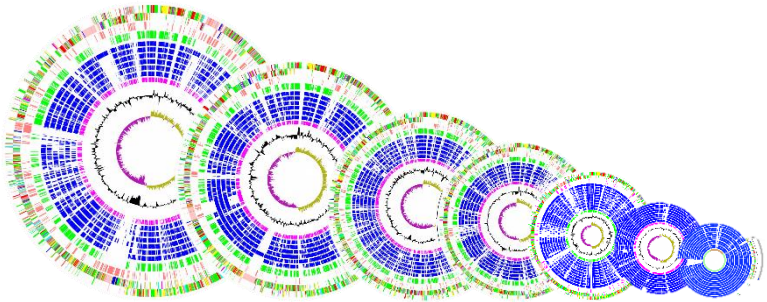
Implementation of Whole Genome Sequencing (WGS) in Microbiology Reference Services

Prof Matt Holden, University of St Andrew and Health Protection Scotland on behalf of the Dr Camilla Wiuff, Strategic Lead Microbiology, Health Protection Scotland and the WGS Service Transformation Group



Healthcare Science Annual Event, 70th Anniversary of the NHS Celebrating Achievement Building Influence
28th June 2018

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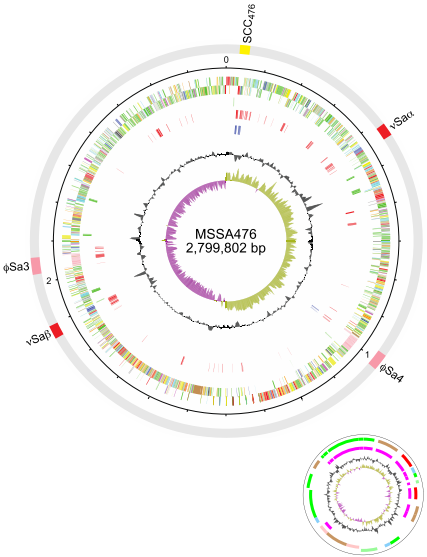
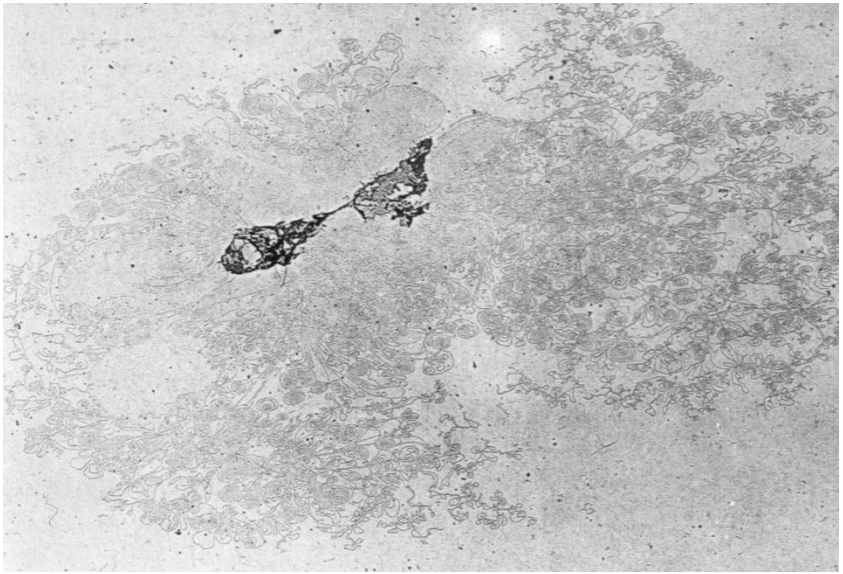
Whole Genome Sequencing and Genomics





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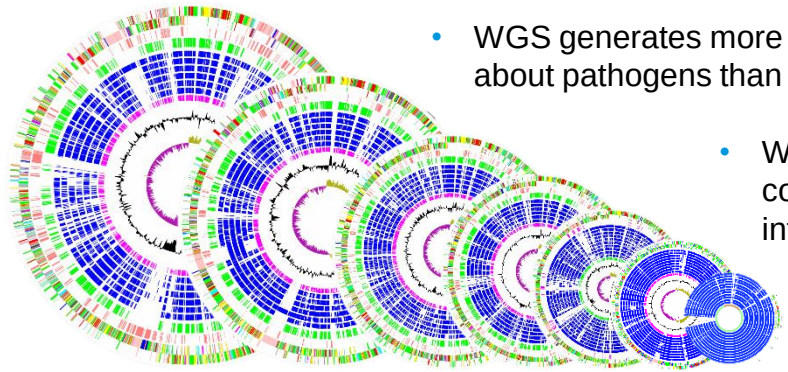
WGS is a game changer in the global fight against infection

- WGS is a new technique that allows us to read the genetic code of bacteria to guide optimal treatment, track their spread and break the chain of disease transmission.



