

A Digital Health Hub

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BUSINESS PROGRAMME

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Welcome

Medical science and innovation is at the heart of modern civilisation, and is the cornerstone of modern healthcare. We find ourselves in an era of scientific convergence, where different disciplines are coming together to shape the way that care is provided with increasing focus on personalised and true precision medicine. The digital and “omic” revolutions which are advancing hand in hand have the potential to transform both public health, and the way we deliver healthcare and more effective disease treatment modalities in an holistic sense to individual patients.

Digital technologies are empowering people across the breadth of society to track and manage their own health whilst also enabling the healthcare industry to efficiently manage, access and analyse all the available data.

Discoveries however are not made in isolation. They are inevitably the product of collaborations, partnerships and wider team-work, often crossing international borders. Such collaborations and partnerships are essential, not

least for joining the design and supply of technology with the demands of transforming healthcare and delivering better outcomes for patients and the clinicians who care for them, but also to underpin the system effectiveness and sustainability necessary to produce those improved outcomes.

The UK government is leading the way in this field with digital health a strategic priority for the NHS. The “golden triangle” encompassed by Cambridge, London, and Oxford provides a unique life sciences and technology ecosystem which promotes the growth and adoption of digital health technologies.

Together we invite our colleagues from across the globe to collaborate with industry and academia within the region to help drive forward future health innovations and translate those into the delivery of the patient outcomes we all aspire to.

Keith McNeil, Chief Clinical Information Officer, NHS England

The digital health opportunity

How Cambridge, London and Oxford are leading the way

Digital health is transforming the future of healthcare. It is dramatically changing and improving the way in which individual citizens can track, manage and improve their health. It is enabling the healthcare industry to access patient data and open up new, faster, smarter pathways to personalised medicines. It is also an enormous market opportunity. In 2014, the global market for digital health was worth £23 billion. This is expected to nearly double to £43bn by 2018. The UK is at the heart of the global digital healthcare revolution. Its domestic market - worth approximately £2bn today¹ - makes it one of the most important.

The golden triangle of Cambridge, London, Oxford and the greater south east region of England lies at a point of unique convergence, with all the ingredients to be the world's capital of digital healthcare. It is a world-renowned life sciences cluster, comprising of multiple award-winning research institutions, thousands of talented scientists, deep experience in clinical trials, and a thriving global business and life sciences community. Similarly, London is the digital capital of Europe, ranked by the European Digital City index as the best city in Europe for digital entrepreneurs. It is a hotbed of digital talent, with 195,900 digital technology employees based in the city².

Teamed with entrepreneurial dynamism, an open regulatory environment, political support, and a national single-payer healthcare system in the UK National Health Service (NHS), the region is an ideal location for digital healthcare to flourish.

Furthermore, digital health enjoys significant political support at both national and city level. The UK government is determined to lead the way in this field and is committed to creating an attractive investment environment for it. The Mayor of London has also identified health as a key economic driver for the city and the NHS has made digitisation a strategic priority in order to reduce healthcare costs and improve patient outcomes.

Already, many of the world's most exciting advances in digital healthcare are happening in the golden triangle. Patient data is being combined with consumer apps, leading to personalised treatments as well as more effective health spending. New paradigms in patient data collection are emerging. Revolutions in data analysis are taking place.

The golden triangle is the land of digital healthcare opportunity - for clinicians, researchers, entrepreneurs, managers, academics and investors. Whether you want to recruit new talent, move your research forward, raise finance for a new product, or prepare for an IPO, the region provides the stage on which you can transform the future of healthcare.

¹ Digital Health in the UK: An industry study for the Office of Life Sciences- Monitor Deloitte, Sept15
² Oxford Economics, 2015



Cambridge



London



Oxford

Why you need to be in the golden triangle

The geographic points of the golden triangle are Cambridge, London and Oxford. The three key strengths of the region are its research, digital, and entrepreneurial ecosystems.

Within this triangle lies the digital and financial capital of Europe, leading universities and one of the world's most powerful clusters of life sciences expertise. It is an outstanding ecosystem - providing life science excellence, technological know-how, financial ingenuity and legal certainty.

It is an ecosystem that is packed close together. This dense cluster provides multiple opportunities for the talented to interact. Innovators in different disciplines and sometimes outside of the life sciences and digital sectors altogether, are collaborating to apply their knowledge to create entirely new businesses in digital healthcare. The result: fresh thinking and original ideas that are tackling some of the most difficult problems in healthcare.

A rich research ecosystem

5 out of 8 of the UK's Academic Health Science Centres (AHSCs).

8 of the UK's top 10 universities for research excellence³ – University of Oxford, University of Cambridge, Imperial College London, University College London, King's College London, London School of Economics (LSE), Institute of Cancer Research, and London School of Hygiene and Tropical Medicine.

