



# Enabling digital health in Australia and the world

Our Australian e-Health Research Centre is leading the way in interoperability, virtual care, and precision health – all underpinned by the power of artificial intelligence.

## Two decades of digital health solutions

The Australian e-Health Research Centre (AEHRC) is the digital health program of Australia's National science agency, CSIRO. For the past two decades we have delivered digital solutions to Australia's greatest health challenges.

Our scientists conduct research and develop scalable, real-world products and services to support industry, governments, and clinicians to deliver efficient and effective healthcare and health systems.

We are recognised by health systems in Australia and across the globe as leaders in digital health research, tool and platform development and implementation. Our software is used in around the world including the UK, Europe, Asia, and the US.

## The pillars of digital health

We recognise the digital transformation of healthcare depends on the development of four broad areas or pillars of digital health:

- virtual care
- precision health
- interoperability.

All our technology in this area is underpinned by the power of artificial intelligence.



## Interoperability

**The quality of information in healthcare is critical to the delivery of safe and effective health care.**

Data quality is essential for healthcare organisations to make informed decisions and provide patients with the best possible care. Our technologies enable interoperability, advanced and effective use of data captured in electronic medical records, through the development of products and services to support use of clinical terminologies such as SNOMED CT and interoperability standards such as FHIR®.

### Ontoserver

Our clinical terminology and FHIR® enabled products are used globally to support the advanced use of SNOMED CT, management of value sets and maps and syndication of clinical terminologies.

Ontoserver provides the foundation of the Australian Digital Health Agency's (ADHA) National Clinical Terminology Service (NCTS) and the UK NHS Clinical Terminology Service.

The NCTS provides state of the art terminology services that promote implementation and adoption of national clinical terminologies in Australia.

As part of the NCTS, a licensing agreement between the ADHA and CSIRO enables public and private health sectors to access Ontoserver for free in Australia.

## Sharing data, not documents

Historically, clinicians shared information with each other by sending a letter or discharge summary – a document that embeds key data and provides contextual information relevant to care ('content' in 'context').

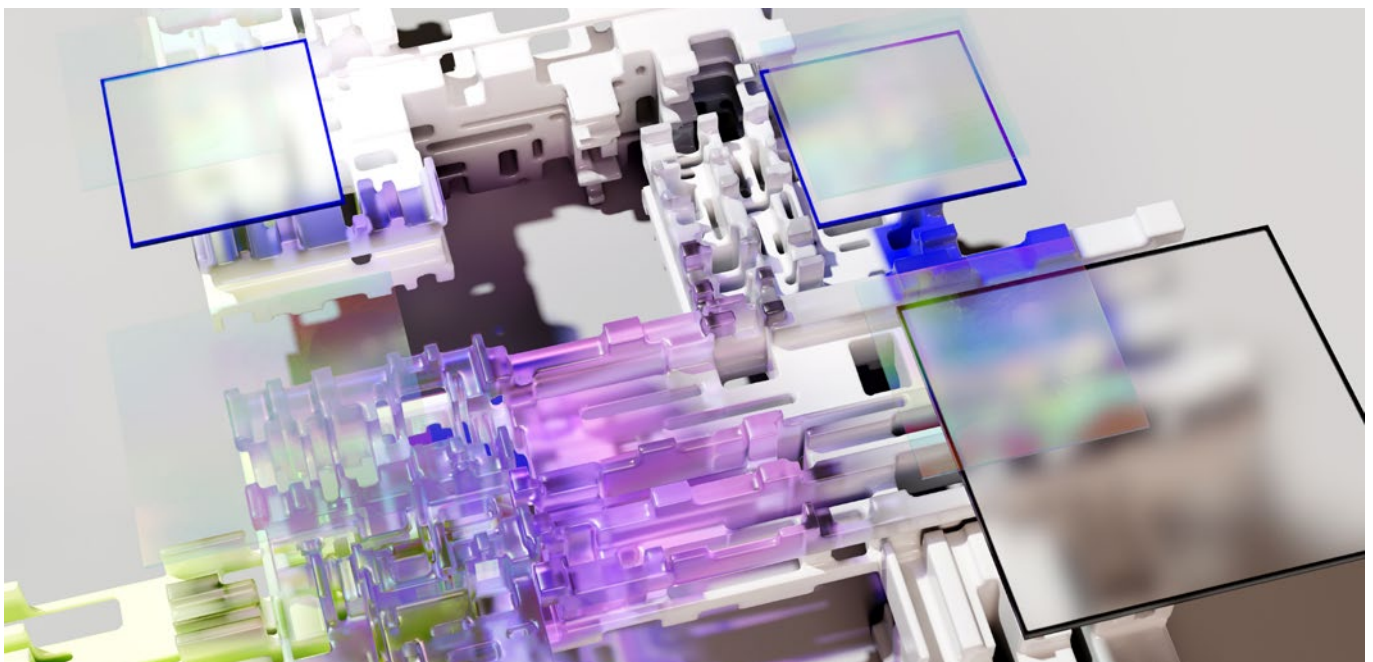
Over time, this information exchange transitioned from paper to electronic, but the format remained as a document.

