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Report

The impact of the genomics revolution on global health – how can governments respond?

Monday 29 February – Thursday 3 March 2016 | WP1463

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Introduction

The genomics revolution

Genomics is the study of an organism's complete set of genetic instructions - and it is revolutionising 21st Century medicine as completely as the microscope and x-rays did in the 19th and 20th centuries.

The ability to sequence the genetic code of a large sample of the population reveals how small variations in our DNA can change our vulnerability to different diseases - and consequently how medicine can be personalised for better prevention, diagnosis and treatment.

Knowledge of the DNA sequence has become an important part of biological research but is also vital for other research disciplines such as medicine, biotechnology and forensic science. By establishing the sequence of an individual's genetic material it is possible to identify sequences or mutations which are specific to that person.

Genomics heralds the shift towards personalised treatment - medicines and other treatments can be prescribed not just for their general effect on a disease, but for the way they interact with a specific patient according to their genetic makeup.

This is a huge step forward for global health as it also provides the opportunity to examine the underlying causes of ill-health, tackling health conditions before they start rather than just identifying and managing patients once ill-health has taken hold.

UK response

The UK is a genomics pioneer. It was in Cambridge that the structure of DNA was identified and British scientists contributed around 40 per cent of research to the Human Genome Project, which first mapped the human genome in 2003. Since then the UK has committed significant academic, political and financial resource to ensure that the UK is a global leader in genomics research and medicine.

The impact of genomics is so fundamental and far reaching that the networks needed to research, translate and implement the science into routine medicine are complex. As a pioneer, the UK has evolved an approach based on learning - as one speaker put it, "building the plane as we are flying it".

It is an approach that offers other healthcare systems the ability to avoid many of the pitfalls experienced in development - leap-frogging pain-points to speed patient benefit in their respective countries.

Wilton Park dialogue

Wilton Park[i] hosted a two day international dialogue to explore how governments can respond to advances in genomics, combined with study tours to world-leading UK genomics centres in Oxford, the National Biosample Centre in Milton Keynes and London. The Wilton Park dialogue aimed to: promote international cooperation; support the creation of a global network of genomic medicine centres; and ensure that information and expertise

can accumulate and be shared.

UK speakers included senior clinicians, politicians, National Health Service (NHS) leaders and business representatives. They were joined by genomics leads from countries including: Bahrain, Chile, Czech Republic, India, Indonesia, Kuwait, Malaysia, Oman, Poland, Saudi Arabia, South Africa and Turkey.

The Wilton Park dialogue centred on the UK's leading genomics proposition, as well as practical ways in which other countries can share in its experience. This report summarises the outcome of these discussions, presented around the themes that emerged during the event.

1. **Impetus** - political leadership.
2. **Discovery** - the 100,000 Genomes Project.
3. **Integration** - delivering routine genomics medicine within the NHS.
4. **Dividend** - improved health outcomes and economic returns.
5. **Challenges and action** - overcoming barriers to national genomics programmes.
6. **Resource** - UK support to global genomics.

1. Impetus political leadership

Political will has been a key success factor in the UK genomics programme, with a clear commitment from the government to progress the state-of-the-art. Underlining this intention, the UK Prime Minister announced an additional £300 million (c US$500 million) investment in genomics in 2014[ii], stating, "I am determined to do all I can to support the health and scientific sector to unlock the power of DNA, turning an important scientific breakthrough into something that will help deliver better tests, better drugs and above all better care for patients."

Political drivers and factors include:

Transforming healthcare
A critical political driver is the understanding that genomics has the potential to transform healthcare systems - a powerful motivation in the UK with its publically popular, free at the point of delivery, National Health Service (NHS). This is recognised with genomics embedded as one of the top five growth priorities within the NHS. It offers healthcare providers the potential to prevent illness in the first instance, better treat disease in the second and ultimately improve patient outcomes.