Leading medical research organisations based within the golden triangle include the Wellcome Trust, the Medical Research Council and Cancer Research UK.

London generates more research papers than any city in the world, after Boston.

Key national networks that bring together researchers, health commissioners and providers, patient groups, local authorities and businesses include the Cell and Gene Therapy Catapult, the Precision Medicine Catapult, the Digital Catapult,

the UCL Institute of Digital Health, and the Academic Health Sciences Network (AHSN).

4 of the world's top 10 universities – University of Oxford, University of Cambridge, Imperial College London, University College London⁴.

New, world-class facilities are opened each year: the Francis Crick Institute is the new centre of inter-disciplinary translational medical research; the Alan Turing Institute is the new national centre for data science; UCL East is a major cross-disciplinary centre for entrepreneurship and innovation; Imperial West houses a huge new biomedical engineering facility, home to the 100KGenome Project and the Farr Institute.

³ as judged by REF 2014

⁴ QS World University Rankings



A flourishing entrepreneurial ecosystem

Approximately 400 commercially successful spin-outs from university/industry partnerships in Cambridge, London and Oxford.

More than £1.56bn (\$2.07bn) raised in life sciences IPOs and follow-on offerings on the London Stock Exchange in 2015.

The UK has the largest pipeline of new pharmaceutical product candidates in Europe, with over 460 in 2013.

Nearly \$900m of venture capital was invested into life sciences companies in Cambridge, London and Oxford in 2015⁵.

In 2015, London-based tech companies raised a record \$2.28 billion, a 69% increase on 2014's \$1.3 billion in funding, which itself was double the 2013 figures⁶.

\$4.4 billion invested in London's tech businesses by American VCs over the past five years - more money than anywhere else in Europe⁷.

⁵⁻⁷ CB Insights

A dynamic digital ecosystem

London is the best city in Europe for digital entrepreneurs, Cambridge and Oxford are ranked 11th and 13th respectively⁸.

UK ranks top in digital public services, digital adoption, digital business and finance in Europe⁹.

UK has the best depth of capital markets for entrepreneurs in Europe¹⁰.

UK digital adoption is the best out of 34 countries¹¹.

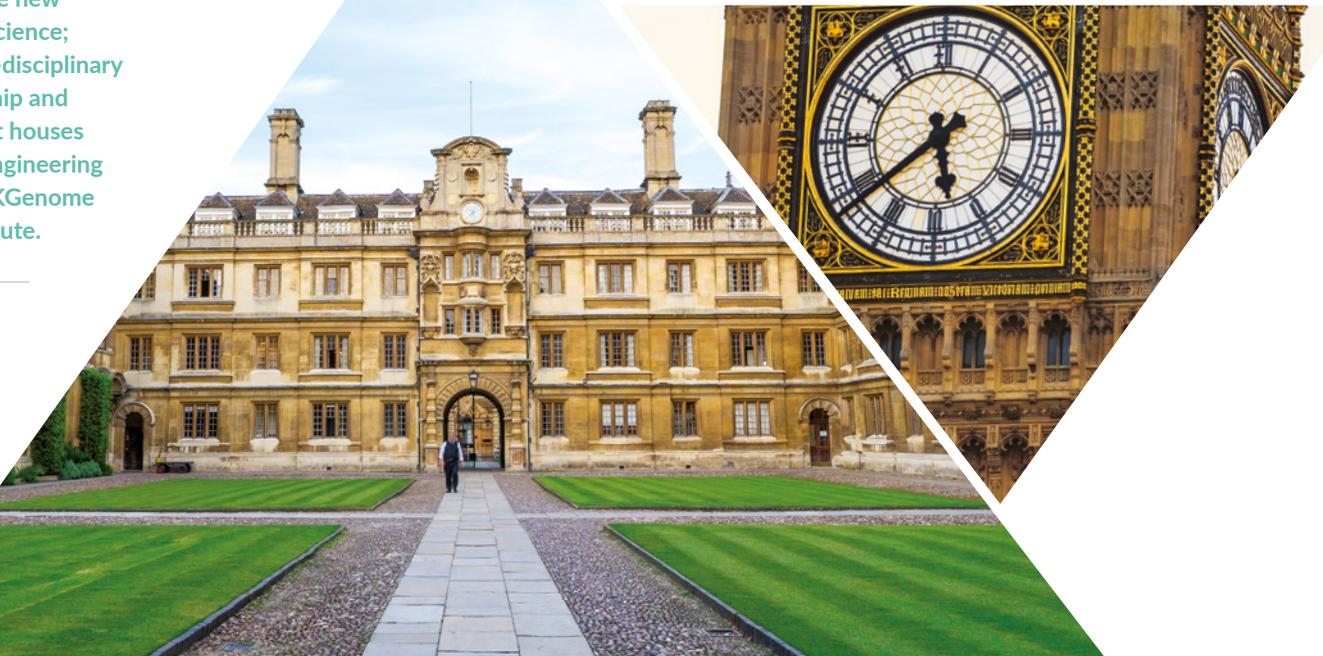
DigitalHealth.London speeds up digital health adoption by bringing together clinicians, healthcare providers, research institutes, entrepreneurs and industry to give companies a clearer route to market. It also offers an accelerator programme designed to support engagement within the NHS and healthcare sector.

