EXECUTIVE SUMMARY

AUSTRALIAN GENOMICS

THE FIRST FIVE YEARS

Australian Genomics

FOREWORD

Australian Genomics set out to build the evidence and inform policy to support the integration of clinical genomics into mainstream healthcare. It was the first time a program of this complexity and size was attempted in Australia.

At our inception, access to genomic tests in Australia was erratic; human genomic testing was mostly used in research or in specialised centres; wait times for results were long; genomic data was siloed, and patient experience was inconsistent.

Over the past five and half years we have risen to these challenges.

We have demonstrated how patients benefit from the application of genomic diagnostics in a wide range of rare diseases and cancers. We have shown the personal value to patients and their families and the cost benefit to the Australian health system. We have taken the research and applied it in clinical practice where the profound effects of a diagnosis can be realised.

At the same time, we have tackled the inconsistencies and fragmentation across jurisdictions to deliver nationally consistent systems and processes that promote greater collaboration at a national, state, institutional and clinical level. And we continue to expand our international reach, strengthening global alliances and our capacity to share information.

Behind these achievements are hundreds of extraordinary people, committed to seeing clinical genomics become standard of care in Australia. Most importantly, our work has been enabled by more than 5000 patients who generously agreed to participate in our research. I look forward to the next stage in this transformation of genomic medicine.

Professor Kathryn North AC
Lead, Australian Genomics
Director, Murdoch Children's Research Institute

OUR IMPACT

5000
Patients recruited / genomic testing

103
Organisational partners

32
Recruitment sites

450
Collaborators & Investigators

117
Jobs created

55
PhD / Masters research students trained

$25 million
Research funding

19
Cancer & Rare Disease studies

119
Peer-reviewed papers

21
Reports

115
Ethics & site submissions per year

23
Sub-projects in Genomic Health Service Delivery

685
Presentations

41
Workshops & conferences

80
Contracts per year

10
Advisory Boards

AUSTRALIAN GENOMICS: THE FIRST FIVE YEARS

Australian Genomics was launched as the Australian Genomics Health Alliance in 2016 with a $25 million grant from the National Health and Medical Research Council (NHMRC) after a Targeted Call for Research. The initial grant from 2016 to 2020 was extended to 30 June 2021 due to the impact of COVID-19. This report marks the completion of that grant.

Australian Genomics has achieved the aims set out in the funding call and identified and delivered additional projects. We have developed a robust base of clinical and economic evidence to inform the use of genomics in numerous clinical areas in a nationally consistent manner. While the impact of COVID-19 was felt, we were able to adapt where necessary. Importantly, research recruitment continued, enabled by switching to telehealth and eConsent.

During our first five years Australian Genomics grew to include 32 clinical sites, 103 organisational partners, and 450 investigators and collaborators. Through our 19 research flagships spanning rare disease and cancers, we recruited more than 5000 study participants who provided us with real time data for applying genomics to clinical practice.

AUSTRALIAN GENOMICS: THE FIRST FIVE YEARS CONT...

The four program areas that ran in parallel to the research flagships have built the evidence to inform policy and practice for a nationally consistent approach to using genomic testing in mainstream healthcare. That infrastructure includes many tools and resources now being exploited by a national and international network of researchers, clinicians, and healthcare services.

The adoption of a federated model for Australian Genomics has proved successful, particularly in negotiating a national approach across jurisdictions in a nation where responsibility for health is shared between the states, territories and commonwealth governments. The model has been cited as an international exemplar.

A NATIONAL DIAGNOSTIC AND RESEARCH COMMUNITY

In 2015 diagnostic genomics across Australia was poorly coordinated and highly variable across states and territories, resulting in inequitable access to services and cost inefficiencies.

In response to this fragmentation Australian Genomics formed a national diagnostic and research community to build disease-focused networks and evaluate the use of genomics in specific clinical contexts and, where appropriate, develop approaches to inform their sustainable implementation into clinical practice. It drew on the expertise of its members to develop resources and conduct projects of significant value to the genomic community.

These included:

- Standardised best practice approaches to clinical and research consent
- Guidelines for mainstreaming genomic pathology reports
- Mechanisms for sharing and resolving discordance in clinical variant classification and disease specific gene lists
- Improved community awareness and consumer support of genomics
- The establishment of a national functional genomics network for resolution of variants of unknown significance
- Evaluation of the unmet needs for genomic testing.

