Australian Genomics Health Alliance

Developing a national genomic medicine strategy

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Co-Lead, Australian Genomics

Deputy Director, Murdoch Childrens Research Institute

3rd Global Genomic Medicine Collaborative Conference

27-29 April 2017

Australian Genomics Health Alliance

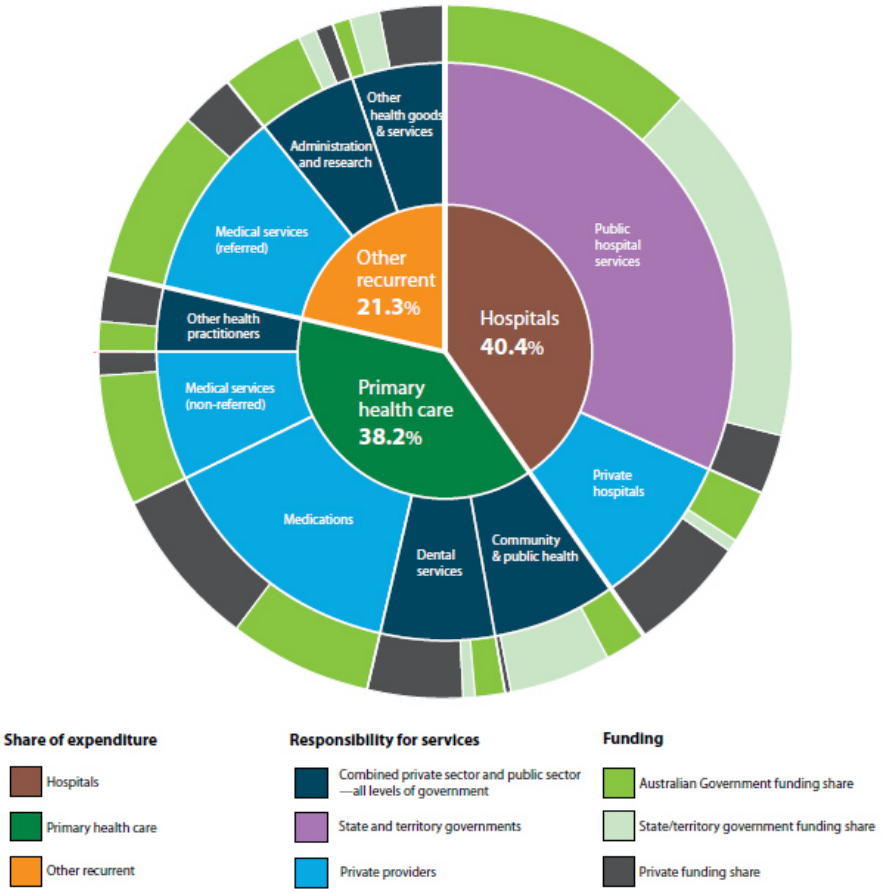
The Australian Health Care System

AUSTRALIA IS A FEDERATION OF STATES

Australian Genomics Health Alliance

The Australian Health Care System

COMPLEX AND FRAGMENTED STRUCTURE



Health service funding and responsibilities

Australia's Health 2014, AIHW

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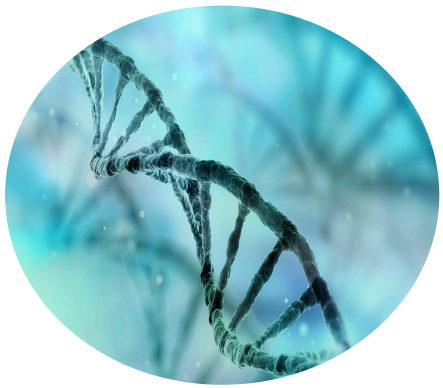


THE WORKFORCE | **THE LABORATORY** | **DATA STORAGE & LINKAGE** | **IN CLINICAL PRACTICE**

- Clinicians
- Patients
- Ethics
- Pathology
- IT
- Geneticists
- Diagnostics
- Bioinformaticians
- Databases
- Programmers
- Sequencing Laboratories
- Hospitals
- IP

WHOLE OF SYSTEM CHANGE IS NEEDED

Melbourne Genomics
Health Alliance

Global knowledge. Individual care.