The Oxford AHSN region is well-positioned to drive improvements in healthcare through development of new technologies, finding better ways of applying existing technologies and contributing to policy.

The Eastern AHSN provides a doorway into the NHS for businesses, with navigation support, facilitated access to expertise and funding, and support for individuals and collaborations.

⁸ European Digital City Index

⁹⁻¹¹ Telefonica Index on Digital Health





An ideal place to conduct clinical trials

A clinical trial hotspot, the multicultural population of the golden triangle results in a significantly diverse genetic population available in one place with which to test medications and products. The region boasts a:

- Highly diverse patient population of more than 16 million, including approximately three million born outside the UK.
- Large single healthcare system that maintains extensive patient records.
- Single point of contact for co-ordination, assessment and patient recruitment support in the National Institute for Health Research (NIHR).
- Number of people taking part in clinical trials in England has trebled over the past five years.
- A receptive environment for trialing digital healthcare services.

In a recent survey carried out by McKinsey, the UK led the way in terms of digital interaction with patients across the whole healthcare system. More than 70% of all older patients in the UK want to use digital healthcare services, dispelling the myth that it is only attractive to younger generations.

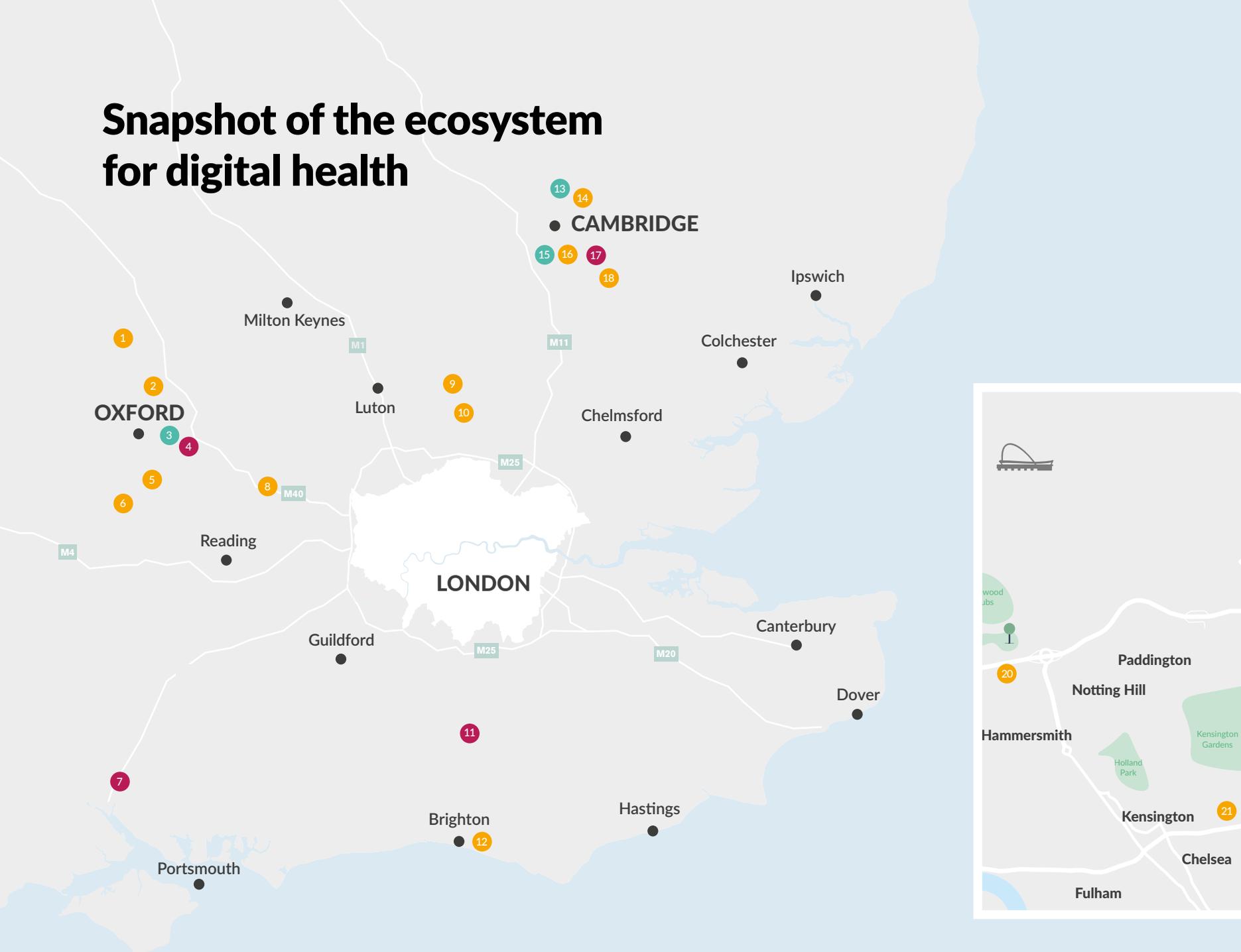
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A single payer system should be of great benefit to biomed, there is huge potential in unlocking NHS data.

