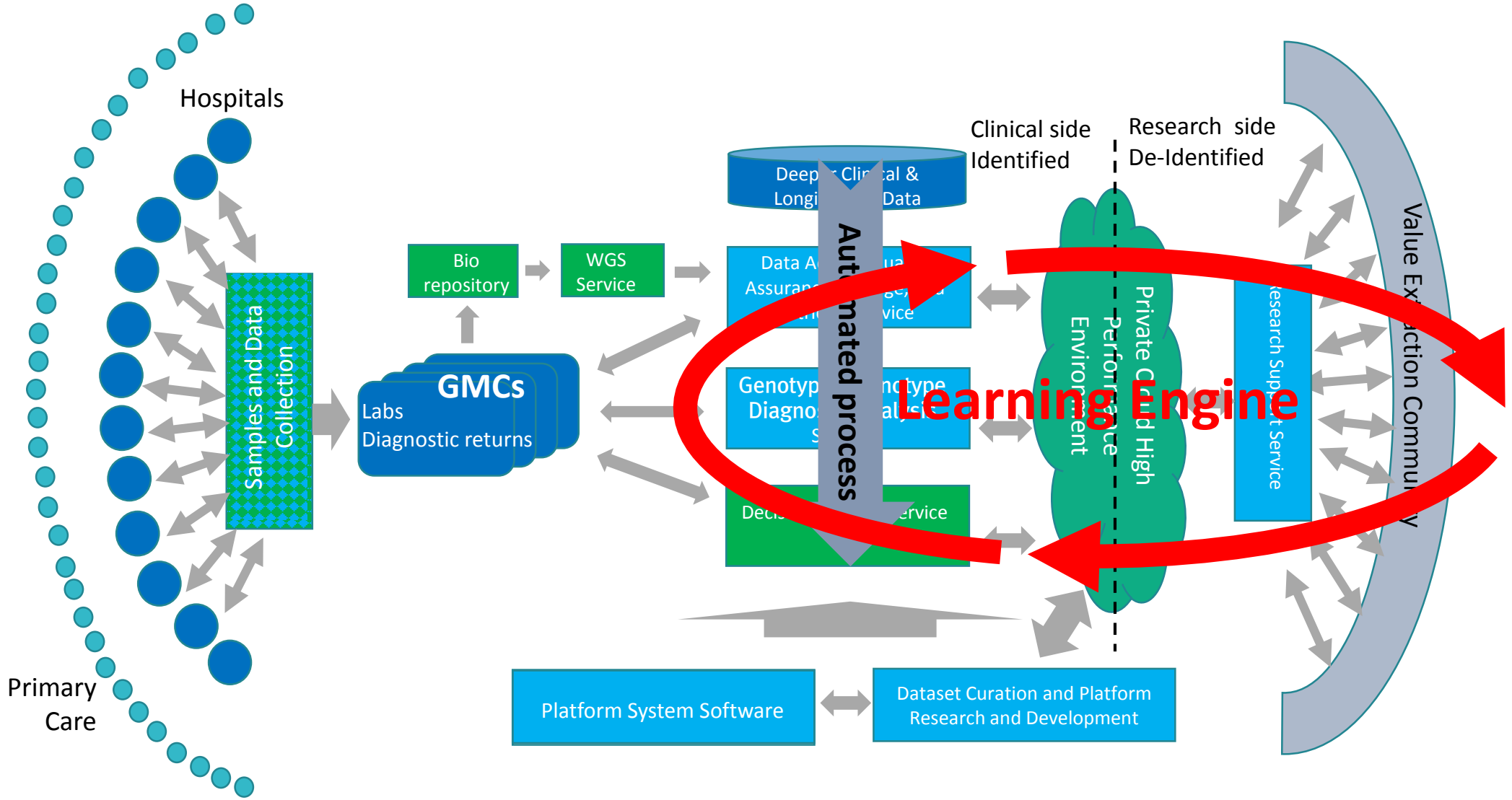
Use part of the sample for FFPE and histology

Freeze part of the sample for genetic tests

- Need to make sure the sample contains mainly tumour cells

- This new pathway requires very significant changes in sample handling, affecting nurses, surgeons, interventional radiologists, pathologists and oncologists

100,000 Genomes Project platform



What are participants expecting?