Health economics
In addition to improving outcomes, genomics has the potential to ensure ever more cost effective healthcare. As healthcare costs rise across the world, the science can help healthcare providers to meet patient expectations within strict budgetary constraints. Genomics is making personalised medicine a reality, ensuring that the right patient can receive the right treatment at the right time for maximum medical and economic efficiency.

Innovative industry
Genomics is also seen as an economic opportunity, both for the UK and partner nations. UK investment continues to focus on and foster an environment of innovation - the ideal vehicle to kick-start novel industries that support its development. These new businesses will ensure that research is translated into medicines and treatments that are scalable, transferrable and, ultimately, affordable. Ambitions are high in the UK, where it is planned to double the size of the market in just four years.

Partnership
Underpinning the UK's unique approach is a global partnership model. Academic, healthcare system and economic cooperation must support genomic medicine. As no single country can fully realise the potential of genomics medicine alone, there is a clear need for international sharing of knowledge and learning. This dialogue at Wilton Park is just one

example of the UK's outreach activities. Others include the commitment to share study findings into the impact of genomics on healthcare delivery and wider economic considerations.

It is vitally important to create an environment of partnership and cooperation if genomics is to thrive worldwide.

2. Discovery - the 100,000 Genomes Project

"The UK is uniquely placed to deliver genomics medicine at scale, with a large heterogeneous population, a world class genomic science infrastructure and a comprehensive health service."

Central to the UK's approach is the 100,000 Genomes Project[iii], overseen by Genomics England[iv] - a company wholly owned by the UK Government's Department of Health[v] (DH).

At the heart of the project is the objective of translating the science of genomics into practical applications and routine medicine. The UK is uniquely placed to deliver genomics medicine at scale, with a large heterogeneous population, a world class genomic science infrastructure and a comprehensive health service.

The project aims to sequence 100,000 genomes to: deliver new treatments and insight; introduce advanced genomics into - and transform - the NHS; and develop a thriving private sector genomics industry. It is informed by five principles:

I. The focus is on rare inherited diseases and common cancers.
II. Patients are drawn from routine care and treated through routine channels.
III. All participants provide a fully informed consent providing for a wide range of data and tissue capture and broad categories of use including research and industry. It is made clear that personal benefit is likely to be low, but the value to medicine and the treatment of future patients is huge.
IV. Data and tissue must not leave the NHS, but instead are accessed through controlled safe havens, with all users properly authorised and monitored.
V. Genomics England coordinates the project under an independent board.

Underlining the importance of partnership, the project is based around Genomics England Clinical Implementation Partnerships (**GeCIPs**). GeCIPs bring together 3,000 of the world's genomics experts as well as disease charities, academic institutions, the NHS and commercial partners - their primary aim is to interpret and translate research into practical medicine. Research itself is focused on 13 Genomics Medicine Centres (**GMCs**) spread across England, which are linked to similar centres in Scotland, Wales and Northern Ireland. They function as expertise hubs and are responsible for sampling, data, validation and feedback.

Above and beyond scientific challenges, Genomics England has successfully managed the huge complexities involved in building a genomics infrastructure from scratch in just three years. Its work has identified complex factors around a range of issues, including: patient consent; sample collection, cleaning and de-identification of data; data standardisation; data security; and data access. In addition, it has created an automated biorepository, a sequencing centre, high performance computing centre and secure datacentre.

''Above and beyond scientific challenges, Genomics England has successfully managed the huge complexities involved in building a genomics infrastructure from scratch in just three years.''

Industry cooperation has been and remains an imperative. Private companies are working in partnership with Genomics England to provide the tools needed to deliver efficient and cost effective routine genomics medicine. Work is underway with pharma companies in a pre-competitive consortium (GENE) involving 5,000 genomes, while the bio-informatics and analytics industries are working to deliver interpretation tools and services. Work is underway with pharma companies in a pre-competitive consortium (GENE) involving 5,000 genomes, while the bio-informatics and analytics industries are working to deliver interpretation tools and services. Genomics England also works with software vendors to develop the highly complex informatics systems needed to deliver on consent, data models, protocols, education and communications.