National Partners
Australian Research Data Commons
Australian Biocommons
BioPlatforms Australia
Breast Cancer Network of Australia
Centre for Genetics Education
Childhood Dementia Initiative
CSIRO
Genetic Alliance
Human Genetics Society of Australasia
InGeNA
Mito Foundation
National Computational Infrastructure
Omico
The Poche Centre for Indigenous Health at the University of Sydney
Rare Cancers Australia
Rare Voices Australia
Syndromes Without a Name Australia
The Royal College of Pathologists Australasia
Zero Childhood Cancer

International Partners
Broad Institute
Canadian Institute for Health Research
ELIXIR
European Genome-Phenome Archive
GEM Japan
Genomics England
H3Africa-Bionet
Oxford University

Global Partners
Global Alliance for Genomics and Health
World Economic Forum

Key activity hubs

Northern Territory
Royal Darwin Hospital

Western Australia
Genetic Services of Western Australia
Harry Perkins Institute of Medical Research
PathWest Laboratory Medicine
Telethon Kids Institute
University of Western Australia

Queensland
Genetic Health Queensland
Institute for Molecular Bioscience
Queensland University of Technology IHBI
QIMR Berghofer Medical Research Institute
The University of Queensland
Townsville Hospital and Health Service
Pathology Queensland
Brisbane Diamantina Health Partners

New South Wales
Australian Institute of Health Innovation, Macquarie University
Centre for Genetics Education
Children's Medical Research Institute
Garvan Institute of Medical Research
Hunter Genetics – Genetics of Learning Disability Service
Macquarie University
NSW Health Pathology
Royal North Shore Hospital
Sydney Children's Hospital Network
The University of Sydney
Victor Chang Cardiac Research Institute
UNSW Sydney

South Australia
Central Adelaide Local Health Network – SA Pathology
Royal Adelaide Hospital
South Australian Health and Medical Research Institute
The University of Adelaide
University of South Australia
Women's and Children's Hospital Adelaide

Australian Capital Territory
Australian National University

Tasmania
Tasmanian Clinical Genetic Services
University of Tasmania

Victoria
Deakin University
Genetic Support Network of Victoria
Gen V
Melbourne Genomics Health Alliance
Melbourne Health
Monash Health
Monash University
Murdoch Children's Research Institute
Peter MacCallum Cancer Centre
Royal Children's Hospital Melbourne
The University of Melbourne
Walter and Eliza Hall Institute of Medical Research

TRANSLATION

The clinical impact of the national diagnostic network is significant: of the 5000 patients recruited for genomic testing across 19 clinical studies over the course of the grant (108 per cent of the initial target) many received a genetic diagnosis that would likely have taken much longer using traditional diagnostic processes. In the cancer flagships 45 per cent of participants received actionable findings. Across the rare disease flagships, the average diagnostic rate was 35 per cent.

While the impact of genomic testing became evident throughout the term of the grant and significantly increased diagnostic rates, an overriding tenet of our work has been to make it accessible and equitable. That is why Australian Genomics was at the forefront of a push to obtain federal funding for clinical genomic tests. Our application to the Medical Services Advisory Committee (MSAC) seeking Medicare funding for genomic analysis for childhood syndromes and intellectual disability was the first of its kind.

In August 2019, MSAC recommended funding a modified version of the application. Genetic testing for childhood syndromes and intellectual disability was subsequently approved for listing on the Medicare Benefits Schedule from 1 May 2020. This is expected to benefit 3000 families a year. Australian Genomics members continue to be involved in other MSAC applications under development or in progress.

PATIENTS RECRUITED
5000

CLINICAL STUDIES
19

CANCER FLAGSHIPS:
45% **RECEIVED ACTIONABLE FINDINGS**

RARE DISEASE FLAGSHIPS:
35% **DIAGNOSTIC RATE**

Four key projects were among those building a body of evidence to inform national policy decisions: health economics, implementation science, policy and ethics. These evaluations worked across the clinical flagship studies to generate evidence for the clinical translation of genomic testing. Health economics research explored the cost-effectiveness and cost-benefit of genomic sequencing compared with traditional diagnostic investigations in different settings, including paediatric critical care, renal genetic conditions, and mitochondrial conditions. Implementation of genomic sequencing in Australia for critically ill children and children with mitochondrial conditions was found to lead to an annual net benefit for the Australian healthcare system and society of $10.6 million and $1.2 million respectively.