- Information about a patient's main condition
- Information about additional 'serious and actionable' conditions (optional)
- Carrier status for non affected parents of children with rare disease (optional)

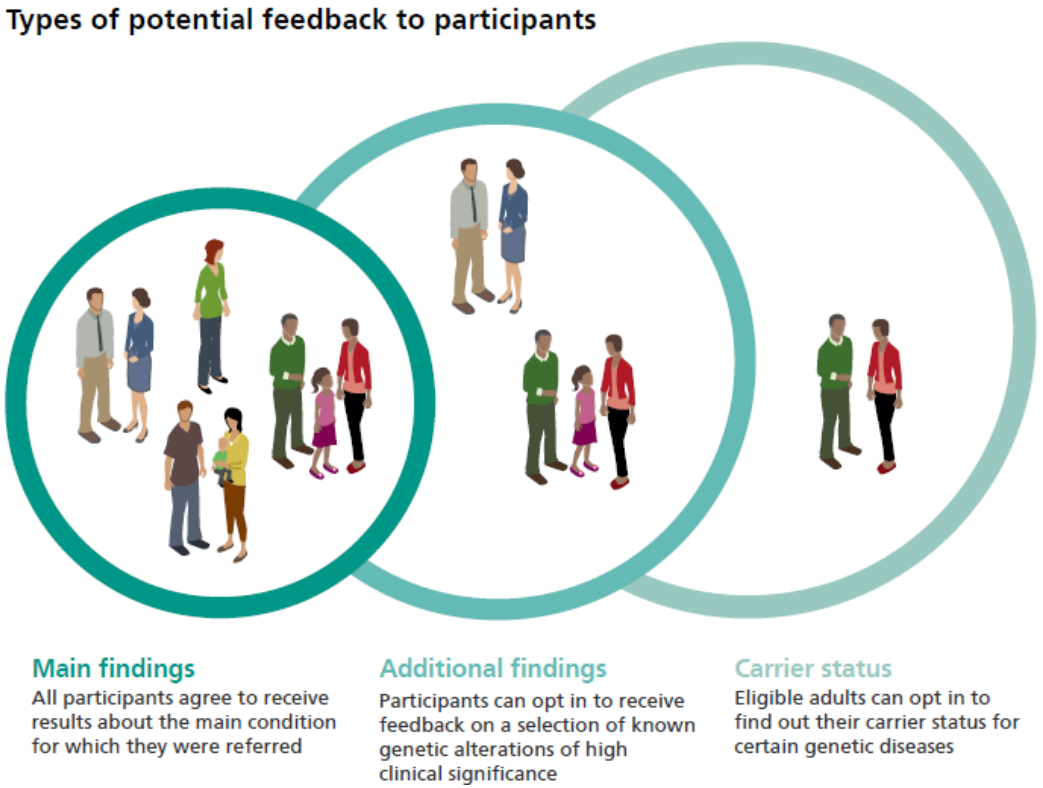


Image courtesy of Health Education England

3. Build a genomic/clinical dataset capable of enabling important health discoveries

Progress to date

Figures as at 05/11/2018

Samples

112,547
Samples collected and received at the UK Biocentre

27,597 cancer

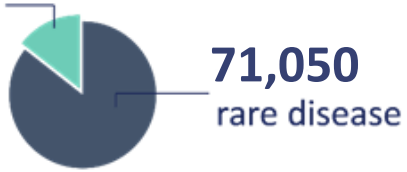
84,950 rare disease

Genomes

92,297
Genomes sequenced at 1 November

21,247 cancer