Alliance members

The Royal Melbourne Hospital

The Royal Children's Hospital Melbourne

The University of Melbourne

Walter+Eliza Hall Institute of Medical Research

Murdoch Childrens Research Institute

CSIRO

agrf

Peter Mac
Peter MacCallum Cancer Centre
Victoria Australia

Austin Health

MonashHealth

Supported by

VICTORIA State Government

Outcomes and evaluation of a demonstration project in genomic medicine (2014-2015)

Exec. Director: Prof. Clara Gaff

Melbourne Genomics Demonstration Project 2014-15

Aim

To design the processes and systems needed to support the appropriate use of genomic sequencing in clinical care

by

Developing and testing a prototype for implementation of genomic medicine (Hybrid implementation-effectiveness trial design)

Develop Policies and procedures

e.g. Counselling and consent

Systems

e.g. Bioinformatics platform, data linkage

Prospectively evaluate system, patient tests

Identify barriers and measure outcomes

Gaff *et al* (2017) *npj Genomic Medicine*

Patient Conditions tested (Flagships)

2014-2015

Acute Myeloid Leukemia

Childhood syndromes

Focal epilepsy

Hereditary colorectal cancer

Hereditary neuropathy

2016-2018

Complex care

Congenital deafness

Dilated cardiomyopathy

Immunology

Advanced solid cancers

Advanced lymphoma (non-Hodgkin)

2017-2019

Controlling superbugs

Bone marrow failure

Complex neurological and neurodegenerative diseases

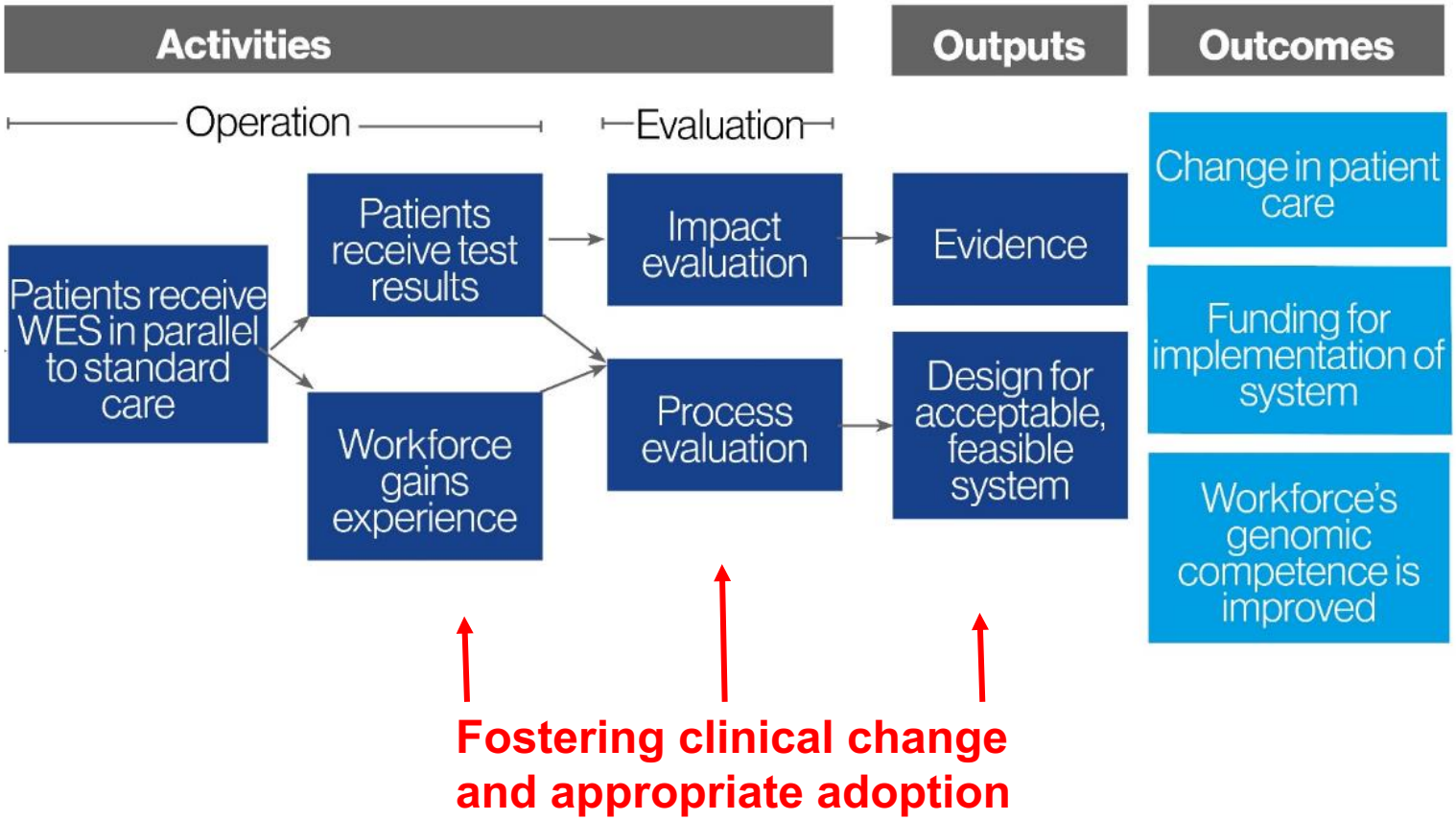
Genetic kidney disease

Perinatal autopsy

Patients:

- Prospectively recruited
- Genomic tests given in parallel with usual care
- Targeted gene lists

Melbourne Genomics Flagship Logic



Gaff *et al* (2017) *npj Genomic Medicine*

Demonstration Project key findings (2014-2015)

Patients accept genomic sequencing

More than 90% of patients consented

Following genetic counselling, 96% of patients felt sufficiently informed to consent

Genomic sequencing improves diagnosis

Overall **6 times** more diagnoses than usual care **6% → 41%**

But genomic sequencing is *not always* better than usual care:

- no increased diagnosis of hereditary colorectal cancer

Patients had better tailored clinical management

Of those receiving a diagnosis, immediate changes in care were experienced by:

28% of children and **21% of all** patients

Demonstration Project key findings (2014-2015)

Patients agreed to share genomic data

98% agreed to share data for research related to their condition

93% agreed to share data for any research

Early sequencing saves health dollars

For infants with childhood syndromes, providing genomic sequencing early in the diagnostic journey results in:

5 times as many infants diagnosed for **75% less cost** per diagnosis*

Re-analysis leads to new diagnoses

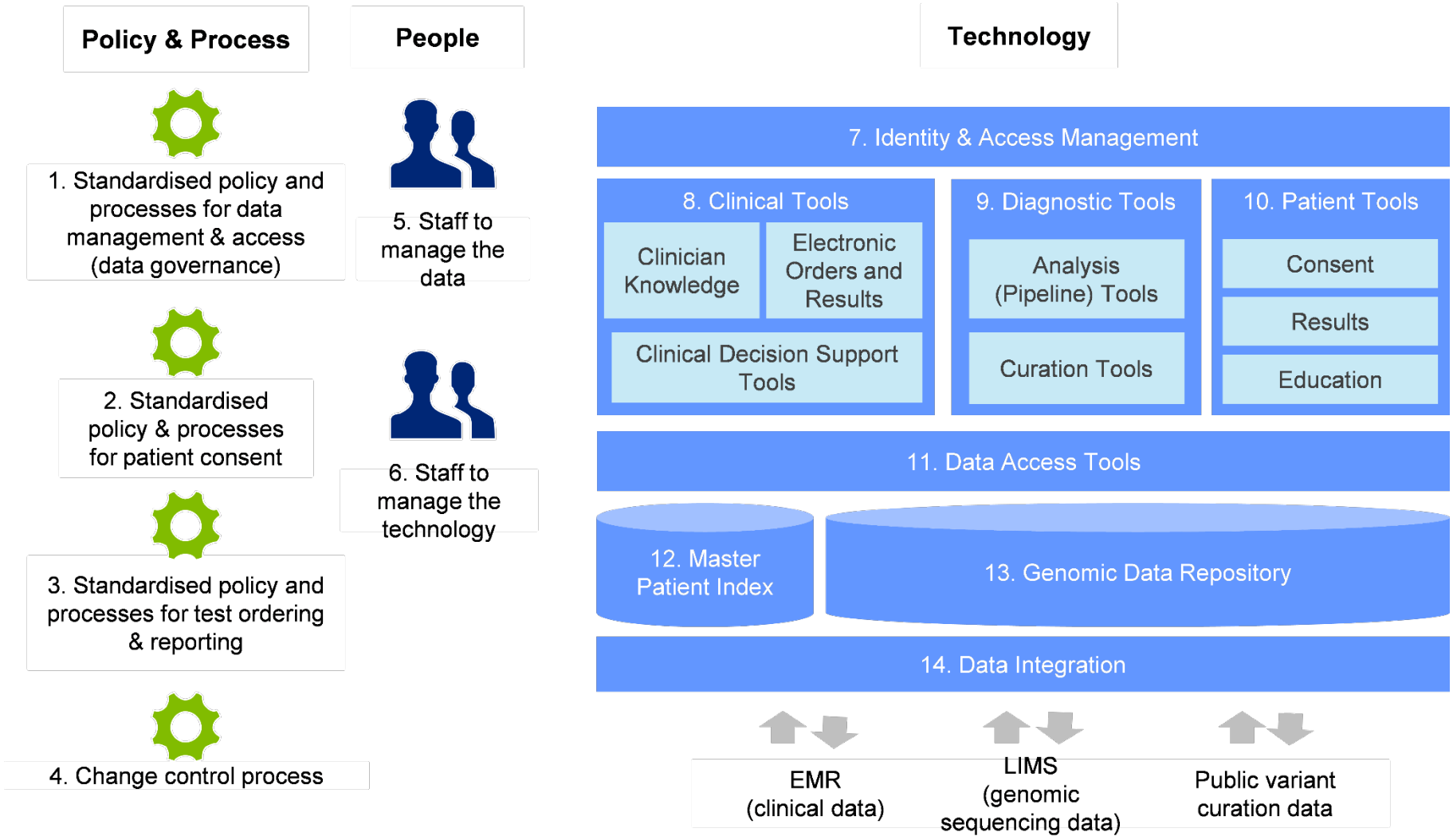
12% of patients received a diagnosis from re-examination of their genomic data (this is expected to increase)