Jenny Barnett, , Chief Scientific Officer
Cambridge Cognition

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Snapshot of the ecosystem for digital health



Incubators and Science Parks

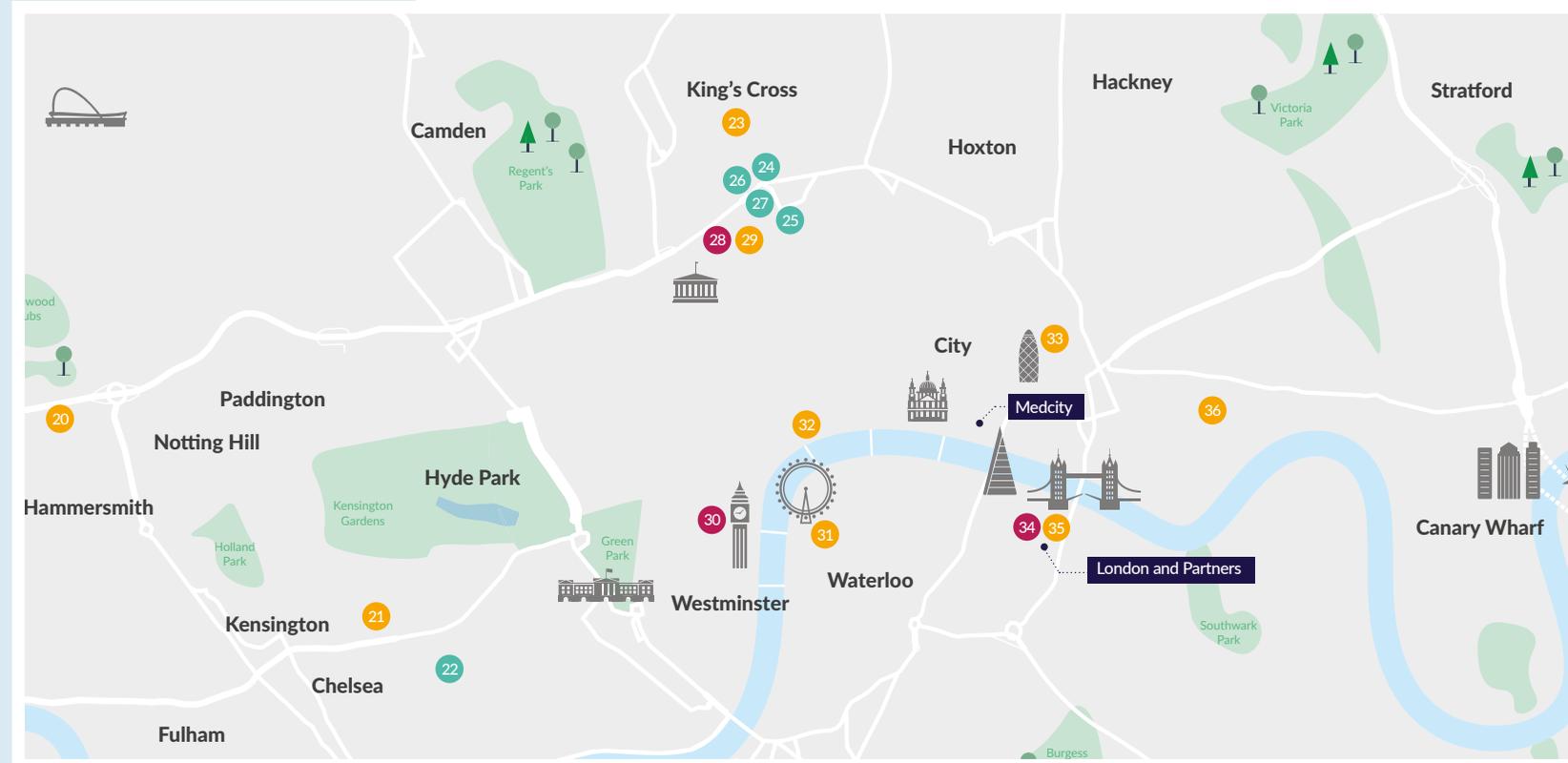
Abingdon Science Park	5	Harwell Science and Innovation campus	6	Londoneast-UK Business and Technical Park	19
Babraham Research Campus	18	Health Foundry	31	Microsoft Ventures	33
Begbroke Science Park	2	Imperial Innovations Incubator	21	Queen Mary BioEnterprises Innovation Centre	36
BioPark	10	Imperial White City	20	St John's Innovation Centre	14
Cambridge Biomedical Campus	16	Janssen Health Innovation	8	Stevenage Bioscience Catalyst	9
Cherwell Innovation Centre	1	King's Innovations	32	Sussex Innovation Centre	12
DigitalHealth.London	35	London Biosciences Innovation Centre	23	UCL Innovations and Enterprise	29