71,050 rare disease



Currently running at **7000** per month

Analysis and Results

Results for **38,957** genomes sent to NHS GMCs

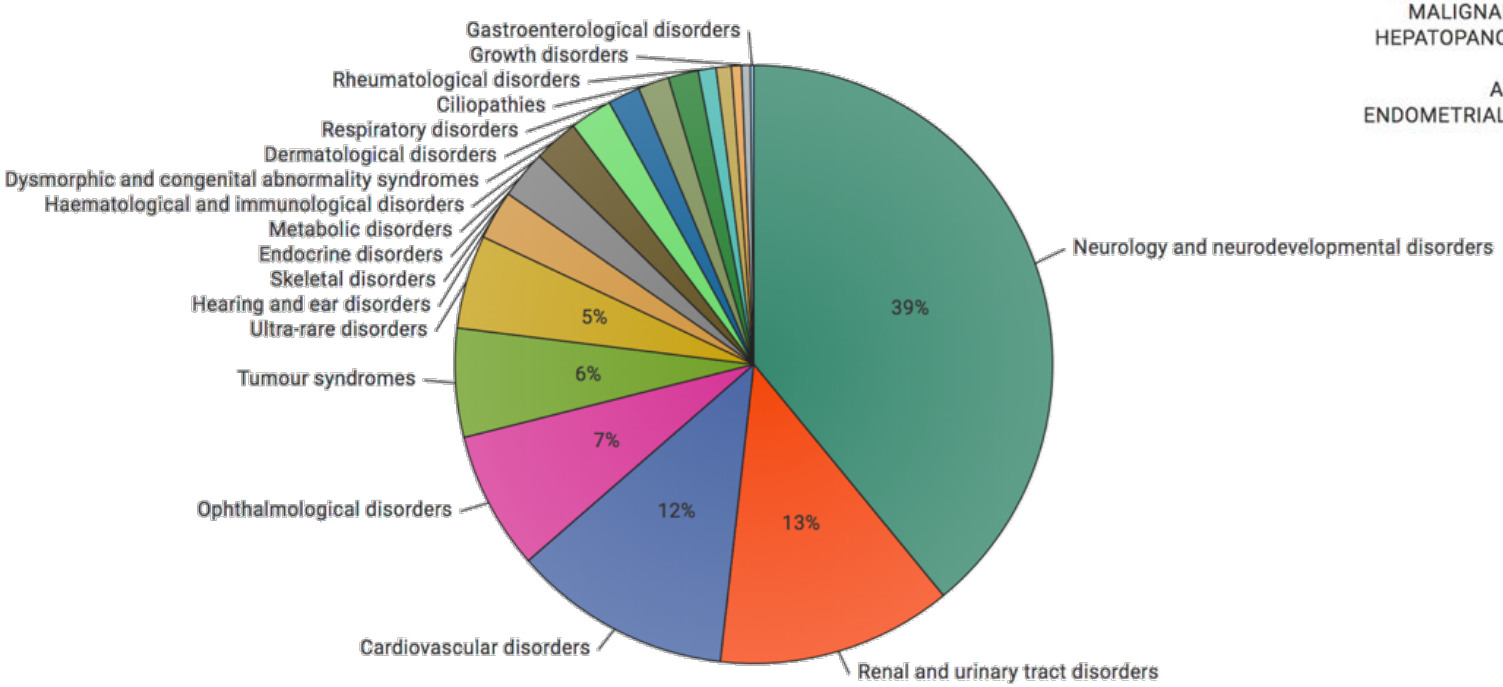
Equivalent to **8,843** cancer genomes and **30,114** rare disease

- 20-25% actionable findings for Rare Disease
- ~ 50% cancer cases contain potential for a therapy or a trial in our report

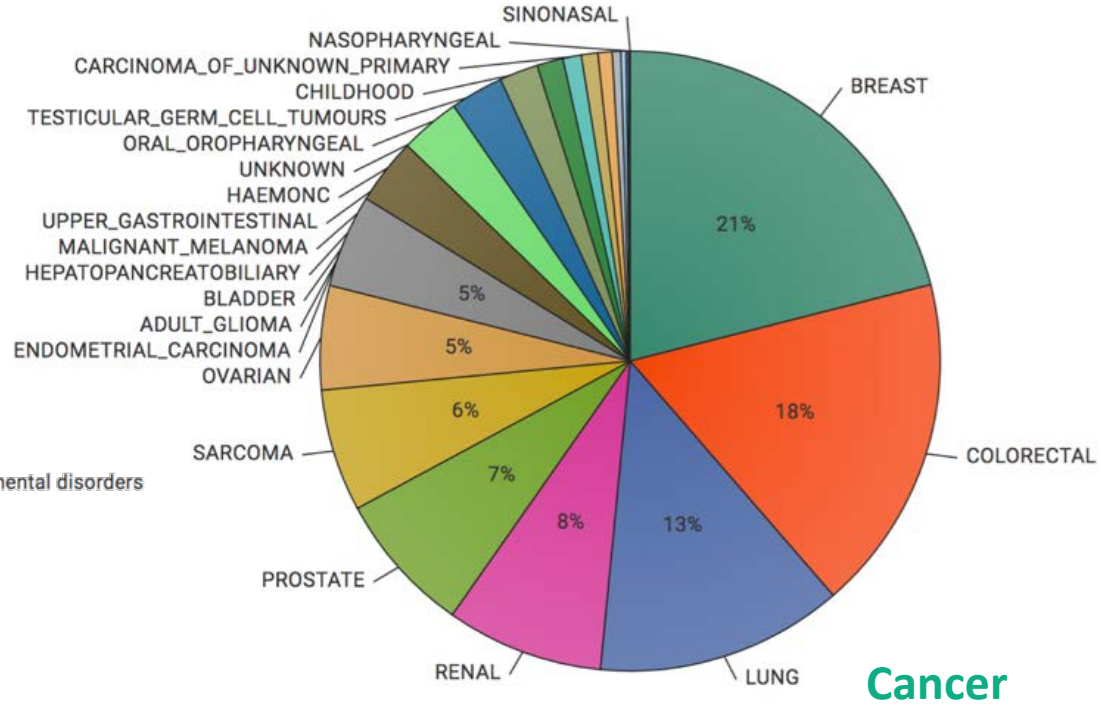
Disease cohorts

Consented for longitudinal follow up, re-contact and additional samples

Rare disease



Cancer



Researchers across the world are getting access to the data: Genomics England Clinical Interpretation Partnership (GeCIP)

