Personalised Medicine
All-Party Parliamentary Group

All-Party Parliamentary health Group

MINUTES

Chair:
Helen Whately, MP

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The Rt Hon. the Lord Warner

Vice Chairs:
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PHG Foundation
2 Worts Causeway
Cambridge
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Joint Event with the All-Party Parliamentary Health Group

Implementing a National Genomic Medicine Service for the NHS: *building on the legacy of the 100,000 Genomes Project*

Tuesday 7 November 2017, 9:00 – 11:00
Macmillan Room, Portcullis House

Speakers

- **Prof Sue Hill**
  Chief Scientific Officer, NHS England
- **Prof Lyn Chitty**
  Prof of Genetics and Fetal Medicine, Institute of Child Health, University College London and Great Ormond Street Hospital for Children
- **Dr Hilary Burton**
  Consultant in Public Health Medicine (and Director 2014-17) of PHG Foundation; former Chair of the Genomics in Mainstream Medicine Working Group of the Joint Committee on Genomics in Medicine and Health Education England
- **Dr Jean Abraham**
  Consultant Medical Oncologist, Cambridge University Hospitals NHS Foundation Trust

Apologies

There were a number of apologies from parliamentarians

Minutes

Helen Whately MP welcomed attendees and expressed a deep interest in healthcare and particularly in science and its vital role in improving patient outcomes.

Prof Sue Hill began by acknowledging that the NHS has had genetics services since the 1960s, but over the decades there have been major changes in what NHS labs have been able to do, including the emergence of molecular pathology testing, enabling molecular diagnoses of many different cancer types.

Focusing on the 100,000 Genomes Project, Prof Hill emphasised that from the outset, one of the main principles has been that whole genome sequencing (WGS) would extend the diagnostic scope in the NHS. The project was designed to recruit participants from routine care such that one of the long-term legacies would be to drive mainstreaming and adoption of WGS technology into the NHS. This has been combined with the creation of 13 Genomic Medicine Centres across England, as well as Health Education England's Genomics Education Programme.

Regarding progress, the 100,000 Genomes Project as a whole has collected 62,000 tissue samples. In a major pathology transformation, the NHS has moved away from embedding tissue in formalin and paraffin towards processing fresh frozen tissues. Whole genome sequences have been produced from nearly 36,000 samples, largely in rare diseases, where there has been an increase in diagnostic yield to 25 – 30%. In some cancer cases, this diagnostic yield has been as high as 65%. Prof Hill then gave three examples of patients who benefited from the power of genomics to personalise intervention.

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Next steps at NHS England include taking forward a new NHS Genomic Medicine Service from October 2018. This includes capitalising on the falling cost of WGS, progressing from standardisation of processes towards system-wide involvement and alignment with planning and commissioning processes. The new service will be part of the drive towards making better use of medicines. Prof Hill also stressed that building a new service for the future involves ensuring comprehensive and equitable access to modern genomic testing as required for the entire population. This more comprehensive approach will improve the quality, value and sustainability of care, and drive personalisation – which is why the implementation of a national laboratory network, a new informatics platform for the NHS and cross-sector collaboration are all so important.

Prof Lyn Chitty, who is Clinical Lead for the North Thames Genomic Medicine Centre, gave an overview of what is needed in order to embed the planned new National Genomics Service in the NHS.

Prof Chitty began by acknowledging that WGS can transform care for some, though not all, of the rare disease patients to whom it is currently being offered, and noted that there are some good examples of its use in analysing the cancer genome, too. However, she cautioned that it is not a universal panacea; it does fall short in some areas, and it is also an evolving technology.

In order to afford and implement clinical WGS, Prof Chitty said that the NHS was going to have to stop doing other forms of genetic tests, and to make sure that WGS was appropriately validated as reliable for identifying chromosomal variations to avoid 'throwing the baby out with the bathwater'. Running a dual system with current forms of testing alongside WGS for comparison of performance will be required, at least in the first instance.

In terms of returning results, patients were said still to be waiting too long; the 100,000 Genomes Project pipeline was said to be improving, but in need of further speeding up. Prof Chitty felt that the Genomic Medicine Centres need greater involvement in improving the whole process.