Academic Health Science Network

Eastern	17
Health Innovation Network (HIN)	34
Imperial College	30
Kent, Surrey, Sussex	11
Oxford	4
UCLPartners	28
Wessex	7

University/Research Institutes

Alan Turing Institute	24
Centre for Cambridge Clinical Informatics	15
Digital Catapult	25
Farr Institute	26
Imperial Institute of Global Health Innovation	22
Oxford Institute for Digital Health	3
Precision Medicine Catapult	13
UCL Institute of Digital Health	27



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The digital health ecosystem is now rich with opportunities in London for innovators who understand the business/transactional model of the NHS in London

Dr Sami Ansari, Co-Clinical Director
Brent CCG

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The National Health Service: a unique partnership opportunity

At a national level, the government is putting its collective weight behind the development of digital health. The NHS in England has committed to an informatics strategy to transform healthcare service delivery using technology at national and local levels. One of the key deliverables set out in this strategy is for all healthcare in the country to be paper free at the point of care by 2020. Already, all UK citizens have been given the option to access online, their most comprehensive health record, their primary care or GP record¹².

The NHS is up-skilling its workforce and introducing the **NHS digital academy** to train information officers in informatics and clinical technology. It is willing to reward innovators and investors who can help it to achieve its goals by unlocking NHS talent and expertise.

The UK government has made £4.2 billion available to support the digitisation of NHS Trusts by 2023. **The Global Digital Exemplar programme** will see 12 acute trusts act as global reference sites. They will have the necessary infrastructure for personalised medicine, use paperless eRecords and open up their APIs to digital SMEs who will be able to offer them tailored products and services. This will create an ecosystem for innovative pathways and partnerships with digital health businesses to examine how data can be used to improve operational efficiency and drive clinical outcomes for patients.

¹² source: <https://www.gov.uk/government/publications/digital-health-working-in-partnership/the-uk-pioneering-digital-health-solutions>



Help is available for entrepreneurs to enable them to understand the transactional flows in the NHS, funding, and fast track options for developing digital health. **The NHS Innovation Accelerator (NIA)** supports the testing of innovations and drives the cultural change necessary for them to be adopted faster and more systematically. It also enables entrepreneurs and the NHS to learn from each other. For example, when the participants identified the misalignment of incentives as a barrier to innovation, the NHS listened and then introduced an innovation tariff to ensure that good products are adopted and businesses reimbursed.

The **Test Bed programme** is designed to evaluate the real world impact of new technologies, combining different types of innovation together, in order to solve a problem. This approach is designed to ensure take-up for a device that has proven its utility.

An easy place to do business

The UK has one of the most business-friendly regimes in the world, making it a fertile environment for digital health. It is ranked 8th in the World Bank's Ease of Doing Business Report 2015.

Corporation taxes

Corporation taxes are 20% and will fall to 18% over the next two years - making them among the lowest in Europe. This compares with a US federal rate of 35% and a European average of around 20%.

Patent Box

The Patent Box enables companies to apply a lower rate of Corporation Tax to profits earned after 1 April 2013 from its patented inventions.

R&D reliefs

There is a generous environment for R&D tax relief. Under the SME scheme - for companies of up to 500 full-time equivalent staff, or with revenue less than €100m, or balance sheet assets less than €86m - the rate of R&D tax relief can be as high as 230%. Loss-making SMEs have the option to surrender some of their losses for a payable cash credit from HMRC. The rate for R&D tax relief for large companies - over 500 full-time equivalent staff, or with

revenue greater than €100m and balance sheet assets greater than €86m - is currently 130%.

Legal framework that protects IP

The UK has strong and stable IP and legal frameworks, based on freedom of contract and world-class legal advisors. Companies can invest in R&D here with the confidence that the regulatory system will protect your IP, patents, and contracts.