* Stark *et al* (2017) *Genet. Med.*

What works and future requirements

Process along genomic care pathway	Success factors	Future requirements
Testing the right patients	Clinical genetics expertise Use of gene lists Group decision making	Ordering system with decisional oversight by experts System supports continued generation of evidence to inform guidelines
Genetic counselling	Counselling protocols	Mechanism to ensure appropriate counselling for patients (especially outside genetics)
Management of additional findings	Use of gene lists to restrict likelihood additional findings	Evidence to guide policy on managing additional findings
Variant interpretation	Gene and variant prioritisation strategies Clinical and laboratory input to classification	Prioritisation strategies Reporting to include clinical and laboratory input
Data storage and reanalysis	Consent for different data storage and reanalysis options	Evidence to guide governance structures to manage data storage and access

State-wide approach to genomic data management



Adoption of the Melbourne Genomics model

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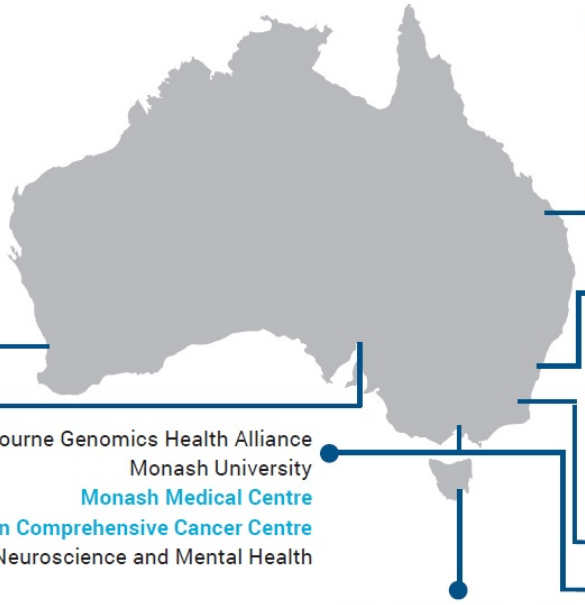
Queensland Genomics Health Alliance

AUSTRALIAN GENOMICS HEALTH ALLIANCE
78 Institutions

PARTNERS

Harry Perkins Institute of Medical Research
Path West
Genetic Services of Western Australia
Princess Margaret Hospital
Telethon Kids Institute
Royal Perth Hospital
Sir Charles Gairdner Hospital
University of Western Australia

South Australian Health & Medical Research Institute
SA Pathology / Centre for Cancer Biology
Women's and Children's Hospital
University of Adelaide
Royal Adelaide Hospital



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Monash University
Monash Medical Centre
Victorian Comprehensive Cancer Centre
The Florey Institute of Neuroscience and Mental Health

Royal Hobart Hospital

The University of Queensland
Lady Cilento Children's Hospital
Institute for Molecular Bioscience
QIMR Berghofer Medical Research Institute
Wesley Hospital
Royal Brisbane and Women's Hospital
Princess Alexandra Hospital
Diamantina Institute
Pathology Queensland
Queensland University of Technology
Queensland Genomics Health Alliance

Sydney Children's Hospitals Network
Royal North Shore Hospital
Garvan Institute of Medical Research & KCCG
Kinghorn Cancer Centre
NSW Health Pathology
Children's Cancer Institute Australia
The University of Sydney
Children's Medical Research Institute
University of New South Wales
Centre for Genetics Education
AIHI / Macquarie University

Australian National University

Murdoch Childrens Research Institute
Victorian Clinical Genetics Services
Melbourne Health / Royal Melbourne Hospital
The University of Melbourne
Walter and Eliza Hall Institute of Medical Research
Peter MacCallum Cancer Centre
Royal Children's Hospital
Victorian Life Sciences Computation Initiative
Austin Hospital

Peak Professional Bodies
Royal College of Pathologists of Australasia
Human Genetics Society of Australasia