GeCIP launched in **June 2014**

3032 researchers world-wide

387 academic institutions

108 signed Participation Agreement

1821 researchers with access to data

33/42 Approved domains

4. Accelerate commercial investment in the genomics industry in the UK

Discovery Forum – more than 90 members

R&D companies [48]

- Biopharmaceuticals [28]
- Molecular diagnostics [20]

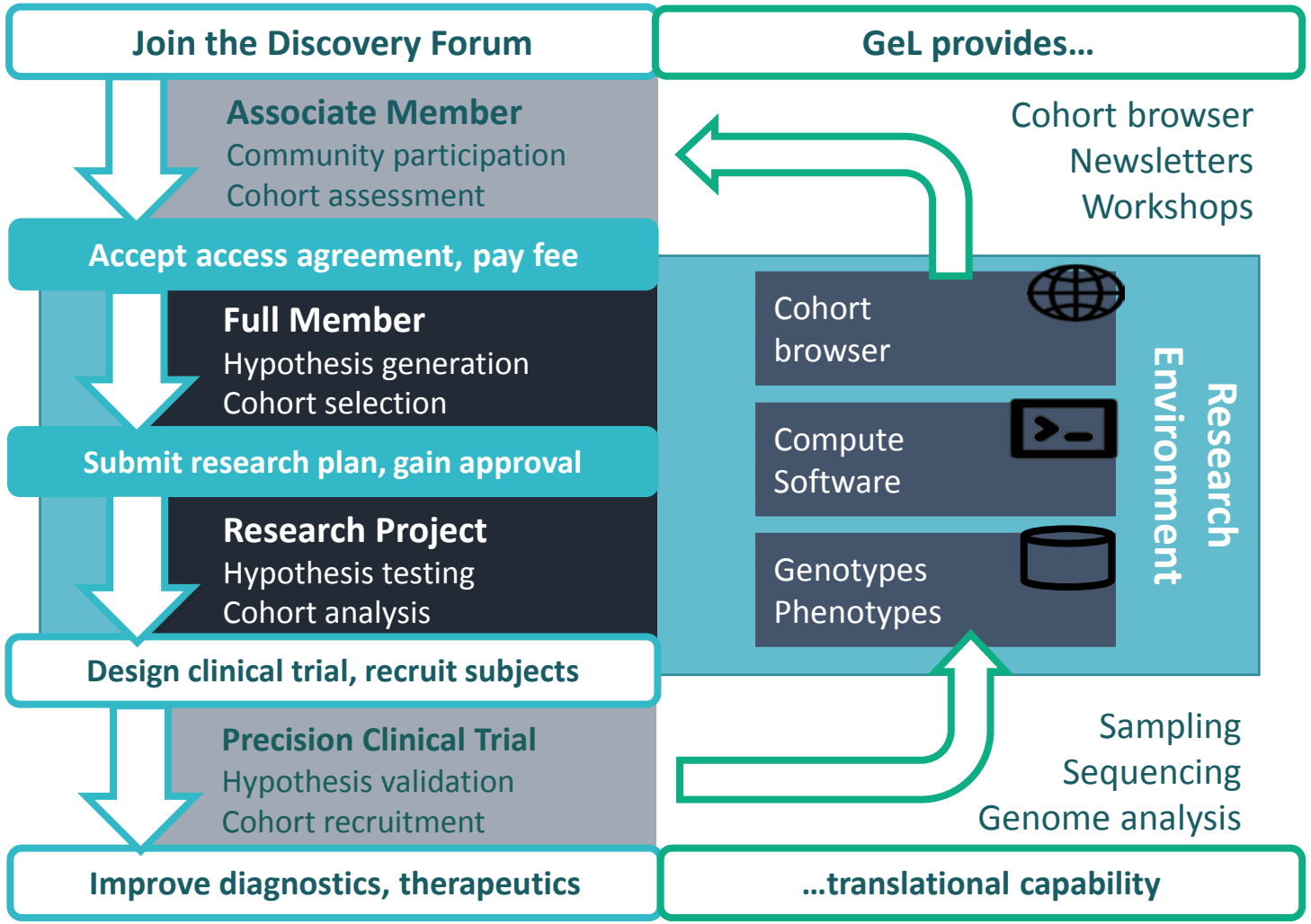
Platform partners [20]

- Sequencing & Bioassay [5]
- Informatics & Databases [15]
- Contract research [1]

Finance, support and regulation [15]

- Finance & Investment [7]
- Regulatory & Trade bodies [2]
- Charities [6]

The Discovery Forum process



So where next?