In the digital world, the recipient often wants to extract key data from these documents for computation. However, sharing data out of context can result in misinterpretation.

FHIR APIs enable accurate sharing of this content.

The CSIRO Australian e-Health Research Centre (AEHRC) has been working with government and industry stakeholders over a number of years to agree on a Fast Healthcare Interoperability Resources (FHIR)R Implementation Guide for primary care practice to practice exchange of health records.

Building on this work, as part of the 2023–24 Federal health budget, CSIRO has been funded to support the Department of Health and Aged Care, Australian Digital Health Agency and HL7au to provide coordination and subject matter expertise to accelerate the development of national FHIR standards. Through a collaborative FHIR Community Process CSIRO will develop an Australian (AU) Core FHIR Implementation Guide and eRequest FHIR Implementation Guides to support the use of FHIR in an Australian context.



## Virtual care

**Access to virtual care depends upon technology based on broadband and mobile technology. Our Health Services group delivers innovative technology to overcome the burden on health services and consumers.**

Our expertise includes mobile technology, home monitoring, telemedicine in rural and remote areas and wellbeing and behaviour change.

We are testing technologies to improve health services for people living in various settings, and from various backgrounds and life experiences.

### **Mobile platform for gestational diabetes support**

We've developed and trialled a mobile health platform to help women and clinicians better monitor and manage gestational diabetes mellitus (GDM).

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The platform, called M♡THER, replaces a traditional paper-based diary system. Women can record information in a smartphone app such as blood sugar levels, blood pressure, weight, diet and exercise.

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Information is uploaded by women to the linked clinician portal, so their dietitian, diabetes educator, midwife and obstetrician can monitor their progress in real time and intervene if required.

The app also includes educational resources to help women understand and manage GDM.

Further implementation studies are also underway at Logan Hospital and Royal Brisbane Women's Hospital.

### **Leveraging technological know-how with next-gen sensors**

Harnessing the rapid development of sensor technology, we are currently exploring a range of emerging smart and intelligent sensors, sensing architectures, and machine learning approaches that can be pervasively integrated with digital care programs, resulting in targeted data collection and remote health monitoring while preserving the privacy of users.

## Implementing our science

Health Implementation Science take a systematic approach to identifying barriers and enablers to the implementation of virtual care interventions. We use a rigorous and scientific approach to demonstrate the effectiveness of our implementation methods.

Our work often involves conducting co-design workshops where we take theory informed recommendations and bring them to life in the relevant context with facility input. This process encourages buy in and collaboration, which we turn into successful outputs, outcomes and impacts such as increased uptake of virtual care interventions and practice change.

## Precision health

Precision medicine is a broad term that encapsulates treatment and prevention of disease through tailored biophysiological information.

Traditional modes of prevention and treatment focus on the best outcome for the largest groups of people, which usually results in at the least a small failure rate. With precision medicine, treatments are determined by personalised information about the individual, often at the genetic level.