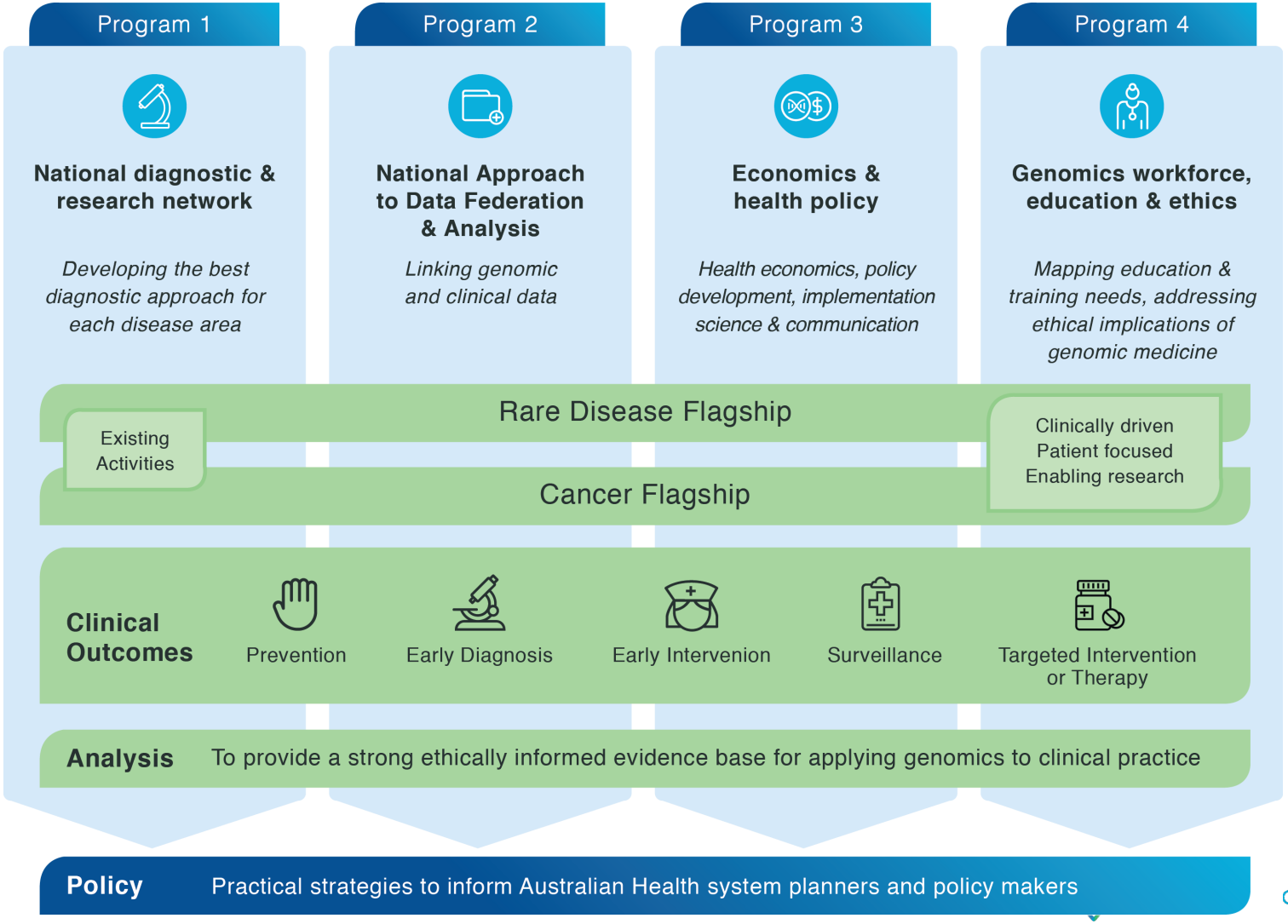
National Partners
Bioplatforms Australia
Australian Genome Research Facility
BioGrid Australia
National Computational Infrastructure
CSIRO
Rare Voices Australia
Rare Cancers Australia
Australian Mitochondrial Disease Foundation

International Partners
Broad Institute of MIT and Harvard
Baylor College of Medicine
UCL Great Ormond St Institute of Child Health
Global Alliance for Genomics and Health
Global Genomic Medicine Collaborative
Genomics England

Australian Genomics Health Alliance

Australian Genomics

$25M NATIONAL HEALTH SERVICES RESEARCH PROGRAM



Genomics ce

Disease Flagships

RARE DISEASE & CANCER

- **Aim: Integrating with our Programs to drive research into the nationwide implementation of genomic testing**

- Each specific flagship is underpinned by:
  - Strong existing national and international clinical, diagnostic and research partnerships
  - Demonstrable leverage with other programs

- Aim to establish a virtuous cycle of **rapid translation and implementation between clinicians and researchers** to evaluate pathogenicity, gene discovery and the development of innovative diagnostic tools.