To date, Genomics England has sequenced over 7,000 whole genomes from the pilot study, and is well advanced in the main phase of the project to sequence a target of 100,000 genomes.

3. Integration delivering routine genomics medicine within the NHS

Partnership

Integrating the research and understanding generated by Genomics England into an organisation as large and complex as the NHS has demanded true cross-governmental cooperation. At the highest level:

- **Department of Health** (DH) coordinates genomics and establishes the UK as a global leader.
- **Genomics England** sequences genomes to advance knowledge.
- **NHS England**[vi] (NHSE) turns genomic knowledge into healthcare interventions.
- **Health Education England**[vii] (HEE) ensures that the NHS has the staff, skills and knowledge needed to deliver genomics medicine.
- **Public Health England**[viii] (PHE) uses genomics to improve prevention and health protection.

It is a partnership that aims to ensure that genomics delivers a major legacy for patients, the NHS and the UK economy by:

- increasing discovery of pathogenic variants leading to new treatments, devices and diagnostics;
- accelerating uptake of advanced genomic medicine within the NHS;
- building public understanding and acceptance of genomic medicine; and
- stimulating an advanced life science industry and commercial activity.

"The relationship between the NHS and genomics medicine is symbiotic: the NHS needs to offer modern, world class services to the public, so its success depends upon incorporating genomics; whilst the success of genomics depends upon its incorporation within the NHS."

The relationship between the NHS and genomics medicine is symbiotic: the NHS needs to offer modern, world class services to the public, so its success depends upon incorporating genomics; whilst the success of genomics depends upon its incorporation within the NHS. Consequently, partnership networks extend from the health service to academia, from funders to private companies and from regulators to the public. Building these networks is complicated but necessary – with the need to overcome traditional barriers and competition, both within and between organisations. Success depends on all parties committing to the principle that new ways of working will deliver improvements to patient care.

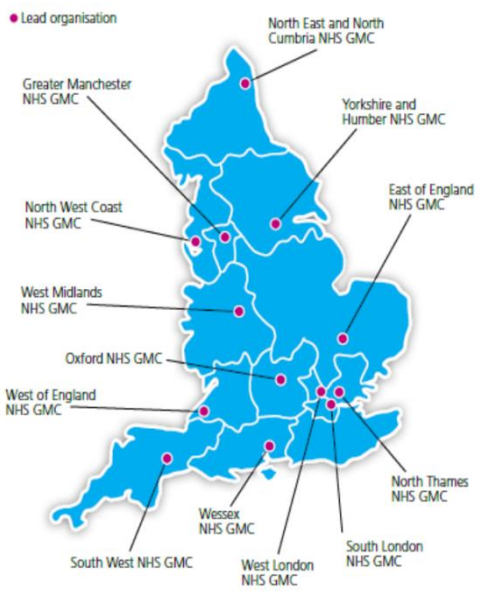
The NHS role

In the first instance, the NHS is tasked with identifying the rare disease and cancer patients who are Genomics England's focus. The NHS then supplies processed samples and collects and submits phenotypic clinical and diagnostic data.

The NHS is also the primary interface with patients and the public, helping them to understand the benefits of genomics as well as the ethical considerations and issues around consent and data usage. In addition, at the other end of the process, the NHS again engages with patients, validating whole genome sequencing (WGS) findings and sharing these in responsible ways.

It is a hugely complicated undertaking that has driven strategic change within the service, demanding:

- financial commitment;
- systems to ensure equitable access for patients across England;
- robust new procurement, contractual and management standards;
- teams dedicated to implementation; and
- strategy and policy alignment to ensure delivery of objectives



NHS/Genomics England

Infrastructure investment has been significant. The NHS is responsible for the Genetic Medicine Centres that underpin Genomics England's work and each of these must be plugged into an integrated network of NHS, academic, charity and private organisations.