Future: Building the future NHS Genomic Medicine Service

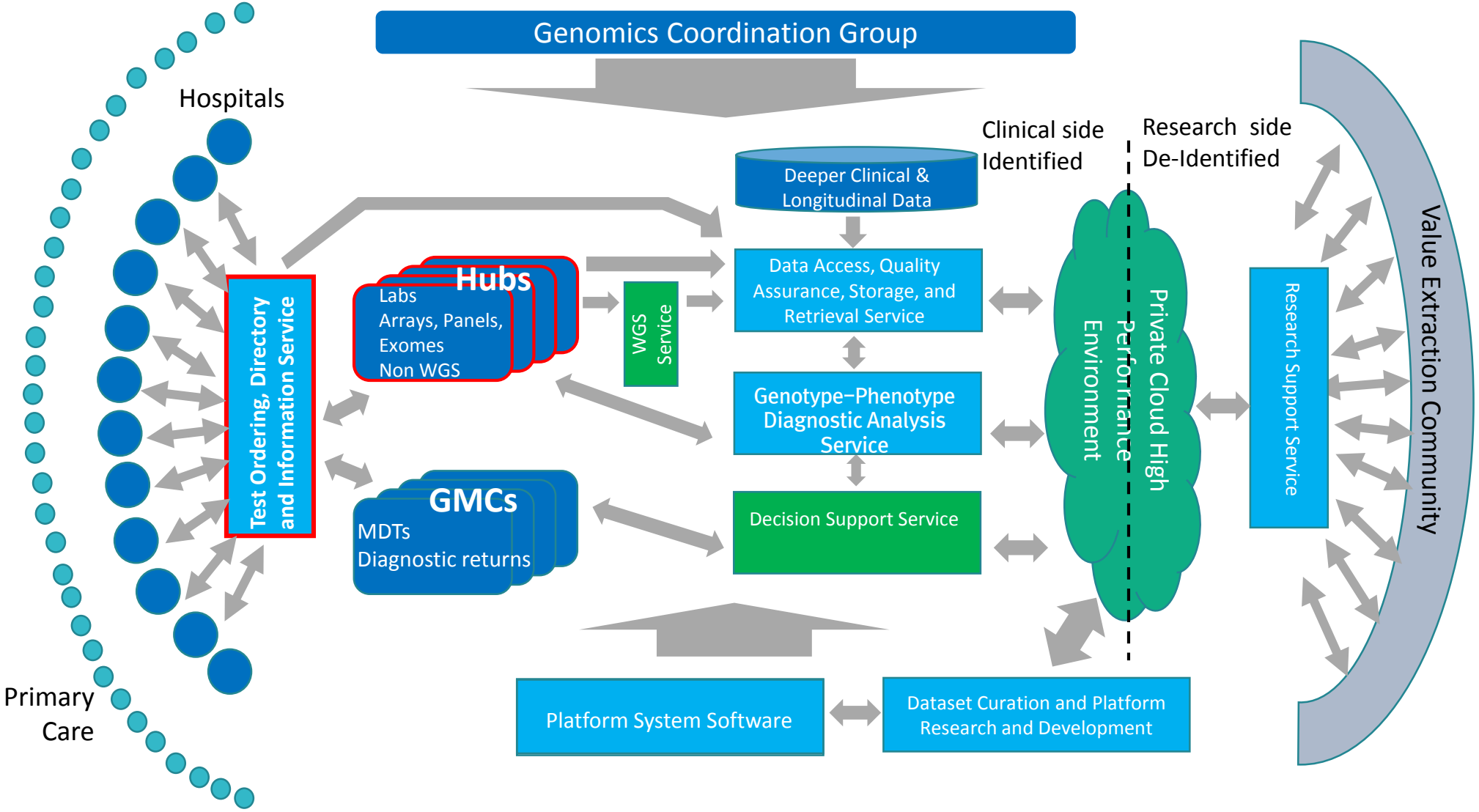
By January 2019 the National Health Service in England will:

- Have a national **Genomic Medicine Service**
- Be operating to **common national** standards, specifications & protocols
- Have standardised **Genomic Consent** for NHS care and Research
- Be delivering an approved **National Testing Directory**
- Have **7 Genomic Laboratory Hubs**

Plus

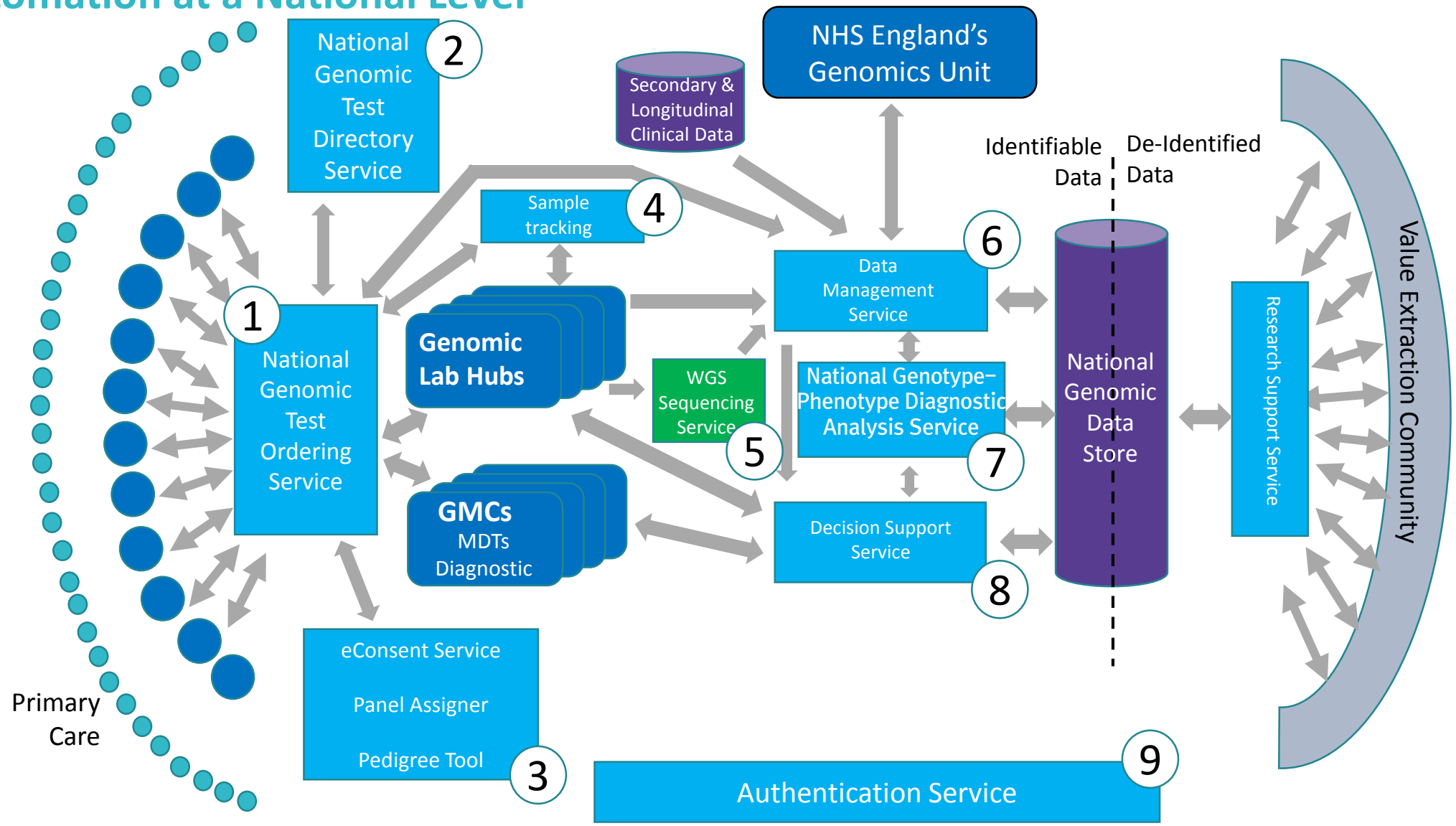
- A single **UK Genomic Knowledgebase** with de-identified data for academic & industry research

