

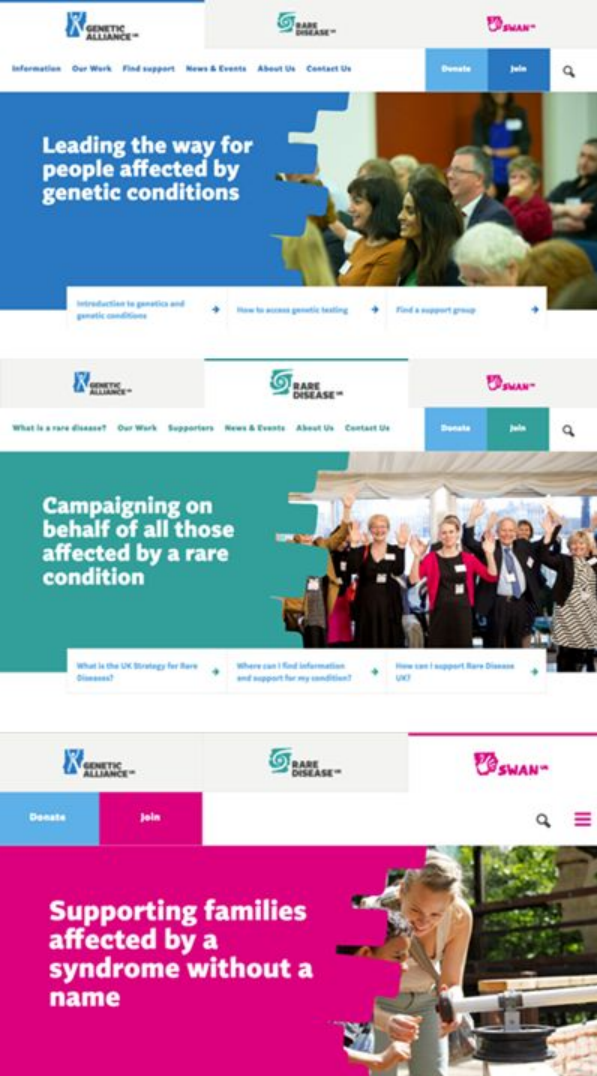


NEXT GENERATION SEQUENCING FOR NEWBORN SCREENING

Examining the potential of whole genome
sequencing

Nick Meade, Director of Policy, Genetic Alliance UK

14 May 2021



ACKNOWLEDGEMENTS

Thank you to our members and all the people living with rare and genetic conditions that have contributed to Genetic Alliance UK's work on newborn screening.

Thank you to Louise Coleman for her work on newborn screening for Genetic Alliance UK.

Thank you to Genomics England for some of the slides in this presentation.



NEXT GENERATION SEQUENCING FOR NEWBORN SCREENING

- Genetic Alliance UK's perspective
- Story so far in the UK
- Genomics England engagement activities



GENETIC ALLIANCE UK PERSPECTIVE ON WHOLE GENOME SEQUENCING IN THE NEWBORN

PATIENT CHARTER ON NEWBORN SCREENING (2019)

Fixing the present

- Examining the global environment of newborn screening and examining where the UK lies
- Examining the UK National Screening Committee's approach to decision-making and how it affects people living with rare diseases

Building for the future

- Delivering a preliminary view from the perspective of people living with rare conditions on the use of genome sequencing as a newborn screening technique
- Proposing a model for piloting this technology within the NHS

geneticalliance.org.uk/wp-content/uploads/2020/01/Newborn-Screening-Report.pdf



BENEFITS OF NEWBORN SCREENING

Timely treatment

- Appropriate care, support and treatment to begin as soon as necessary
- Progression of a condition can be stopped before morbidity occurs

Timely information

- Early diagnosis for childhood onset rare diseases
- Allows for planning
- Avoids the diagnostic odyssey

Opportunity for choice and family planning

- Family planning and reproductive choice opportunities are easier the earlier couples discover their risk

Wider benefits

- Research benefits from data and patient identification

Platform for a strategic approach

- Newborn screening identified as having a potential role in the UK Strategy for Rare Diseases in 2013



SIMPLE BASIS FOR PERSPECTIVE

Fact: The use of genome-wide (whole genome or exome) sequencing for population-based newborn screening presents an opportunity to detect and treat or prevent many more serious early-onset health conditions than is possible today.

Friedman, J.M., Cornel, M.C., Goldenberg, A.J. et al. Genomic newborn screening: public health policy considerations and recommendations. BMC Med Genomics 10, 9 (2017).

<https://doi.org/10.1186/s12920-017-0247-4> (and many many other papers too)

Our perspective: if this opportunity can be realised - we should **investigate so that the benefits of newborn screening can be delivered in a wider set of conditions.**

We therefore call for a pilot study of whole genome sequencing as a newborn screening tool.