This network includes around 70 NHS hospitals as well as local genetics laboratories, clinical genetic services and local pathology laboratories. They are mapped to 15 Academic Health Science Networks (AHSNs) and link with 10 UK universities which provide an MSc in genomics medicine. GMCs also work closely with HEE to ensure that NHS staff are equipped to deliver genomics medicine.

GMCs are repaying infrastructure investment by transforming the NHS - introducing radical and positive change. GMCs: bring more effective and cost-efficient care; herald a sea change in collaboration across the service - removing ingrained clinical, technical and functional silos; drive innovative approaches to patient engagement; modernise the use of informatics; standardise DNA extraction protocols; and embed the more effective collection, tracking, linking and use of data.

"GMCs are repaying infrastructure investment by transforming the NHS - introducing radical and positive change.''

"With genomics set to have an impact on virtually every aspect of healthcare delivery, education must similarly have an impact on every aspect of the health service.''

Education

Delivery of all that genomics promises is dependent on a properly skilled workforce. As much of what genomics brings is new, this has driven radical change in NHS education

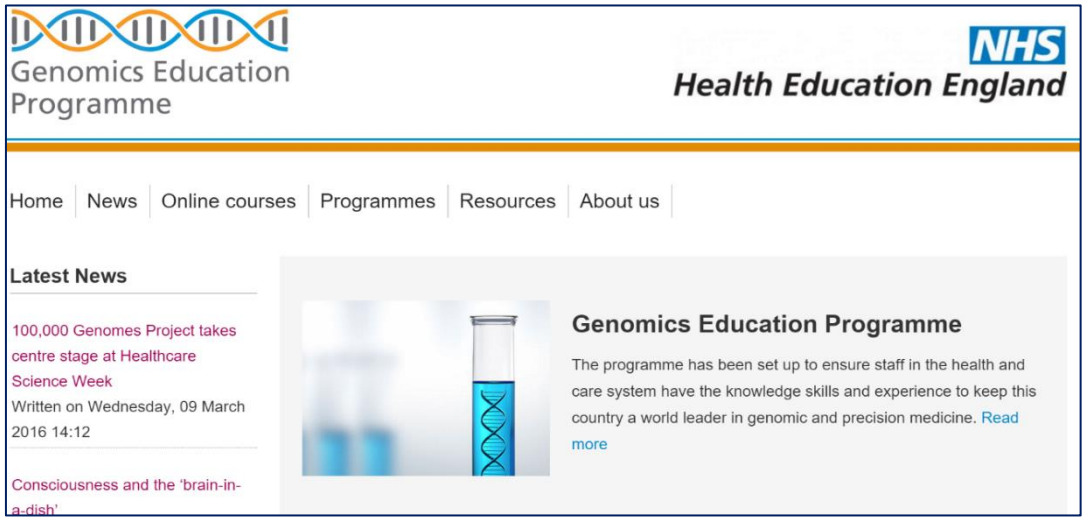
HEE is leading on delivering the right NHS workforce with the capability and capacity to deliver genomic medicine for patient benefit. Partnership has again been at the heart of the approach, with Genomics Education Programme (GEP) resources developed by building links with GMCs, GeCIPs and universities.

With genomics set to have an impact on virtually every aspect of healthcare delivery, education must similarly have an impact on every aspect of the health service. HEE is engaging genomics specialists, clinical specialist, the general workforce ─ and on through to patients and the public.

In terms of the health service, education has involved:

- embedding genomics into education and training for the prospective workforce;
- commissioning additional postgraduate training in molecular pathology, bioinformatics, etc;
- creating research fellowships to support Genomics England;
- developing and commissioning an MSc in Genomic Medicine with Genomics

England;
- developing continuing professional development (CPD) for the specialist genetics, pathology and specialist clinical workforce;
- developing and implementing non-specialist staff training modules; and
- developing additional multi-media resources such as videos, online training and disease specific factsheets.