Rare Disease Flagships

SUMMARY OF PATIENT RECRUITMENT NUMBERS

RARE DISEASE FLAGSHIP	RECRUITMENT	TOTAL
Neuromuscular Disorders	200 (A) + 320 (P)	520
Mitochondrial Disorders	110 (A) + 100 (P)	210
Epileptic Encephalopathy	65 - 100 (P)	65 - 100
Brain Malformations and Leukodystrophies	225 (P)	225
KidGen Renal Genetics	392 (A) + 166 (P)	557
Genetic Immunology	100 – 200 (A & P)	100 - 200
Intellectual Disability	45 - 55 (P)	45 - 55
TOTAL FIRST ROUND RARE DISEASE FLAGSHIPS		**1722 - 1867**

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Cancer Flagships

SUMMARY OF PATIENT RECRUITMENT NUMBERS

CANCER FLAGSHIP	RECRUITMENT	TOTAL
Somatic Cancer	335 (A) + 30 (P)	365
Acute Lymphoblastic Leukaemia	292 (P)	292
Germline Cancer – AYA / Paediatric	1000 (AYA) / 400 (P)	1400
Germline Cancer - ICCon	300	300
TOTAL FIRST ROUND CANCER FLAGSHIPS		**2357**

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National diagnostic & research network

PROGRAM 1

- Delivery of a **coordinated and sustainable system** for the provision of genomic testing in the clinical environment – technology agnostic.
- **Evidence** to support funding as part of clinical care.
- **National referral network** with standardised approach to diagnosis.
- **Unified approach** to test ordering, minimal clinical data set required, ethics, consent.

Secondary aim: identification of "enriched" cohorts of patient for gene discovery research projects.

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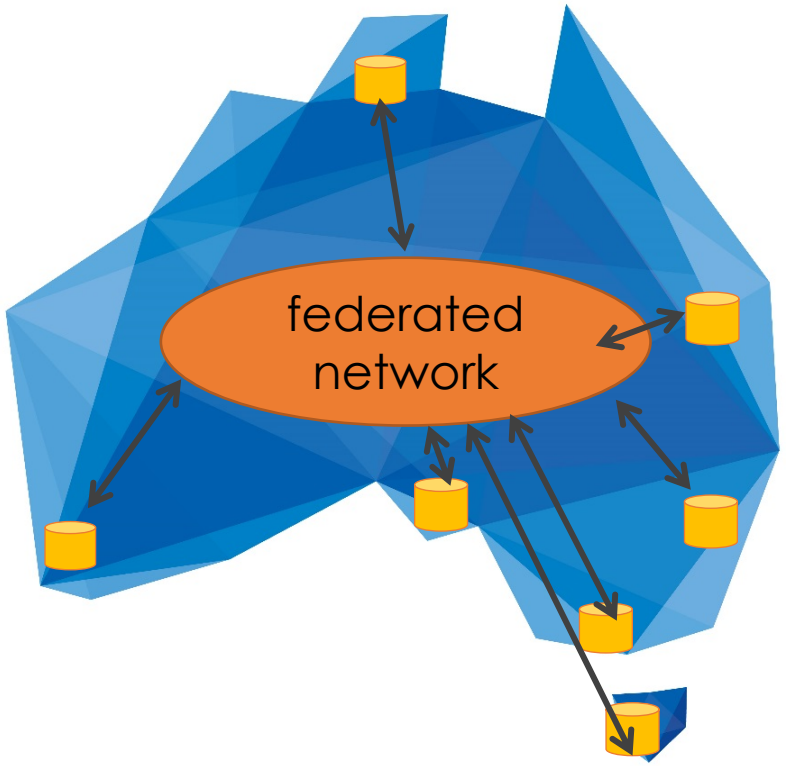
National Approach to Data Federation & Analysis

PROGRAM 2

IDENTIFED HEALTH DATA
State-based repositories



RE-IDENTIFIABLE HEALTH DATA
Accessible with consent through a secure federated network

Software tools

INTERNATIONAL SHARING

Matchmaker Exchange

Beacon Network

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National Approach to Data Federation & Analysis

PROGRAM 2

Clinical variant classification guidelines for consistency and sharing

Genotype/ Phenotype national data resources

- Framework for capturing phenotype-genetic variant associations

Accurate Phenotype information

- Reference ontology for phenotypic information
- Linking with standards developed internationally and expanded locally

Common framework for pipelines

Data Sharing

- Piloting national infrastructure and governance to allow the ethical sharing & querying of standardised clinical genomic data

