Integrated **action**

Aridhia leads the way in the development of systems to manage chronic disease. Here, company members introduce their innovative work

L-R:

Dr Rachel Knight (Chief Medical Specialist)

Dr Catherine Kelly (Medical Director)

Rodrigo Barnes (Chief Technology Officer)

Dr Andy Judson (Director of Data Science)

Could you outline the background to and vision behind Aridhia?

CK: Aridhia is a young biomedical informatics company founded by David Sibbald, a successful business entrepreneur, and Professor Andrew Morris, Consultant Diabetologist and Head of the Biomedical Research Centre in Dundee, UK. They aimed to bring together their collective experience in medical informatics, high-performance computing and analytics for the benefit of healthcare.

Aridhia's main focus is to support the management of chronic disease through the use of informatics. These chronic diseases include diabetes, cancer, and respiratory and cardiovascular disease, all of which have an increasing global prevalence.

RK: We are also trying to create a multidisciplinary team which includes partners from clinical, technological and research backgrounds. Aridhia is working to resolve the gap between healthcare data collection/collation and the application of focused analysis. This will inform clinical practice, service design and linkage to research.

What is understood by the term 'stratified medicine'?

AJ: Stratified medicine constitutes observational, clinical and genomic data for a large group of patients and is used to predict the most effective treatment regimes. Its aim is always to support improved treatment decisions through a better understanding of what has happened to similar patients in the past. As a methodology, it could help us move from a reactive to a proactive care delivery model.

Could you outline the concept of integrated care and how it relates to Aridhia's vision?

RK: Integrated care is the facilitation of appropriate, timely and accurate communication and coordination between a number of varied care providers. This is particularly pertinent for patients suffering with one or more chronic diseases. By integrating clinical data from a variety of pertinent clinical systems that hold data on these patients, an holistic overview of the patient's care pathway can be shared across organisational boundaries.

AJ: Although there are an increasing number of IT systems and technologies that capture or store healthcare data, this information often remains in silos and is not linked, curated or analysed. Our services are designed to help squeeze the most value out of this data. This gives clinicians the data they need at the point of care, but also enables health system regulators, providers and policy makers to make informed healthcare decisions. That's truly integrated care.

Has a collaborative approach proved important to the success of Aridhia?

CK: Every project we undertake is a collaborative process. Each individual, institution or company can learn from others, and that's why we work the way we do. Healthcare is undergoing a dramatic evolution and, if we're going to get things right, close

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We partnered with Pivotal, as their Pivotal One platform promises a faster, more productive way to develop applications with big data. We're now working closely with Life Technologies to provide the biomedical informatics platform and DNA sequencing technology that drive discovery and genetic analysis.

What are Aridhia's plans for the future?

RB: Our experience to date suggests that there are a range of similar issues at play in any given environment. There is also a willingness to pool the experience of healthcare operations and academic research to find more effective treatments and pathways of care. We hope to contribute to an expanding body of knowledge that incorporates datasets and analytic methods to help tackle the problems of chronic disease management.

AJ: Working at Aridhia you sometimes feel ahead of the curve, relative to what national health services are asking for right now. Aridhia's focus for the coming years is to build a portfolio of analytics and informatics products and services. These range from disease-specific patient profiles and population-based quality performance indicators, to survival modelling and risk stratification with a library of predictive models and statistics research conducted in a safe and secure environment.

Healthy partnerships

International Innovation looks at four Aridhia collaborations and the impact they are having on the ground

KUWAIT HEALTH NETWORK

Providing healthcare professionals with the information they need to demonstrate the quality of care they are delivering to patients with diabetes and its complications, and to identify areas where care could be optimised

The system includes:

• A diabetes disease registry which enables healthcare professionals to track and monitor their own patient population. This provides accurate and up-to-date information about the true prevalence of diabetes across specific regions and country-wide

• Patient profiles, where key information required for clinical outcomes can be entered and viewed on the system. The patient profile includes the subset of laboratory results which are commonly used to monitor diabetic control and risk of future complications

• Analytical services, which allow healthcare professionals to view their organisation's achievement of recommended Ministry of Health standards of care through a range of charts, reports and infographics

The system has been developed collaboratively with colleagues from Dasman Diabetes Institute and the heads of four Primary Health Centres within the capital region – Abdulla Al Salem, Al Sager, Nuzha and Shuwaikh – as well as with support and input from laboratory clinicians working at Amiri Hospital, Al Sager and Dasman Diabetes Institute.