She also noted that trained clinical scientists - who are in short supply - are needed to interpret the results of WGS. Clinical scientists have to work with clinical geneticists, oncologists and other clinicians and scientists in multidisciplinary teams in order to efficiently and effectively interpret results. In Prof Chitty's view, the NHS lacks much of the highly trained workforce that it will need, and so training and education will be key in delivering a national genomics system.

Prof Chitty also raised the question of how to manage the process once WGS has become mainstream, when any trained clinician could request a genomic test and demand begins to rise. She reiterated the need for further education for health professionals on when to request WGS testing, and around delivering results to patients and, where appropriate, following them up with families. All of these skills currently sit within clinical genetics, her belief was that the NHS needs to invest in more genomics consultants, because they can help educate colleagues and embed this technology and new way of working in other clinical specialties.

She reiterated the desperate need for additional investment in education and workforce development generally, saying that Health Education England's Master's course in genomics for NHS professionals wasn't fit for purpose in terms of embedding genomic medicine across the workforce. Instead, she felt that training should involve courses that are shorter and more clinically focused, alongside embedding genomics in medical and nursing school curricula. The Royal Colleges should also embed genomics as part of mandatory training for all of their specialties, and more genetic counsellors trained as a matter of urgency.

Prof Chitty concluded by echoing the importance of equitable access to genomics for patients -not only to genome sequencing, but also to trials of new treatments. The importance of an effective and efficient IT service was also highlighted as a crucial element in the successful mainstreaming of genomic medicine.

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Dr Hilary Burton began by explaining the evolution of genomic medicine in the NHS since the launch of the Government's pivotal genetics White Paper *Our Inheritance, Our Future* in 2003. She concluded that there are not currently enough clinicians at all levels with the necessary skills to make the most of genomics, and there is still much work to be done to embed sufficient proficiency in genomics into professional training across the specialties.

Focusing on the example of cardiovascular disease, Dr Burton argued that diagnosing and managing inherited diseases requires substantial knowledge of genetics, understanding of the many genes and their variants that can be involved, as well as the ability to assess the various associated clinical features. She also noted that work done in 2009 had revealed massive variation in the provision of specialist services for inherited cardiac conditions, indicating a desperate need for cardiologists with the necessary additional training in genomics. While there is considerably more awareness of genomics now than then, she said that this this need for specialised clinicians persists in 2017.

Dr Burton concluded that until this important area of medicine is actually recognised and properly embedded within the medial curriculum at all levels of training, the NHS would remain a long way off genomics in mainstream medicine. She emphasised not only the need to train new cardiologists to specialise in inherited cardiac disease, but also the necessity for their colleagues at all levels to be able to recognise when their patients may be at risk of such a condition, and be able to order and interpret the relevant genomic tests.

She went on to highlight some of the complexities of integrating genomics into clinical practice effectively so that doctors can use it properly. These included identifying which patients would benefit from testing; knowing which test to ask for; having or obtaining the necessary supporting clinical information; and understanding the meaning of test results at a sufficient level to avoid making an incorrect diagnosis.

Dr Burton concluded by applauding the work of the Genomic Medicine Centres and Health Education England in this area, but nevertheless emphasised that the Royal Colleges, who are responsible for setting specialist training curricula and accreditation, should be developing work programmes to direct the inclusion of appropriate genomics knowledge for doctors.

Dr Jean Abraham focused her discussion on how genomic medicine can influence cancer treatment, and how it overlaps with clinical trials. Using the Personalised Breast Cancer (PBC) Programme in Cambridge as a case study, she explained how samples are being taken from cancer patients for WGS and analysis in order to inform clinical decision-making.

The hardest part of the establishing the PBC programme, she said, was setting up the essential multidisciplinary Oncogenetics Review Board, because it involved cooperation between various professionals who didn't normally interact. However, the programme now runs smoothly from patient recruitment, taking samples, processing, WGS, analysis and interpretation of results. Importantly, the programme delivers the results of tumour genome sequencing back to patients within 12 weeks, and often less – fast enough to be clinically actionable, informing treatment choices.

Dr Abraham felt that results that are not returned to patients in a time frame that allows doctors to act on them were almost meaningless, other than for research purposes. Indeed, PBC patients were said to particularly appreciate this goal of returning results quickly.