Genomic Medicine Service schema

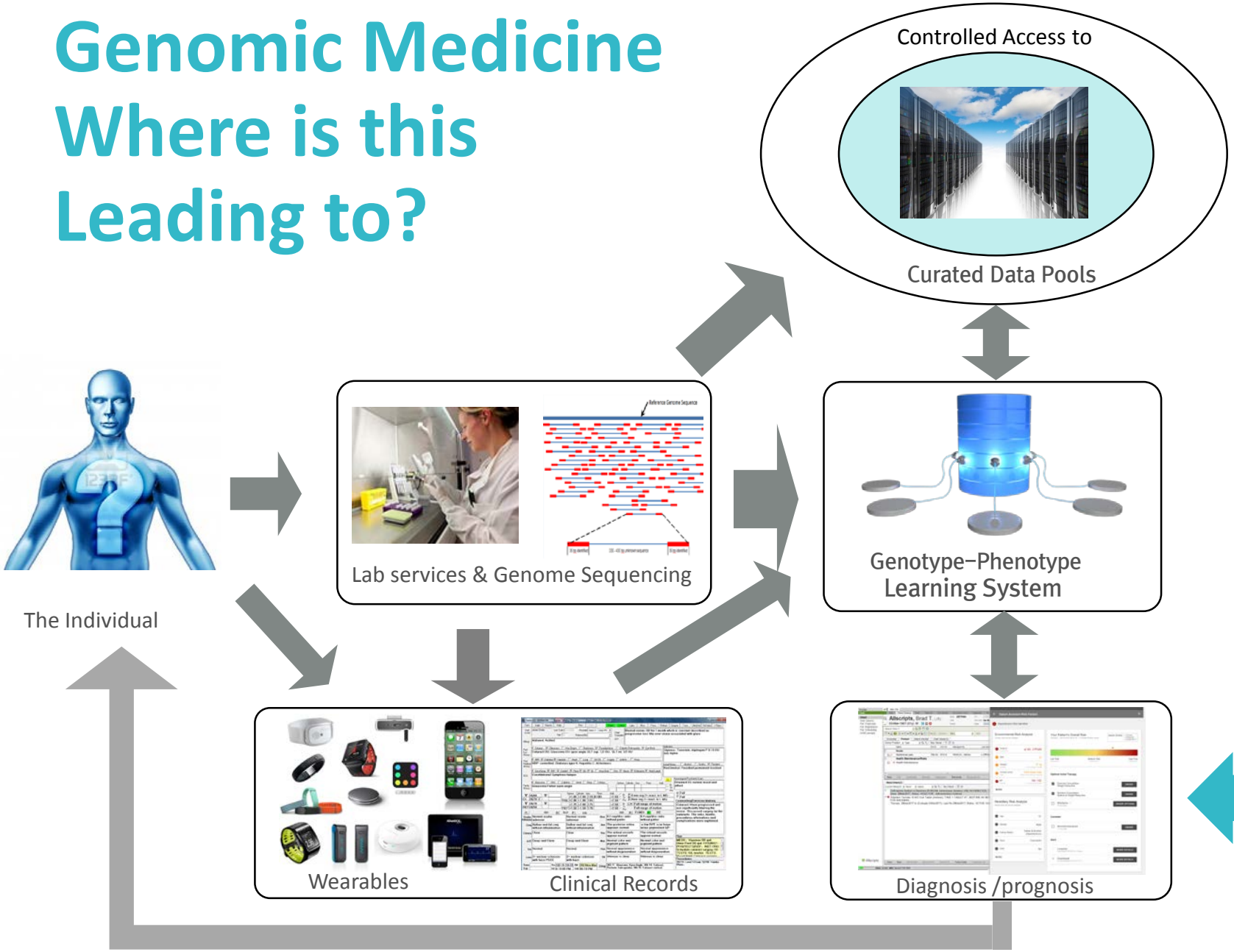


National Genomic Informatics Service

A modular integrated system designed to provide Genomic Medicine automation at a National Level