HEE's Genomics online resources - https://www.genomicseducation.hee.nhs.uk/

This is leading to the dramatic educational change demanded by genomics medicine, including:

- a substantial rebalancing of skills across the workforce as people are required to work differently;
- a focus on the importance of multi-professional working;
- an understanding of the need to develop a greater informatics capability – combining and integrating the data generated to maximise patient benefit;
- the identification of new areas of workforce requirement, such as expanding the number and role of Genetic Counsellors;
- the adoption of 'full pathway' education;
- establishing quality assurance at every stage of the process; and
- a deeper recognition of the role of R&D and ongoing innovation.

Information and analytics

Genomics medicine is also driving and accelerating improvements to, and the use of, data within the NHS. The guiding principle is the standardised, efficient and responsible collection and use of data. The challenge is to make data available to researchers but within the very strict parameters of patient consent. In the NHS, data is kept separate and protected by firewalls - it is brought together for very specific purposes and only after thorough validation.

NHS information and analytics is informed by:

I **Data standards:** define and collect data consistently - guided by international standards.

II **Quality:** embed data integrity with robust quality assurance processes to ensure accuracy and consistency.

III **Data protection:** ensure that laws and guidelines (around, for example, consent) are fit for purpose - with frequent reviews to ensure they keep pace with societal, medical and technological changes.

This is leading to major improvements in the use of data. In cancer treatment, for example, the NHS can now track every cancer patient in the country. Data can be collected from virtually every system within the service in virtually every format, including Word, PDF and CSV. NHS processing systems pull around 2 million records per month across 1,700

multidisciplinary teams, collecting around 1,000 data items on every tumour. In addition, the system has built-in patient access so they can see how their treatment is progressing. The same system is now being applied to rare diseases.

Regulation
The UK is basing its approach to regulation on its previous experience in human embryology. Working with the UK's independent regulator ─ the Human Fertilisation and Embryology Authority[ix] (HFEA) ─ ethical considerations are embedded within every aspect of genomics. It is a critical step in building public trust as genomics is integrated into routine medicine.

It is leading to robust systems across every aspect of genomics, including consent, traceability, donor information and the highly technical considerations around suitability for use with humans. Supporting this, rigorous professional codes of conduct ensure personal accountability.

Regulatory and ethical considerations are reviewed regularly, to ensure that they keep with societal and scientific changes.

"Genomics medicine is not a future concept for the NHS - it is happening today. And it is available on a scale unimaginable just 10 years ago."

4. Dividend - improved health outcomes and economic returns

Clinicians from across the UK shared their practical experience of genomics and were clear on its stage of development: genomics medicine is not a future concept for the NHS - it is happening today. And it is available on a scale unimaginable just 10 years ago.

In terms of rare diseases and cancer, genomics is transforming prevention, diagnosis and treatment. Participants heard from specialists based in genomics centres in Belfast, Cambridge, Glasgow, Liverpool, London and Manchester to better understand the reality of genomics medicine and the dividends it is delivering in 2016.

Dividend - improved health outcomes for rare disease and cancer

Bardet-Biedl syndrome (BBS) is a rare ciliopathic human genetic disorder with effects that can include renal disease, obesity and diabetes. As recently as 2008, NHS treatment of BBS was sub-optimal. Owing to its rarity, the journey to diagnosis was often a long one resulting in unnecessary delay. Even when diagnosis was made, care was often fragmented. It was a care pathway that was poor in terms of health economics - with many appointments for patients, high management costs and lost working days for families and relatives.

In 2008, the BBS National Service was established, jointly developed with commissioning bodies, patient support groups and research groups. Based on a next generation genetic testing service with centres in London and Birmingham, genomics has transformed diagnosis, treatment and management. It has proved so successful that the model is being replicated across the spectrum of ciliopathies.