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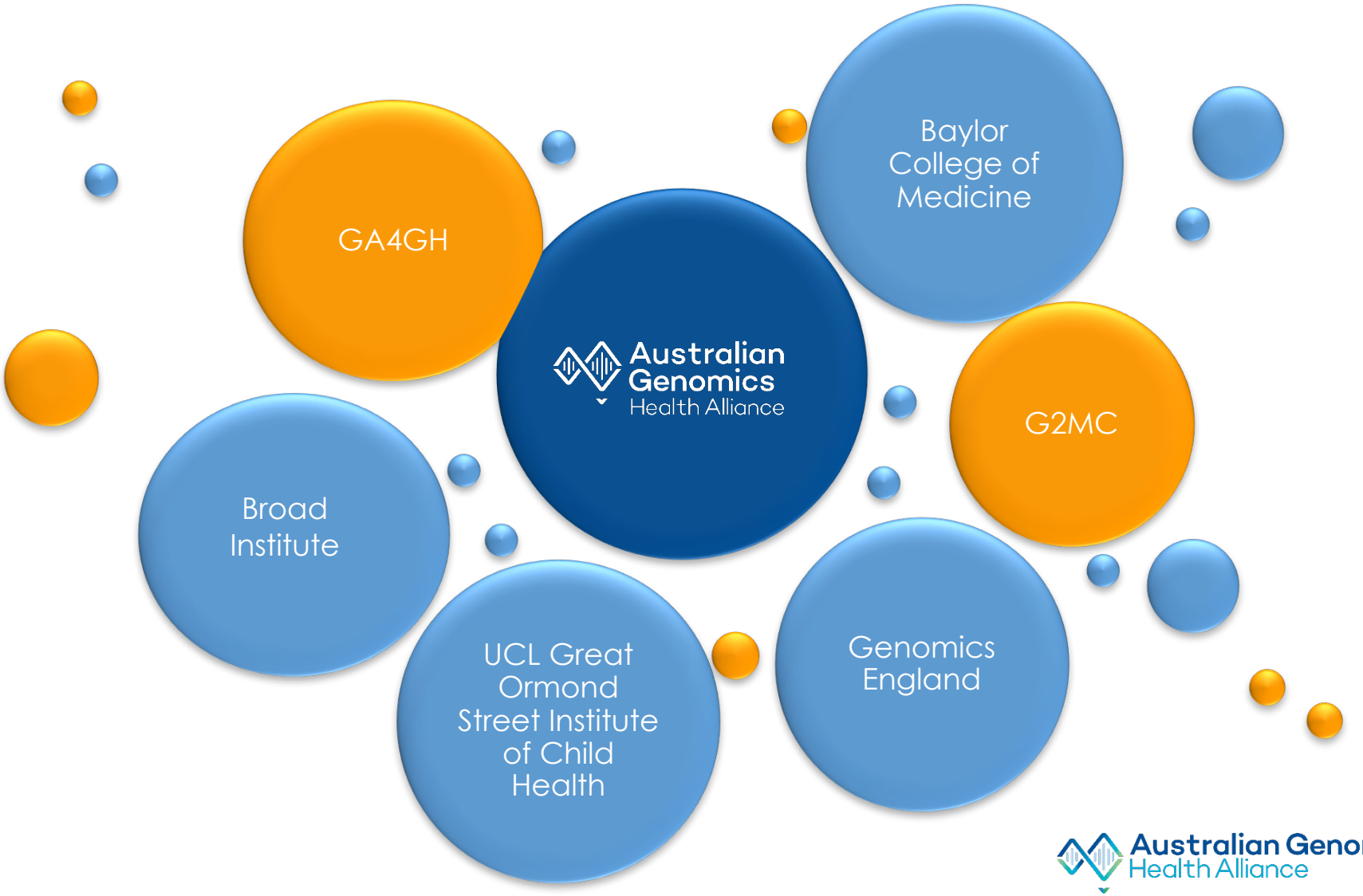
Program 2: Linkages
INTERNATIONAL & GLOBAL INITIATIVES



Health Economics
PROGRAM 3

Evaluation of diagnostic approach:

- Rate of diagnosis, time to diagnosis, cost effectiveness, optimal timing, clinical utility.

Direct Health outcomes:

- Prevention, early intervention, surveillance, therapy

Indirect Health and Social outcomes

- Quality of life and cost burden of disease (health service costs, home modifications, respite care, welfare dependency).