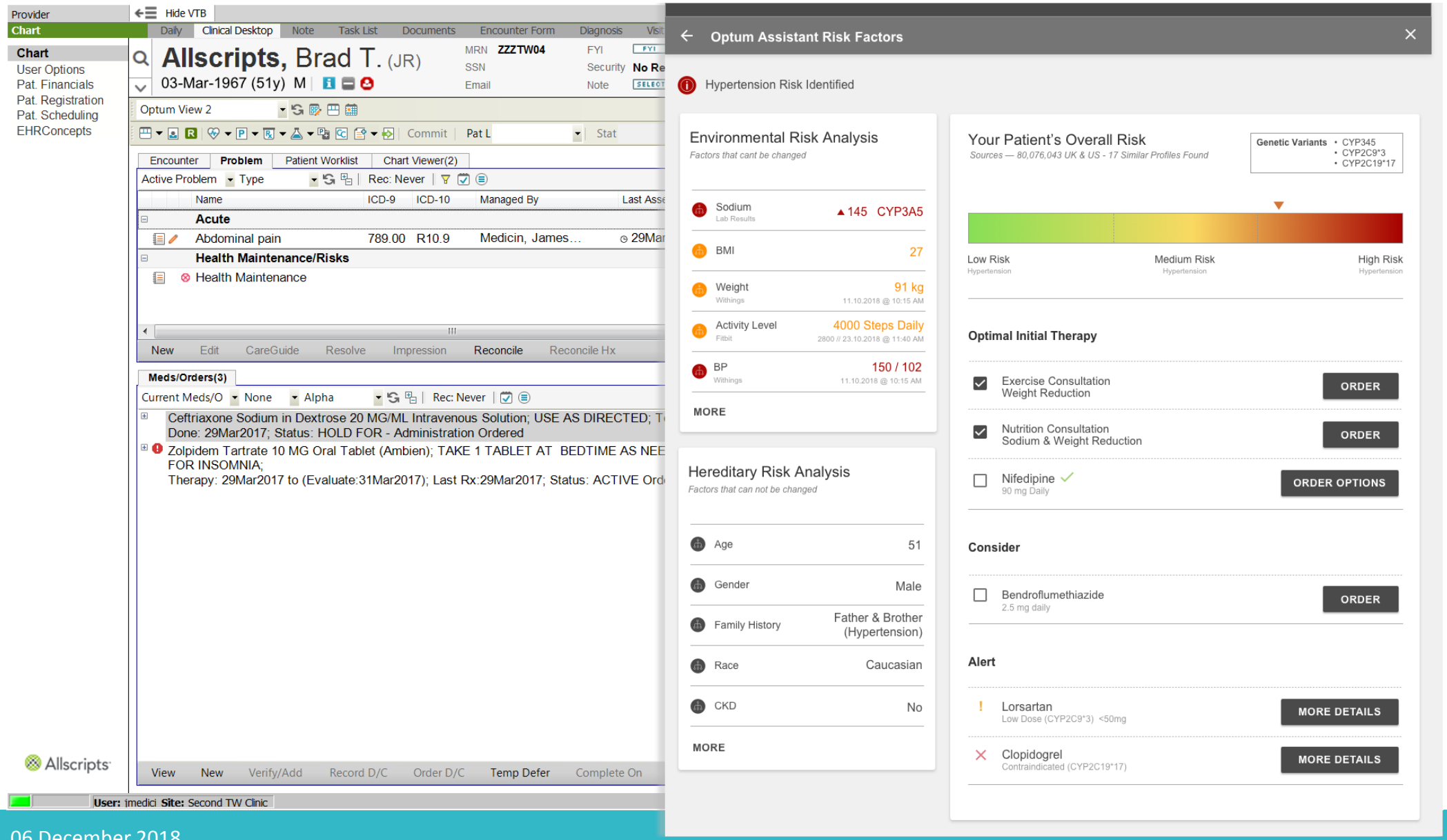


Genomic Medicine Where is this Leading to?



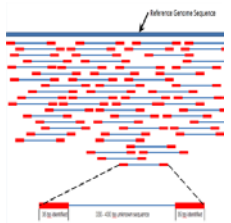
Personalised precision health service

Clinical Record + Wearable Data + Genomic Analytics



And what will a Personalised Precision Health Service Enable?

The Individual



Lab services & Genome Sequencing

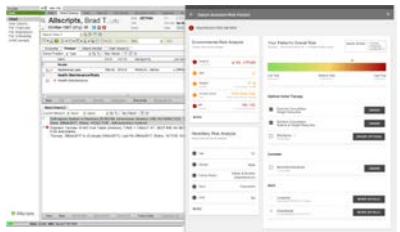
Wearables

Clinical Records

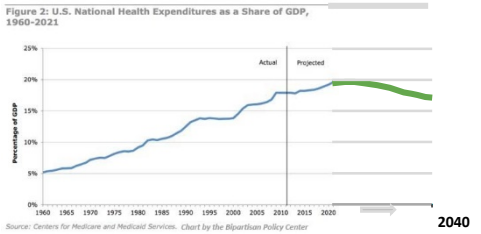
Controlled Access to

Curated Data Pools

Genotype–Phenotype Learning System



Diagnosis /prognosis



Affordable Population Health Care

Everyone who has engaged in this project deserves thanks and congratulations, but the real heroes are our participants

Stay in touch

@genomicsengland #genomes100k

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