TRANSLATION CONT...

The implementation science team facilitated the translation of research findings into clinical settings. Working with clinical flagships and collaborating organisations, researchers identified the challenges of transitioning genomic testing into standard of care and built enablers to address these, including for non-genomic specialists.

The ethical, legal and policy issues surrounding genomic technologies are immense, particularly in relation to privacy and data sharing. Research in this program investigated issues in current contexts, including existing regulation for governing genomic data sharing. It produced policy recommendations and engaged in national discussion around many of the complexities associated with genomic medicine, such as the use of genetic information in life insurance assessment, 'ownership' of genomic information, and optimised informed consent.

Another program area focused on the preparedness of the healthcare workforce to implement genomics into clinical practice. After identifying gaps in knowledge and capacity among genetic specialists and non-genetic specialists, researchers developed tools and resources to address the knowledge gap. These include an international set of standards for consistent reporting of design, development, delivery, and evaluation of genomics education interventions. The standards have been endorsed by several international bodies, including the Global Genomics Nursing Alliance.

DATA INFRASTRUCTURE, MANAGEMENT AND ACCESS

More than 100 million genomes are expected to be sequenced by 2025. To manage data of this scale and complexity, genomic medicine needs high-performance computing; data storage infrastructure; and local and national services for data access and exchange.

Australian Genomics developed data standards and processes to capture and use clinical and genomic data from across Australian clinics and laboratories, to support the activities of our clinical Flagship studies. In addition, these activities informed a coordinated, national approach to generating, processing, curating, storing and sharing genomic and related clinical data. This has occurred across four key areas of activity:

- Storage and access of genomic data
- Standardisation of genomic and clinical data
- A national genotype-phenotype database
- Improved clinical standards for interpreting genomic variants

Among the high-impact developments to emerge from this program is a live national platform Shariant which has enabled variant-level information sharing across borders, with 10 participating diagnostic laboratories from four states. The Shariant database has grown to more than 7400 curated variants submitted by laboratories.

A new open online platform, PanelApp Australia, was developed for gene and virtual gene panel curation. Launched in late 2019, it now hosts about 250 virtual gene panels, many of which were developed by Australian Genomics rare disease flagships. Modelled on the Genomics England version, the platform has served to share knowledge between diagnostic laboratories and improve evidence-based practice, facilitating the resolution of more than 2000 discrepant gene curations nationally and internationally.

DATA INFRASTRUCTURE, MANAGEMENT AND ACCESS CONT...

In a first for Australia, we developed a platform to enable study participants to make choices in real time about how their data is used for future research. Dynamic consent, as it is known, is a powerful tool and was made possible through the creation of a platform called CTRL (Control). Standardising data use conditions in this way eliminated ambiguity in data use permissions and streamlined complex data sharing processes.

Many other tools and resources developed throughout the grant are now available to the wider research community, members of whom are using them to support their own projects. They include data capture instruments and data sets, patient support materials, guidance on research ethics and governance, and publications. A full list can be found here https://www.australiangenomics.org.au/tools-and-resources/

INTERNATIONAL ENGAGEMENT

Australian Genomics' international partnerships and collaborations have burgeoned since 2016. We continue to work with international data consortia to promote uniform standards and practices around data capture, access and sharing. These global data facilities are critical to understanding the genetic basis of disease, particularly rare diseases.

As a Driver Project of the Global Alliance for Genomics and Health (GA4GH) – a network of more than 600 organisations across 100 countries - Australian Genomics informs the development of tools and policies for data sharing, tests them under real conditions and supports the dissemination of best practice locally. Genomics England and Australian Genomics formed an offshoot of the GA4GH, the Genomics in Health Implementation Forum (GHIF). The Forum, which meets at least twice a year, provides a platform for large-scale genomics initiatives to share resources and expertise. We hold senior leadership positions on both the GA4GH and the GHIF.

Ongoing collaborations with Genomics England and the World Economic Forum have contributed to the harmonisation of data capture, data exchange, and the co-development of platforms.