Policy
PROGRAM 3

Robyn Ward

Development of policy relating to genomic medicine:

- Scalable, Equitable, Accessible & Cost Effective

Australian Genomics National Implementation Committee

- Chair: Deputy Secretary, Australian Government Dept. Health

- Representatives from Aust. Health (State & Fed)Ministers Advisory Committee, Med. Services Advisory. Committee Pharmaceutical Benefits Advisory Committee

Context: National Health Genomics Policy Framework

Implementation Science PROGRAM 3

Jeffrey Braithwaite

- **Identifies and overcomes the barriers for adoption** of research
- **Promote uptake of genomics** into routine healthcare in clinical, organisational and policy contexts

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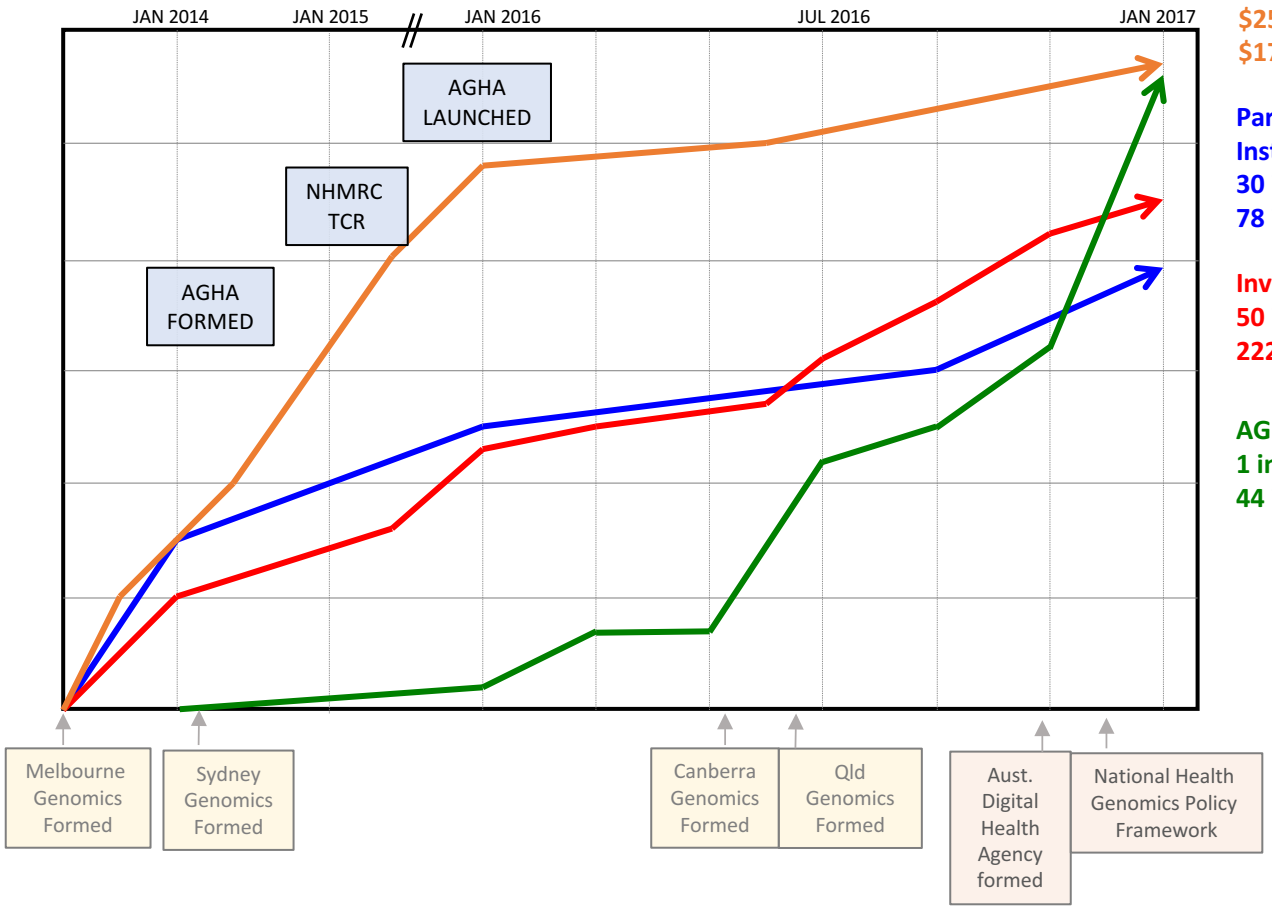
Workforce, Education & Ethics
PROGRAM 4

- **Needs assessment (education and training)** of health professionals whose role will be impacted by clinical genomics.
- **Mapping current education and training activities** available to Australian health professionals and gaps.
- **Developing a general evaluation framework** for continuing professional development in genomics.
- **Conducting ethical analyses of clinical genomics**, such as data sharing, uncertainty, incidental findings and consent.

Evolution of Australian Genomics



Leverage
$25M in 2014,
$175M in 2017

Partner Institutions
30 in 2014,
78 in 2017

Investigators
50 in 2014,
222 in 2017

AGHA Staff
1 in 2014,
44 in 2017