Two case studies were used to emphasise how complicated the whole process really was. It involved a lot of people working together, including clinicians, clinical geneticists, laboratory scientists and co-ordinators. An efficient and effective medical record system was also said to be crucial for data collection and management, with Dr Abraham reiterating the overwhelming need to strengthen NHS data infrastructure, particularly if genomic services are to be offered nationally.

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Questions and Answers

Lord Woolmer asked whether the focus should be on building up centres of excellence to handle greater capacity, rather than continuing to try to ensure specialists are available evenly across the entire system – which has failed, historically.

Prof Hill responded by arguing that the creation and ongoing success of 13 Genomic Medicine Centres demonstrated there can be a concentration of expertise in a centre, but working across a wider geography. She said that they knew they could move samples and data, and drive the identification of patients across the system, and that the key was how clinicians in more peripheral sites were supported by specialists who can work with their clinical teams more locally.

Prof Chitty added that there are local centres, but there nothing to prevent the existence of national ones too, and certainly for some rarer conditions that was happening.

Ali Mortazavi raised the issue of working backwards from what is therapeutically possible, and then finding the sort of patient populations that can really be helped.

Prof Hill highlighted that the 100,000 Genomes Project has revealed that the type of personal intervention and treatment will vary, they won't all be traditional drugs and other therapeutics, but rather there will be a range of suitable measures. She agreed on the real need ito bring together all of the technology that is available for identifying populations that might benefit from known therapeutics, saying that it would be necessary to look not only at DNA, but also how it is essentially translated within the body and eventually expressed and proteins, and how we can monitor and use that information.

Lord Willis expressed concerns about the Health Education England Master's course in Genomics, in terms of access and content as well as an overarching concern regarding outdated training models for NHS staff.

Dr Burton agreed that the NHS workforce did need to be better trained and prepared, to provide a deeper understanding of disease risk and genomic testing options. This should include the ability to recognise potential symptoms of rare disorders and when to request genomic tests. She concluded by suggesting a new type of professional to bridge the gap between the laboratory and clinical teams, with a deep understanding of genomics, as well as more trained genetic counsellors who can support patients and families.

Lord Willis added that in modern curricula of various disciplines including nursing, genomics virtually does not feature at all. He also warned that in bioinformatics, despite growing need within the NHS, there was a real dearth of trained people coming through who actually see the NHS as part of their future work plans.

Dr Burton agreed with this observation.

Prof Hill agreed that there is a need to systematically embed skills not only in genomics, but also in data handing / coupling of big data sets. She felt that there was also a need for more workforce literacy in some of the major scientific and technological advances, and said that all this needed to be systematically embedded in undergraduate and pre-registration programmes, as well as postgraduate training.

Regarding the Master's in Genomic Medicine, Prof Hill noted that it has been developed to upskill only certain parts of the NHS workforce. She emphasised that a new way of working was emerging, whereby information is easily accessed and collaboration between health professionals and scientists is key. Part of the challenge will not only be getting those specialists we need, including genetic counsellors, but embedding some of those skills in all of the workforce.

Prof Chitty agreed with Prof Hill, concluding that this is an evolution of NHS workforce, particularly in the laboratories. She stressed the need for more clinical scientists and the need to retrain some people in genetics.

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Dr Abraham added that part of the process involved communicating the amazingness of what you can do with this kind of data and how much it can transform people's lives. This, she said, would encourage further engagement. Nor did everyone need to be an expert in genomic medicine; different parts of the NHS workforce parts needed different skillsets. Whilst not all need to interpret genomic results, new doctors, nurses, and others all need basic genomics knowledge.

An unidentified questioner said that as a participant in the Health Education England genomics education programme, they felt that the programme was not wide enough and it couldn't possibly encompass all areas of the workforce, but that there should be opportunities for graduates of the programme to collaborate.

Prof Hill highlighted the Faculty of Genomic Medicine created by Health Education England as an attempt at bringing those alumni or current participants together.

Mel Brola requested additional details on the IT platform supporting the 100,000 Genomes Project.

Prof Hill explained that a data infrastructure had been created that enables all the deep clinical data to be collected and matched with the WGS data, and then to be utilised in a de-identified way, with consent from participants. Moving forward, all of the NHS genomic data will move into one NHS data warehouse and, if patients consent, data will move into a de-identified space for access by researchers – she described this as a 'reading library' as opposed to a 'lending library'.