**DO YOU AGREE THAT WGS
SHOULD BE PILOTED IN NBS?**

KEY QUESTIONS TO BE ADDRESSED

From our Patient Charter:

- Where does newborn screening using genome sequencing fit within the system?
- Would the use of genome sequencing in newborn screening be cost-effective?
- Should genome sequences be stored? How and under what terms?
- Which conditions should be screened for? How should they be selected?
- What are the learnings from genomic medicine pilots more widely?
 - Opportunistic screening
 - Variants of unknown significance



APPLYING WGS TO NEWBORN SCREENING

‘All of the prior studies of utility of exome sequencing have started with a patient already in front of a doctor. [...] When you switch to screening mode, you don't have any clues.’

Dr Jennifer Puck, professor of paediatrics at UC San Francisco, in Bionews, promoting paper:

Adhikari, A.N., Gallagher, R.C., Wang, Y. et al. The role of exome sequencing in newborn screening for inborn errors of metabolism. Nat Med 26, 1392–1397 (2020). doi.org/10.1038/s41591-020-0966-5



STORY SO FAR IN THE UK

PREVIOUS REPORTS



Our Inheritance, Our Future

Realising the potential of genetics
in the NHS

Presented to Parliament by the Secretary
of State for Health

By Command of Her Majesty

June 2003



Genetics White Paper 2003

Genetics 'will bring new challenges as well as opportunities for screening programmes' and identified the possibility of screening 'babies at birth as part of the standard postnatal checks and to produce a comprehensive map of their key genetic markers, or even their entire genome'. The paper recognised the 'wide range of ethical and social concerns' which it asked the Human Genetics Commission (HGC) to examine.

webarchive.nationalarchives.gov.uk/20121103041523/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4019239.pdf



PREVIOUS REPORTS



Human Genetics Commission report 2005 acknowledged the potential benefits that genetic screening of the newborns could deliver, identifying advance planning in the NHS and the potential of personalising healthcare to a patient's genetic makeup. However, the report's conclusion was that the technology would not be affordable in the NHS within 20 years, and that the important ethical and social issues need to be reassessed in five years' time.

webarchive.nationalarchives.gov.uk/20120504102235/http://www.hgc.gov.uk/Client/document.asp?DocId=154&Catego ryId=10



PREVIOUS REPORTS

A T G C T G A C T C C A G T A A G A A T G C
A C T C C A G T A A G G A A T G C T A C T C
C A T C G A T G C T G A T C C A G T A A G A
G A G G A A T G G T A A G A A T G C C C A G
G T A A G A A T C G A T G C T G A C T C A G
T C G A T G C T G A C C C A G T A A G A A T
G G A A T G C T A C
A A T G G T A A G A
G A A T C G A T G C
C T C A G G A A T G
A C T C C A G T A A
T G C T G A T C C A
A T G C T G A C T C
A C T C C A G T A A
C A T C G A T G C T G A T C C A G T A A G A
G A G G A A T G G T A A G A A T G C C C A G
G T A A G A A T C G A T G C T G A C T C A G
T C G A T G C T G A C C C A G T A A G A A T
C A T C G G A A T C G A T G A A T C G A T A
T A A G A A T C G A T G C T G A C T C A
A C T C C A G T G A A T C G A T C T A C T C
C A T C G A T G C T G A T C C A G T A A G A
G A G G A A T G G T A A G A A T G C C C A G
G A A G E N E R A T I O N G T G T G A C T C
A T G C C C A G T A T G G E N O M E C T C A
A C T C C A G T A A G G A A T G C T A C T C
C A T C G A T G C T G A T C C A G T A A G A
G A G G A A T G G T A A G A A T G C C C A G
G T A A G A A T C G A T G C T G A C T C A G
T C G A T G C T G A C C C A G T A A G A A T
A A T G G T A A G A A T G C A G A A T G C C
C A G T A A G A A T G C G A A T G C T A C T

Annual Report of the
Chief Medical Officer 2016

Generation Genome

Generation Genome 2016

Chapter 11 of the 2016 Chief Medical Officer's report 'Generation Genome' was devoted to genomics in newborn screening. A series of challenges, opportunities, questions and acknowledgements were raised. The report recognised the fundamental value of genomics in the context of newborn screening, that of a much higher potential number of conditions tested and a greatly reduced need for follow up testing.

assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/631043/CMO_annual_report_generation_genome.pdf



LATEST REPORT



HM Government

GENOME UK
The future of healthcare



Genome UK 2020

We will:

- Enable the NHS to move from a system that primarily detects and treats illnesses to one that utilises genomics to predict and prevent ill health.
- Continue to develop a public health and screening system that uses genomics to intensify screening and interventions in those at high risk.
- Establish a clear, evidence-based position on whether and how genomic sequencing should be implemented for newborns, and how that genomic data could inform their care later in life.

assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/920378/Genome_UK_-_the_future_of_healthcare.pdf



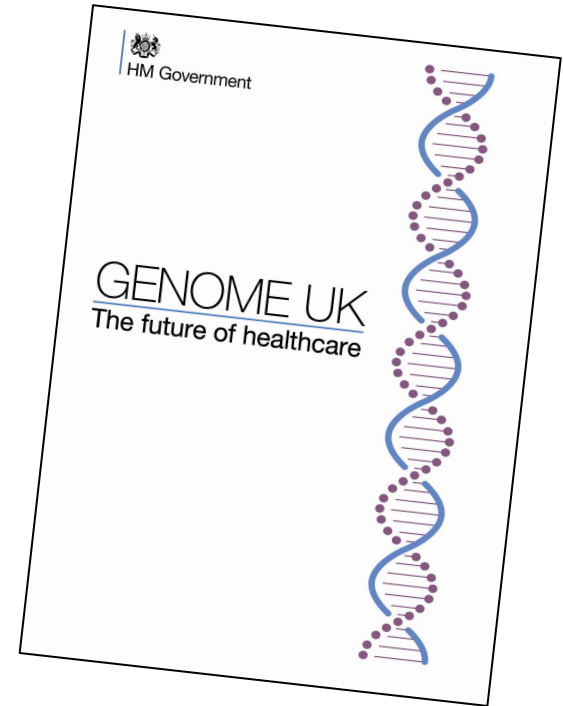
GENOMICS ENGLAND PUBLIC DIALOGUE ON GENOME SEQUENCING FOR NEWBORN SCREENING

Whole genome sequencing for newborn screening

“Recent improvements in genomic sequencing offer the chance to rethink our approach [to newborn screening]. The UK National Screening Committee recently reported that there is clear potential for genomics in the testing for many of the conditions currently included in the blood spot test.

Whole genome sequencing could significantly increase the diagnoses of other genetic conditions, which is particularly valuable if early detection reduces or avoids harm in early life or improves long term outcomes from the condition.

Initial investigations indicate that this has the potential to enable a major NHS transformation, delivering benefit to thousands of children who would benefit from early intervention to reduce or avoid harm in early life.”



Genome UK: the future of healthcare. HM Government 2020

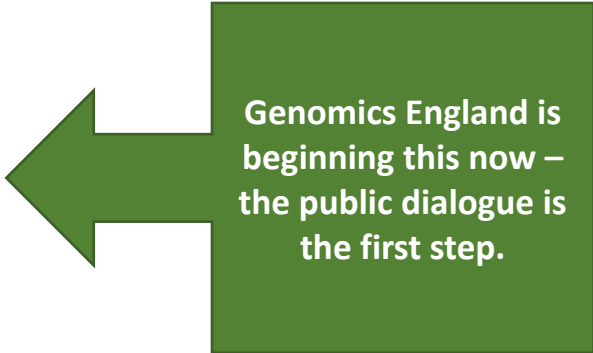
Whole genome sequencing for newborn screening

“The UK has in the region of 97% uptake of newborn screening and strong public engagement in genomic medicine.

Together with our world-leading genomic infrastructure embedded in the NHS, this makes the UK uniquely placed to conduct a high quality, large-scale research programme to determine whether and how sequencing should be implemented for screening in newborns.

Such research would need to include a study of opportunities, risks and the ethical and regulatory issues involved.”

Genome UK: the future of healthcare. HM Government 2020
p28



Genomics England is beginning this now – the public dialogue is the first step.

Public dialogue

Partners

Genomics England, The UK National Screening Committee, with additional funding from Sciencewise

Aim

To carry out a **public dialogue** to gain an understanding of the **diverse perspectives reflective of the UK public** around **newborn screening** and **genomics**, in order that future policies and decisions can better reflect **societal views, hopes, concerns and aspirations**.

Context

1. The potential use of WGS as a technology **in addition to or to replace** some parts of the current NHS newborn screening programme (which has defined purposes and criteria). What might be the potential benefits and harms for the baby throughout their lifetime, for parents and the wider family, for others in society, and for the NHS?
2. The potential **novel** uses of WGS in newborns – going beyond traditional screening and exploring different purposes (e.g. lifetime monitoring, pharmacogenetics, family planning, research, information only), and the potential benefits and harms for the baby throughout their lifetime, for parents and the wider family, and for others in society, and for the NHS.