Precision medicine allows us to know about the patients first before we treat them.

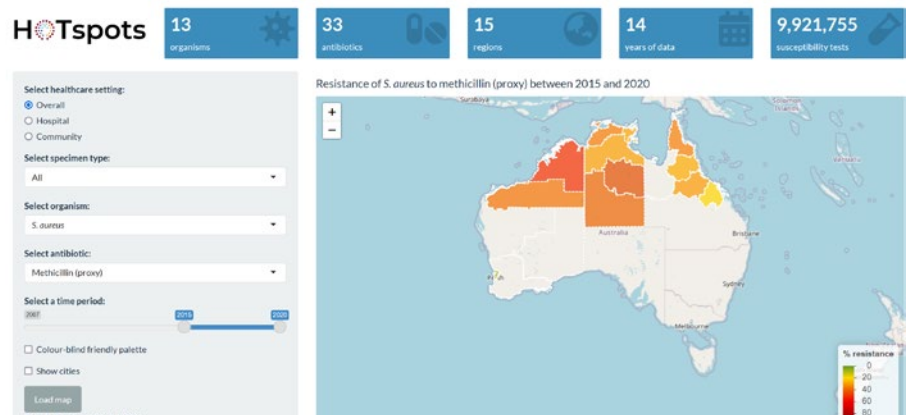
We don't drive innovation alone. We work with partners to further their application. We partner with governments and industry to drive scalability via cloud computing; machine learning to analyse big data sets and using hardware together with algorithms to find the answer to our collaborators' specific questions.



## HOTspots

The HOTspots platform uses artificial intelligence/machine learning to harmonise disparate surveillance datasets across One Health sectors. One Health combines information about microbial populations in human, animal, and environmental hosts.

This technology will permit a deeper understanding of the geographical variation of AMR in Australia and provide insights into new and innovative strategies to mitigate the AMR threat across human and animal populations and the environment.



## Newborn screening

Reproductive carrier screening tests are important as the CF-causing gene is passed down from both parents who usually do not have the disease themselves.

Together with gene testing lab Genepath and Pathology Queensland, we analysed data from 3958 people between 1970 and 2020 with cystic fibrosis, an inherited disorder that causes severe damage to the lungs, digestive system and other organs in the body.

The aim was to reveal whether current guidelines for carrier screening require changes due to shifts in the ethnicity of Australia's population.

We found that people of East Asian ethnicity are disproportionately affected by limitations in testing guidelines which recommend testing a small number of high frequency variants.

## AI and Alzheimer's disease

AEHRC supports Australia's Alzheimer's disease (AD) research cohorts analysing longitudinal imaging, biomarker and clinical data analytics of over 2000 patients. Through AI and machine learning, we support researchers and clinicians in diagnosis and early intervention management of Alzheimer's disease.

Current diagnosis of pre-clinical Alzheimer's disease is difficult because there are very few biological markers with high accuracy.

The Biomedical Informatics Group at the CSIRO Australian e-Health Research Centre (AEHRC) is developing key technologies for in vivo quantitative assessment of tau and amyloid- $\beta$  ( $A\beta$ ) deposition. There are suspected to be early markers of AD.

With this work, we've shown that  $A\beta$  starts to accumulate in the brain 20 years before the onset of the clinical symptoms of AD, providing a broad window where potential interventions can be performed.

## Artificial intelligence

**Artificial intelligence is set of tools and techniques that we can use to help health services, clinicians and researchers deliver improved healthcare.**

AI tools are critical to healthcare because they can be used to improve the safety, quality, efficiency and accessibility of Australia's healthcare system. Our digital technology is underpinned by AI, which offers data analytic capability, clinical decision support and improved health system efficiency.

From genomic engineering to independent living, AEHRC is using artificial intelligence techniques and machine learning approaches now to overcome the challenges facing the healthcare system of the future.

As Australia's national science agency, CSIRO is solving the greatest challenges through innovative science and technology. CSIRO. Unlocking a better future for everyone.

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