The platform would, she said, really enable the new laboratory network to function but the was a lot more work still to be done to ensure the interoperability and functionality needed for every single NHS provider was delivered.

An unidentified questioner raised the challenge of clinical interpretation of genomic data, and whether there is a role for technology (alongside training additional staff) to speed up the implementation process.

Dr Abraham explained that both the 100,000 Genomes Project and the Personalised Breast Cancer Programme mentioned previously were iterative processes. As the projects develop, she said, it was possible to improve evidence and work along multiple routes to get results back to patients faster.

Prof Chitty added that this was one reason why data sharing was so important, because there was an opportunity to learn from other centres' expertise, and for the same reason data really needed to be shared anonymised basis internationally.

Prof Hill acknowledged that as we move into digital pathology for cancer it would enable thinking about other artificial intelligence techniques, and eventually link with a greater understanding of the tumour, whereby the genome sequences are matched with other data.

Dr Burton, expanding upon the iterative nature of the process, raised the importance of the ability to go back to the clinician and investigate certain results. This makes involving a mainstream clinician quite complicated, because if they haven't seen the patient recently, that clinical feature is unlikely to be in the patient's notes, which are on paper not digital. The capacity for mainstream clinicians to contribute to the ongoing clinical interpretation process was still a problem, she said.

Richard Dale asked whether there is any overlap between these programmes and the UK Biobank or other large cohort studies.

Prof Hill explained that UK Biobank have a whole raft of genomic developments as part of their work programme and there are ongoing discussions between the projects that are utilising genomics on the type of information that we would be able to deduce from a population-based approach.

Kaiya, a clinical scientist, asked how quickly scientific platforms are evolving and what measures are being put in place to ensure they were robust enough to incorporate future technologies.

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Prof Hill acknowledged that some technologies have not yet been fully utilised. She added that part of thinking about the future includes how to utilise cutting-edge technology better, and clarity the type of developments that we need to see. Plans at NHSE include an annual refresh of the genetic test directory by an expert committee that will review all the available evidence and also the technological developments, so that the laboratories that are providing the testing for rare disease and for cancer in its broader sense are really aware of the latest technologies.

Dr Abraham added that conversations with academia are also crucial to ensure we stay ahead of technological developments.

Finbar Cotter asked what is being done to ensure that we fundamentally change the NHS to think of itself as a research organisation, so that it can benefit fully from the personalised medicine.

Prof Hill acknowledged that, in terms of commissioning a new service, the expectation of aligning routine care alongside research and industry collaboration will be the operating model for the future, and that will be aligned with the National Institutes of Health Research funding priorities. She added that every single patient should have a high-quality clinical service, irrespective of location, and that was essentially what the 100,000 Genomes Project and NHS linkage was trying to ensure. It will also be important to continue to engage with the clinical community, and with patients.

Dr Burton noted that embedding research into clinical care was the whole premise of the NIHR and applies well beyond the 100,000 Genomes Project, as well as that translation research is absolutely key.

Dr Abraham highlighted that many patients *want* to be asked for their cooperation and if you do it sensitively and appropriately, with well-trained staff, they are typically very willing to do what they can.

Finbar Cotter reiterated the need to fundamentally change the way this change is being delivered in order to do it in a way that the NHS has not done up until now.

Prof Hill acknowledged that this was part of a much wider debate within the NHS about the use of real-world data to really drive new research conversations, new relationships with industry, and new developments within the pharmaceutical industry regarding cross-cutting new approaches to drug discovery, drug development and clinical trials. The advantage of current work in genomics though was to make sure patients get the best possible care by this early alignment, with all the principles that are very much embedded not only in NIHR but also in the Academic Health Science Networks. She said a genomics innovation network would be established to make sure innovations were continually pushed into the NHS.

Prof Chitty added that the output from the 100,000 Genomes Project and other notable large-scale projects was testament to the value of research in the NHS, and that was one of the things that should be built on.

Dr Abraham concluded by highlighting the importance of how medical data is recorded. If you want to do real-world research, and you want your NHS consultants to take part, she said, then NHS consultants need to be trained how to input medical data appropriately so that it is useable by researchers.

Maggie Throup MP concluded the session by acknowledging the great progress that had been made in genomics and the great potential for improving healthcare.