Brown-Vialetto-Van Laere syndrome (BVVL) is a rare degenerative disorder that leads to progressive sensorineural deafness. Diagnosis is difficult - misdiagnosis can often lead to multiple ineffective treatments and unnecessary surgery without delivering patient benefit. Whole genome sequencing allows clinicians to rapidly identify the disease and treat it simply - and cheaply - with vitamin B2.

Adverse drug reactions - as well as rapidly identifying and effectively treating rare diseases, genomics is allowing clinicians to prevent - and/or identify and treat - serious adverse drug reactions to medicines such a Warfarin and Carbamazepine. It is eliminating unintended patient harm and life threatening emergency medical admissions by ensuring that the right drugs are targeted to the right patients.

Breast cancer approaches have, to date, used a combination of screening and risk prediction models based on family history and lifestyle to detect and treat breast cancer in its early stages. Whilst the most effective approach available it is flawed, with the need for regular imaging and sometimes invasive procedures that deliver imperfect results. Using genomics, clinicians are now able to far more accurately assess each individual's personal

risk - moving from a reactive approach to one where the patient receives a long-term management plan that combines targeted screening and non-invasive options such as Tamoxifen to prevent breast cancer developing at all.

Lung cancer research is helping clinicians to better understand genetic change in tumours to expand the traditional three sub-types. As more detailed insight of types of lung cancer develops, new, highly personalised and effective medications targeting the genetically different subtypes of lung cancer are already being used in the clinic.

Prostate cancer treatment is advancing with researchers discovering genetic hallmarks that allow them to use Olaparib - a drug originally developed for ovarian cancer - to treat patients who have ceased to respond to more traditional prostate cancer approaches.

Stage II (Dukes) Colon cancer research has developed a genetic blood test that allows clinicians to identify high risk patients who are likely to experience recurrence after surgery and will benefit from chemotherapy.

Colorectal cancer research into tumours has shown that it is a heterogeneous disease and that traditional one-size-fits-all approaches are ineffective. Genomics is identifying those patients who will benefit from novel treatments - sparing many the trauma of chemotherapy.

Cytotoxic therapy - a costly treatment that is ineffective in around 80 per cent of patients - is similarly being transformed by genomics. Until now success or failure has only been measurable after treatment. Today, using genetic biomarkers, clinicians accurately predict patient response to chemotherapy before treatment, ensuring that it is only targeted at those likely to benefit from it and sparing non-responsive patients from the treatment.

Dividend - economic returns

The UK intends that genomics both improves patient outcomes and reduces healthcare costs. It is an ambitious objective but an important one - if genomics is to have a real impact upon patient well-being, in the UK and around the world, it must be scalable and affordable. Success, therefore, must be measured in economic outcomes as well as clinical benefits.

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Health economics

The UK is undertaking economic assessments of genomic sequencing for disease diagnostics, treatment, disease prevention and disease risk assessment. The aim is to assess if: a) sequencing will improve health but increase health care costs; or b) improve health and decrease costs. The following are just three examples of how genomics medicine can improve health economics.

Example 1 - cancer: sequencing can help diagnosis by identifying relevant mutations causing disease. Consequently, sequencing could help to reduce or avoid adverse treatment events and reduce delays to treatment. As an example, KRAS mutation testing can identify patients with metastatic colorectal cancer who are unlikely to benefit from expensive treatment with anti-EGFR monoclonal antibodies - realising significant savings. Across the health economy as a whole, using sequencing to reduce the use of interventions in patients who will gain little or no benefit could have important economic implications, particularly if a treatment is used frequently or is expensive.

Example 2 - rare diseases: hypertrophic cardiomyopathy (HCM) is the most common monogenic cardiac disorder and the most frequent cause of sudden cardiac death (SCD) in young people and competitive athletes. Most people with HCM are asymptomatic and SCD can be the first sign of disease. Treatment for those thought to have the disease include life-style changes, drug therapy and ICD implants - all of which incur costs. Genomic sequencing is far more effective, with only those patients at risk receiving treatment to focus clinical and financial resources on those who need them.