The ‘research question’ for the dialogue

What are the implications of whole genome sequencing (WGS) for newborn screening for the NHS and society?

Public dialogue

Objectives

- **Understand participant views, concerns and aspirations** specifically around the use of WGS in newborn screening, and the **values and principles** that inform those views.
- Understand how participants **perceive potential harms** and **deal with uncertainty**, and how they **trade these off against potential benefits** for various affected parties, such as the child, the parents, the wider family, the NHS and society more broadly.
- Discuss the **safeguards** that participants think should be in place to help **minimise harm** and **maximise benefits**.
- Gain insight into what kinds of **support and information** various groups would find useful/critical to **help guide choices**.
- Explore what **expectations and understanding are the same**, and **what are different**, between **the public; clinician, academic, industry and other stakeholder groups** around the ambitions and concerns for newborn WGS and screening in the UK.

**DO YOU AGREE WITH
THESE OBJECTIVES?**

Publication of public dialogue results

Thursday 8 July 2021 – online event

Please contact simon.wilde@genomicsengland.co.uk for more information and to register.

Thank you to Simon for these slides.

Genetic Alliance UK has been pleased to be involved as part of the multistakeholder oversight group supporting this project.

We eagerly await the results!



THANK YOU

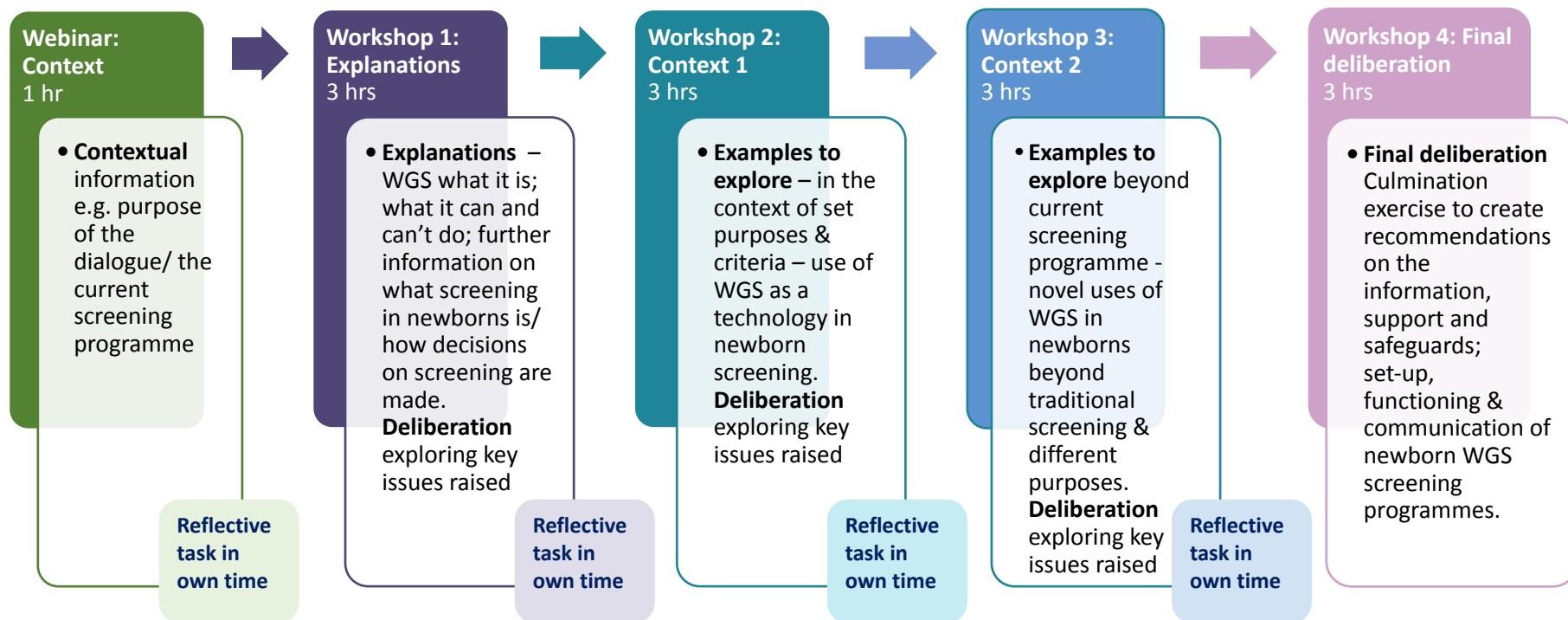


APPENDIX

The following two slides are the remainder of the slides shared with Genetic Alliance UK by Genomics England.

They provide greater detail on the engagement activity, and are shared here for transparency and a comprehensive representation of Genomics England's message.

Public dialogue route map



Specialist / expert involvement