Business advice

For an innovative, emerging sector such as digital health, having a world-class quality of business support infrastructure is vital. All the major global accountancy firms have multiple presences in the golden triangle.

Time zone and language

The UK remains a gateway to Europe due to its geographic position and the English language. Office hours overlap with those countries that collectively account for 99% of the world's GDP. It is the perfect location from which to collaborate on global research projects.

Access to funding

As a global financial capital, London provides access to finance for all digital health enterprises - from early-stage seed finance through to IPO and a deep, liquid stock market. There is also a vibrant angel finance ecosystem throughout the golden triangle.

The talent

The golden triangle has a rich and diverse talent base, thanks to the strength of its academic institutions and the range of research being undertaken in the sector. It is a brilliant place to find and hire great people - from specialist researchers to general managers - additionally, international talent is always keen to move to the region.

The UK has one of the most business-friendly regimes in the world.



Case studies

Innovation in the golden triangle

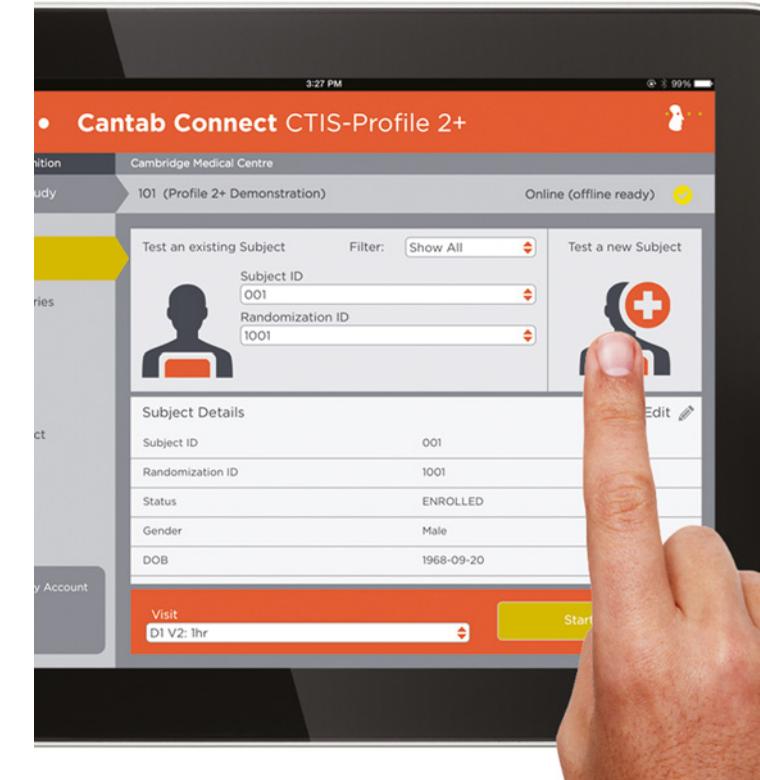
Cambridge Cognition: Collaborating throughout the region

Cambridge Cognition translates gold standard neuroscience research into tools that are useable and practical for doctors, researchers, and patients. These tools make the drug development process more efficient, through their development of software based on the new insights into neuroscience that flow out of nearby Cambridge University. The company retains close links with the university, which many staff members attended. As part of a cluster of tech, biotech and pharma businesses in Cambridge, finding partners to work with is straightforward; whether to collaborate on research or when sourcing talent.

Like many medical device companies, Cambridge Cognition has found the UK to be a receptive environment. This is in part thanks to Europe's pragmatic regulatory framework that makes it generally quicker for innovative new products to reach the market here than in the US. As well as having access to excellent clinical expertise and research, the company has also taken advantage of generous R&D tax credits and grants from Innovate UK to grow.

Six months ago, Cambridge Cognition entered into a joint venture with London-based design-led research company, Ctrl Group, to launch Cognition Kit. This new venture will take the partners' science and tech expertise and apply it to consumer-grade wearable devices such as the Apple Watch. Their approach is to use laboratory-grade research to inform mass data consumer products, which then in turn feedback large quantities of data for further research into how people use things (e.g. drugs and medical devices) in the real world; enabling both further product refinement and a better basis for research.

In other words, Cambridge Cognition are interested in not only helping to develop new drugs but also in how mobile health can help to make drugs more effective; or enable patients to better manage their health; or measure precisely how and when they use their drugs. This information then positions them to make a digital health case for the drug, beyond the simple assessment of its efficacy in a lab.