Example 3 - pathogens: genomic sequencing in infectious diseases can to help

inform disease diagnosis, and predict which antibiotic would work best. In tuberculosis, for example, whole-genome sequencing has recently proven to be an effective and cost-effective option, compared to slow routine laboratory testing.

Innovation economics

The UK is also focused on using genomics to drive the wider economy, seeing the sector as a catalyst for innovative businesses and a powerful new string to the UK's economic bow. As genomics disseminates around the world, partner countries can also use the sector to kick-start their own innovative industries - helping to recoup investment and scale genomics implementation.

The UK is determined that its pioneering of genomics and global leadership will translate into commercial success. To progress this, the government has put in place a range of initiatives designed to help new and existing UK businesses to realise the economic potential of genomics medicine - essentially to share genomics with the world. These include the Precision Medicine Catapult and making the UK an attractive place for inward investment by pharma, biotech and medtech companies - translating innovation into economic value.

5. Challenges and action - overcoming barriers to national genomics programmes

Discussions covered barriers that new national genomics programmes might face as they move towards implementation. Whilst the issues raised were diverse, a number of key themes emerged. Themes and actions are summarised in the table below.

Challenge summary	Action summary
How do we create political will?	• Healthcare is a strategic sector - encompassing a range of critical political drivers, including public health and well-being, economic growth, scientific and technological development and national reputation. • Very soon, genomics will be medicine - the earlier countries get on board the more advanced they will be and can realise the healthcare and economic opportunities it offers. • Build healthcare, economic and academic arguments - a roadmap of where the country is now and where it needs to be. • Engage with **Science and Innovation Network**[x] **(SIN) and UK Trade and Investment (UKTI) in-country** to initiate high level, government-to-government contact. Through working with Healthcare UK, they will bring you access to a wealth of UK genomics resources, an area where the UK can offer tangible support to national initiatives. • The UK can deploy expert delegations to either host or visit political decision makers to assist in the formulation of arguments in favour of genomics. • The UK may also be able to provide financial assistance through grants,

	aid programmes, etc - SIN or your UKTI adviser in-country will be able to advise you.
How do we 'prove' the economic benefit of genomics - particularly with the need for frontloaded investment?	• Partnering with a genomics leader such as the UK reduces the levels of investment necessary - avoiding pitfalls and going straight to 'best practice'. • Use evidence to demonstrate savings in, e.g. long term care, through preventative medicine, targeted treatment to the right patient, more cost effective treatments, fewer lost work days and better disease management. The UK's ongoing assessment of genomics healthcare economic benefit will be shared and can be used to build a compelling economic argument. • Work with the UK (initially through your in-country SIN and UKTI advisers, who will connect you to Healthcare UK and UK experts) to demonstrate the wider economic benefits delivered through kick-starting a domestic healthcare innovation sector.
How do we 'prove' the clinical validity and utility of genomics to governments and populations?	• Use the UK experience as a case study. • Establish academic, clinical and business partnerships with UK genomics organisations to access validated data. • Engage initially through your in-country SIN and UKTI advisers, who will connect you to Healthcare UK and UK experts. • As above, UK expert delegations can help in the formulation of genomics arguments.
Given the complexity of building an effective genomics medicine system - where do we start?	• Partnership is the lifeblood of genomics - academically, clinically and economically. No one country can or needs to do this alone. • Find a partner, such as the UK, that has already done the heavy-lifting. • Existing insight, experience, technologies, processes and approaches can be tailored to specific countries' needs - fast tracking the development of genomics systems so that they very quickly realise potential and prove value. • Countries can access a range of UK organisations that can support them in