The full system went live in the four Primary Health Centres in early 2013, bringing the benefits of an integrated care record to the capital region's diabetic patients.

KUWAIT SCOTLAND EHEALTH INNOVATION NETWORK

Nominated as 'International Collaboration of the Year' in the Times Higher Education Awards 2012

Aims:

• Effective and safe treatment of patients through real-time integration of clinical and administrative services for disease management, audit and governance

• Capacity-building through training and development of staff

• Scientific advancement through engagement with international research community

In addition to the delivery of the Kuwait Health Network system, there are now also over 100 Master's students on the University of Dundee-accredited degree programmes working in healthcare in Kuwait, mainly in primary care, where they are applying this learning directly in clinical practice.

Partners: Ministry of Health of the State of Kuwait, Dasman Diabetes Institute, the University of Dundee, NHS Tayside

DECIPHER HEALTH

Delivering a scalable informatics platform that will support linked phenotype-genotype datasets from consented patient cohorts from Lothian and Tayside across a range of cancer types

The system will include:

• A set of Clinical Analytical Services, which enables healthcare professionals to gain a cancer-focused view of clinical patient information at different stages of the cancer pathway; obtain insights into local clinical outcomes; and demonstrate achievement of national cancer quality performance indicators

• A Research Analytics system, which will deliver a platform where owners of clinical and genomic datasets and researchers can collaborate in a sustainable, secure environment which meets the elastic computing, analytical and statistical requirements to deal with big data

• Bi-directional flows of data between the clinical and research environments

Every year, about 30,000 people in Scotland are told they have cancer, and trends predict that the number is likely to rise to almost 35,000 between 2016-20. The Scottish Government has given DECIPHER Health its full backing, highlighting it as a major milestone in the advance of personalised medicine, and an accolade for Scotland's life sciences sector.

NHS SCOTLAND

Delivering a range of analytical services focusing on quality improvement, patient care and information governance

Working with a range of senior academic and clinical experts from across a range of specialities, the project has developed a range of analytical services including:

• A patient and cancer tracking solution at NHS Tayside and NHS Fife which integrates a variety of data sources for use by administrative staff

Coverage: This solution tracks all patients referred or admitted to secondary care facilities, from within a population of 800,000 patients across the two NHS boards. Cancer Tracking alone currently monitors 17,000 patients.

• A Risk Stratification application currently in use in general practice in NHS Tayside and NHS Grampian which provides a portfolio of risk scores for chronic disease in the over 40's

Coverage: Currently live in 30 GP practices across the two NHS boards, covering over 100,000 patients.

• The Data Driven Quality in Prescribing project is a clinical trial in NHS Tayside and NHS Fife featuring real-time data integration and analysis to improve safety and quality of medicine prescribing in primary care.

Coverage: Live in 39 GP practices across the two NHS boards, covering almost 240,000 patients.

Clinically led, **technology driven**

With chronic diseases a growing concern among the medical industry, health and biomedical informatics company **Aridhia** is spearheading the development of novel analytics through a truly collaborative approach

CHRONIC DISEASES ARE the world-leading cause of mortality and morbidity, claiming 36 million lives each year. A UN summit in 2011 acknowledged that dealing with chronic diseases is a global priority, while the World Health Organization has stated that there is a pressing need for comprehensive, integrated action to reduce the burden of noncommunicable diseases. The World Economic Forum has estimated the financial burden of these diseases to be at $47 trillion over the next 20 years, placing a huge financial strain on healthcare systems.

Despite these warnings, patients with chronic diseases often fail to receive the long-term, coordinated clinical care they require. The provision of healthcare services for these patients is often fragmented, with silos of clinical information held by different care providers. This fragmentation can make it difficult to share information effectively, and to assess clinical outcomes across the entire pathway of care.

ARIDHIA

A shared ethos of using informatics to enable a more integrated approach to healthcare delivery led Dr David Sibbald and Professor Andrew Morris to form Aridhia in 2008. They believed that, if the treatment of patients with chronic diseases was to improve despite the need to deliver more care with less budget, then healthcare systems needed to be more coordinated, with data analysis used to support decision making and evaluation of outcomes. Today, Aridhia provides this integrated approach via a groundbreaking use of biomedical informatics and analytics. Through a series of collaborative projects, the team leads the way in improving the management and understanding of chronic conditions.