The combination
of data and consumer
apps will lead to more
effective health spending

Jenny Barnett, Chief Scientific Officer,
Cambridge Cognition

AliveCor: Delivering your heartbeat at your fingertips



AliveCor is a Silicon Valley start-up based around a break through idea, wearable medical-grade ECG devices you can stick onto the backs of smart phones, (Kardia Mobile) and now integrated into a replacement strap for the Apple Watch (Kardia Band). Cardiac rhythm disturbance, in particular atrial fibrillation, is a major risk factor in terms of strokes.

When patients feel symptoms, such as palpitations, they can capture ECG data and use voice to text to describe symptoms. Clinicians can then look at the correlation

between symptoms and heart rhythm. By assessing patients' data remotely, the company reduces the 85% of patients who present to hospitals with heart symptoms that can be severe but which are medically unproblematic. They may also be hard to assess as palpitations may have subsided by the time patients present. So far they have recorded about 1.5 million ECGs in the UK alone (10 million worldwide), building an anonymous database with other data points that are shared with AliveCor. This will enable ECG studies to use large population data helping researchers

We've had a very positive experience of participating in the NHS Innovation Accelerator and we've found the AHSN network very helpful.

Francis White, VP Sales and Business Development, NHS Innovation Fellow

understand how best to transform the cardiac pathway to address, for example, the huge problem posed by undiagnosed atrial fibrillation.

The company opened an office in the UK in January 2013. In addition to their positive experience of participating in the NHS Innovation Accelerator, they have found working with AHSNs such as Imperial College Health Partners which has serendipitously introduced an AF taskforce, very helpful. At the end of this financial year turnover is forecast to be 3 times that of the previous year.



I like the vibe that we have in London, the environment, the creativity that is around. It is a very small place, in a way, with lots of very talented people together, with very diverse talents, really smart legal and financial brains rubbing together with really creative tech and media people.

Dr Anne Bruinvels, Founder, Px HealthCare

Px HealthCare: Tracking cancer patients wellbeing

In 2013, Px HealthCare launched its Owise breast cancer app in the Netherlands. The company had always intended to grow its business abroad. Having been selected for participation in the NHS Innovation Accelerator, and attracted by the appeal of the golden triangle, it decided to relocate its centre of business operations to the UK from July 2015.

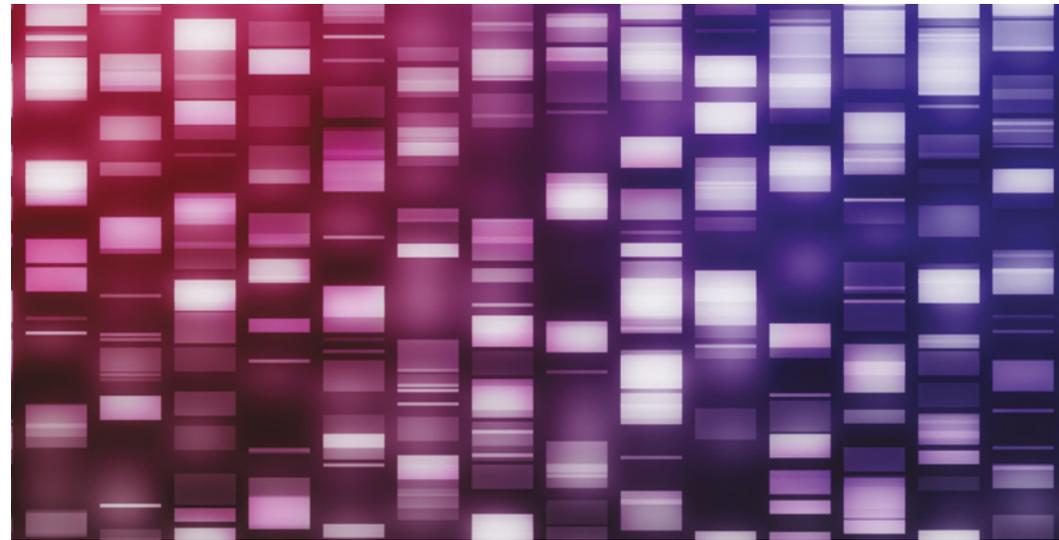
The Owise app has functions for tracking patients' physiological and emotional wellbeing. Breast cancer has many options in terms of personalised medicine as there are more than 150 different combinations of treatments. Clear, graphical representations of this data can be shared with, and reviewed by clinicians. Clinicians can react quickly to adjust drug dosages, for example, or act to address pain or nausea, without necessarily having to see patients face-to-face.

The NHS Innovation Accelerator has been a fantastic experience for Px HealthCare and given Owise a launch pad for bringing it to patients in the UK. The company have been investigating how patients would like to use the app, working closely with NHS clinicians and IT architects. In February 2016, Px launched a UK version of Owise breast cancer and are now looking to develop Owise for all types of cancer.

Px are delighted with the help they have received from UCLPartners (AHSN), who have helped open doors for them in the NHS, and have some fantastic ongoing work with UCL Hospital.