	establishing a genomics infrastructure. • Healthcare UK, accessed through your SIN and UKTI advisers, is your key contact for support in identifying UK partners.
How do we gain public buy-in to genomic medicine?	• Educating populations on the benefits of genomics is critical if it is to be understood and accepted. With patient consent a necessary prerequisite, genomic potential can only be realised if populations have bought in. • Use UK case studies to demonstrate the benefits that consent brings with improved patient outcomes that result from genomics medicine. • Access Health Education England's experience, expertise and resources to fast-track the systems and processes needed to engage effectively.
How do we deal with the social, religious and ethical issues surrounding genomics?	• Each country has its own unique circumstances and needs to proceed accordingly. • Education and regulation will be critical factors. • UK experience around education and regulation can help to set up the right frameworks, which can be adapted to meet specific needs.

6. Resources - UK genomics organisations

The Wilton Park dialogue recognised the need to support healthcare systems as they move towards the implementation of genomics medicine. The list of organisations below summarises the specialised UK Government support organisations available to overseas healthcare systems.

The UK Science and Innovation Network (SIN) is jointly funded by the Foreign and Commonwealth Office and the Department for Business Innovation and Skills. SIN works across the entire UK science and innovation landscape supporting UK and host country stakeholders to make international connections, set up strategic collaborations and leverage research and innovation funding.
https://www.gov.uk/government/world/organisations/uk-science-and-innovation-network

UK Trade and Investment (UKTI) is the government department that helps UK-based companies succeed in the global economy. UKTI has professional advisers both within the UK and across more than 100 international markets.
www.gov.uk/ukti

If you are looking for UK partners, your first point of contact in-country should be your SIN contact or UKTI Adviser – acting as your gateway to the following UK resources.

Healthcare UK is a joint initiative between the Department of Health, UK Trade and Investment and NHS England. Healthcare UK's primary role is to promote commercial partnerships between UK and overseas healthcare organisations - sharing skills, technologies and expertise, as well as facilitating government to government engagement. It acts as the bridge between international demand for healthcare services, systems and

infrastructure and the rich pool of UK know-how and capability in these fields.
https://www.gov.uk/healthcareuk
Healthcare.uk@ukti.gsi.gov.uk

Genomics England is a wholly owned company of the Department of Health set up to deliver the 100,000 Genomes Project. This flagship project will sequence 100,000 whole genomes from NHS patients and their families. The project is focusing on patients with rare diseases, and their families, as well as patients with common cancers.
http://www.genomicsengland.co.uk/

Innovate UK works with people, companies and partner organisations to find and drive the science and technology innovations that will grow the UK economy.
https://www.gov.uk/government/organisations/innovate-uk/about#our-responsibilities

The Precision Medicine Catapult is focused on making the UK the most compelling location in the world for the development and delivery of this new targeted approach.
https://pm.catapult.org.uk/

The Newton Fund aims to promote the economic development and social welfare of either partner countries or, through working with a partner country or countries, to address global development challenges.
http://www.newtonfund.ac.uk/

Adam Toms

Wilton Park | March 2016

Wilton Park reports are brief summaries of the main points and conclusions of a conference. The reports reflect rapporteurs' personal interpretations of the proceedings – as such they do not constitute any institutional policy of Wilton Park nor do they necessarily represent the views of the rapporteur.

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[i] https://www.wiltonpark.org.uk/
[ii] http://www.genomicsengland.co.uk/uk-to-become-world-number-one-in-dna-testing-with-plan-to-revolutionise-fight-against-cancer-and-rare-diseases/
[iii] http://www.genomicsengland.co.uk/the-100000-genomes-project/
[iv] http://www.genomicsengland.co.uk/
[v] https://www.gov.uk/government/organisations/department-of-health
[vi] https://www.england.nhs.uk/
[vii] https://hee.nhs.uk/
[viii] https://www.gov.uk/government/organisations/public-health-england
[ix] http://www.hfea.gov.uk/index.html
[x] https://www.gov.uk/government/world/organisations/uk-science-and-innovation-network