Describing themselves as 'clinically led, technology driven', their work focuses on linking pre-existing data from information silos to support clinical care, quality improvement and translational research, and to provide an accurate, complete understanding of chronic illnesses and the impact of treatment on clinical outcomes.

A MULTIDISCIPLINARY TEAM

What makes Aridhia particularly unique is their in-house expertise from a range of diverse fields. Medical Director, Dr Catherine Kelly elaborates: "Success requires a multidisciplinary approach and our people are our most important asset". The team comprises experts from clinical, academic, data science, computer science, health policy and information governance domains. This collaborative approach enables the group to identify innovative technology solutions that meet the requirements identified by the clinical and research communities, while understanding the specific challenges of these environments. Furthermore, the

working environment of Aridhia is dynamic, and encourages the whole team to innovate. Whether these insights are into the needs of patients, healthcare organisations, researchers or policy makers, they can all help to improve care for those with chronic diseases.

COLLABORATION

Collaboration is also central to Aridhia's approach. Working closely with other organisations has proved crucial to identifying how best to address the chronic disease challenge. Rodrigo Barnes, Chief Technology Officer, notes: "Collaboration is a complex undertaking but can be very rewarding. There is a strong trend to open innovation that reflects the underlying diversity of organisations needed to find new solutions. We know our industrial approach can enhance existing academic/health science partnerships".

The relationship the team fosters with its clients is also particularly collaborative. Each client that approaches Aridhia has their own set of needs and aims. Rather than proposing 'out-of-the-box' solutions, each programme is tailored to meet the exacting requirements. As such, the team works closely with clients to ensure that analytical services are configured to their requirements.

SUPPORTED BY ANALYTICS

Aridhia maximises the utility of data available from existing sources within a healthcare system to develop a set of linked, validated events for individual patients which follows them across organisational and institutional boundaries to provide a patient-centred view of clinical information and support integrated care delivery across health economies. These analytical services offer different ways of visualising data, including pathway analysis and clinical outcome metrics, providing population- and patient-level insights to care providers, patients and policy makers.

Further secure export of these de-identified data to Aridhia's research service facilitates linkage with other clinical, genomic or image datasets. It also provides a suite of analytical tools for researchers to investigate new models for predicting risks of disease, complications or response to treatment,

Defining roles

Aridhia's professional scope facilitates excellence in many areas

Clinical and life science professionals outline the product strategy for the business

Software engineers, developers and infrastructure services experts manage the development, testing, deployment and hosting of client solutions

The data science team brings together data from multiple sources, gathers insight and understanding, develops predictive healthcare models, tests hypotheses, helps develop ETL logic and provides anonymised research extracts

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while ensuring compliance with privacy and confidentiality requirements at all times. Critical insights gained from analysis in this research environment can be packaged up and deployed back in through the clinical analytics service, further enhancing the functionality available to clinical users.

A PLATFORM TO SUCCESS

The Aridhia Platform is unique in bridging the gap between healthcare and research analytics through the use of big data analysis.

Built using EMC and Pivotal technologies, the Aridhia Platform provides scalability in terms of user numbers, data storage and computational requirements. It integrates patient and clinical data from existing sources, and then processes and models this data before delivering it to end users via a range of analytical focused services. The Platform includes Clinical Analytics and Research Analytics services, which ensure that the data provide utility for both clinical and research professionals.

Aridhia is already using the Platform and services to improve the treatment of chronic disease around the world. As part of the Kuwait Scotland eHealth Innovation Network, the team has been working to support integrated clinical care, audit and governance of diabetes

in Kuwait, and has designed and implemented a clinical analytics service, which is currently operational within Kuwait City and scheduled to be rolled out across the country in 2014. Projects closer to the company's UK base have included a risk stratification service alongside the National Health Service (NHS) Scotland (which predicts the risk of admission to secondary care within 12 months), and the biomedical informatics platform underpinning the Stratified Medicine Scotland Innovation Centre.

FUTURE PLANS

Aridhia has very ambitious plans. It aims to continue collaborating with world-leading organisations in order to develop and roll out new clinical and research services. The company also hopes to exploit recent advances in next generation sequencing, and develop an advanced image analytics platform applying state-of-art technology innovation from big data, while also aligning current analytics with the new cancer outcomes and services dataset (COSD) and National Institute for Health and Care Excellence (NICE) guidelines in England. Alongside this, the team will continue to build the capacity, analytical and technical skills to become a global market leader in biomedical informatics, and address the global issue of chronic disease management.