As a socially-motivated enterprise, it is looking for the right kind of investors and believes London is a good location due to its forward-thinking community.

Seven Bridges: Commercialising the biomedical data analysis platform



London is a great place within the life sciences sector. It has some of the best scientists and a great global community that people want to come and live and work with.

Julia Fan Li, Senior Vice President
Seven Bridges

Seven Bridges UK is a biomedical data analysis company focused on connecting the world's biomedical data and make it useful. Seven Bridges provides a user-friendly platform for genomic analysis. As next-generation sequencing costs fall for human DNA, more and more data is being produced which needs to be analysed before it can be useful for clinical decision making.

They opened their first overseas office in London two and a half years ago, responding to political and policy announcements in the UK.

The 100,000 Genome Project in particular has created a vibrant genomics environment in the UK. Last year they received a Small Business Research Initiative (SBRI) grant from the Department of Health and Genomics England to complete and launch an analysis tool for highly accurate variant calling using population genome graphs.

The graph-based tools are able to learn from data over time and provide a more accurate reference paradigm. It helps create an ever more

accurate view of the genetic makeup of both individuals and the population as a whole. Seven Bridges is also able to store and analyse vast quantities of data in the cloud.

London & Partners helped the company to find office space in the city. The company has gone from 0 to 25 employees in 2 years. Seven Bridges undertakes research as well as business, R&D and commercial activities; commercialising the pioneering biomedical data analysis platform that helps drive therapeutic discovery.

Isansys: The pursuit of more efficient patient monitoring

Isansys is creating a new class of data-driven biomarkers. Take the work they are doing with hepatologists at the Royal Free Hospital in London: the data from just one wireless wearable sensor patch taken over a 20-minute period is equivalent to the data and information content traditionally obtained from a blood test which takes hours of lab time and requires the patient to attend the hospital. This is a major shift towards data-driven methods - it is, quite possibly, the emergence of a new paradigm.

Isansys introduced the first generation Patient Status Engine (PSE) in 2012 and launched the second generation PSE2 at the end of 2015. It is now available in a number of hospitals in the UK and overseas. The PSE2 is one of the few viable technology solutions that is able to address the requirement for improved and more efficient patient monitoring, against a backdrop of increasing demands for healthcare services.

All of this has been made possible with the support of the Oxford Academic Health Science Network, which offers a live testbed of 3.3 million people. This creates a strong pull of digital innovations through into the health and social care system.

"The AHSN recognised the power of what we're doing and how it runs across a range of clinical sectors," says Keith Errey, CEO of Isansys Lifecare. "It was with their help and support that we received Phase 1 and Phase 2 funding from Innovate UK through the SBRI programme and were able to transform our system from being 'something interesting' into a complete scaled system; bringing benefits to patients and clinicians in the shortest possible timescale.



We are now being recognised by people around the world. Over the last few months we have shipped systems to Norway, Germany and India. Demand has surpassed our expectations.

Keith Errey, CEO
Isansys Lifecare.

Support networks in the golden triangle

Join us to shape the future of digital healthcare. You can access targeted support and expert advice from a number of organisations throughout the region, each one of which has the specific aim to help researchers, academics, entrepreneurs, corporates and investors locate, grow and thrive in the golden triangle ecosystem.

MedCity

Helps businesses to:

- understand the life sciences ecosystem
- navigate the life sciences networks
- provide introductions to specialist corporate partners

medcityhq.com

London & Partners

Facilitates businesses to:

- set up and scale up in London
- connect with London's business networks
- access high quality professional legal and accountancy advice

invest.london

Mayor's International Business Programme

Supports high-growth SMEs to export their products and grow their business:

- through mentoring from experts and entrepreneurs
- taking them on trade missions
- via workshops and event

gotogrow.london

Department for International Trade

Support businesses to:

- expand and grow into global markets
- locate and grow in the UK

gov.uk/dit

Academic Health Science Network

Supports industry/SMEs by:

- fostering partnerships and collaboration at all levels in NHS organisations, life science companies and universities;
- speeding up adoption of innovation into practice to improve clinical outcomes
- co-creating, testing and evaluating new products and services

ahsnnetwork.com

DigitalHealth.London

Eases businesses' access to the NHS through:

- facilitating matchmaking, collaborations and partnerships
- supporting innovators to test and roll out products
- providing market intelligence.

digitalhealth.london

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We have an established track record in delivering evidence-based solutions, combining science, healthcare data, and technology within the regulatory environments.

Jenny Barnett, Chief Scientific Officer
Cambridge Cognition

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Contact us

MedCity can help you navigate and access different parts of the academic, NHS and industrial life sciences and healthcare environment across the golden triangle of Cambridge, London, Oxford and the greater south east region of England.

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