- WGS generates more accurate and comprehensive intelligence about pathogens than any other technique.
- WGS will transform how we investigate and control outbreaks and how we manage infected patients.

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The journey to WGS in public health microbiology in Scotland

- Prior to 2013, individual Scottish reference laboratories had established collaborative WGS research projects with academic partners
- However, there was no coordinated approach to implementing WGS in public health microbiology (PHM) services
- A national workshop on future WGS based PHM services initiated a coordinated approach to introduction of WGS technology in two reference centres in Glasgow and Edinburgh (2015)

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Our strategic objective

....is to implement and provide a sustainable, resilient, responsive, high quality and cost effective microbial WGS capability for NHS Scotland.

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The WGS Implementation Group

Clinical governance
Since 2015 the national steering group, **WGS Implementation Group**, has driven and overseen structured implementation of WGS

Since 2017, the WGS IG was included in the Scottish Health Protection Network's (SHPN) coordination of national public health developments

Operational developments
The **WGS Service Transformation Group** has contributed to development of all parts of the service, including laboratory methodology and setup, bio-informatics analysis and IT built

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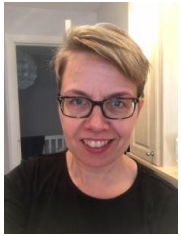
NHS Lothian
NHS Greater Glasgow and Clyde
University of St Andrews
Public Health England
University of Glasgow
The Scottish Government
Scottish Microbiology and Virology Network
SHPN SCOTTISH HEALTH PROTECTION NETWORK Promoting and Supporting Good Practice

WGS Service Transformation Group (WGS STG)



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Collaborative working

Service transformation within budgetary constraints

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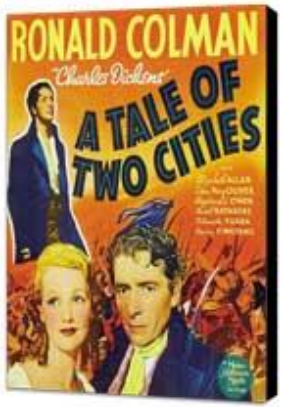
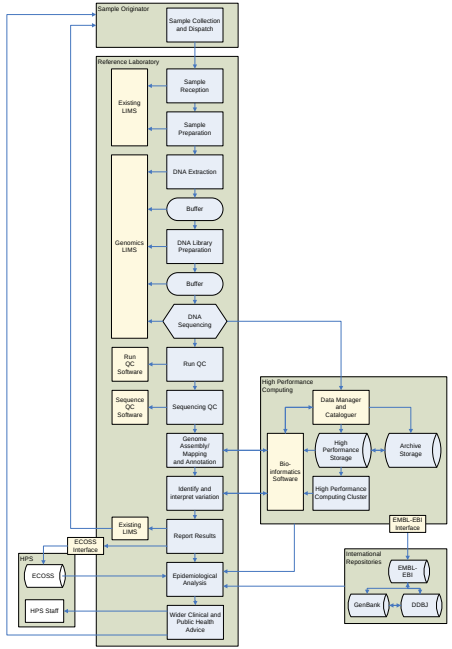
Service design and planning

- Options appraisal of WGS providers resulted in ‘2-site reference laboratory model’ with organism/clinical area specialised services
- The model provides service flexibility, responsiveness, resilience, scalability and strategic oversight that will allow optimal response to public health threats and emergencies
- Utilising the expertise and clinical leadership of existing reference laboratory and HPS teams



Designing the architecture of the service



- With NSS business analyst we designed the generic architecture of the two-site service delivery model
- It defines WGS-based services from patient sample to reporting of result for patient and public health purposes
- It identified further points for option appraisal

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Planning and prioritisation of services

- Prioritisation exercises involved reviewing WGS service landscape in Scotland, and readiness for transformation to WGS based services including:
  - Readiness for WGS by micro-organism; pilot studies, research, availability of bio-informatics pipelines and typing schemes, validation methods/equipment
  - Patient and public health needs
  - External drivers in the PHM service landscape (PHE/UK, NHS, ECDC, GMI, FAO/WHO, PHG)

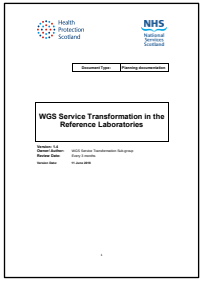
Flexible and responsive planning approach

Quarterly review of progress and summary of challenges

- Pilot studies (progress)
- Laboratory optimisation (wet lab side
- Bio-informatics analysis (pipelines)
- IT developments (local and national)
- Capacity optimisation

Review and revision of ops plans

- New service roll-outs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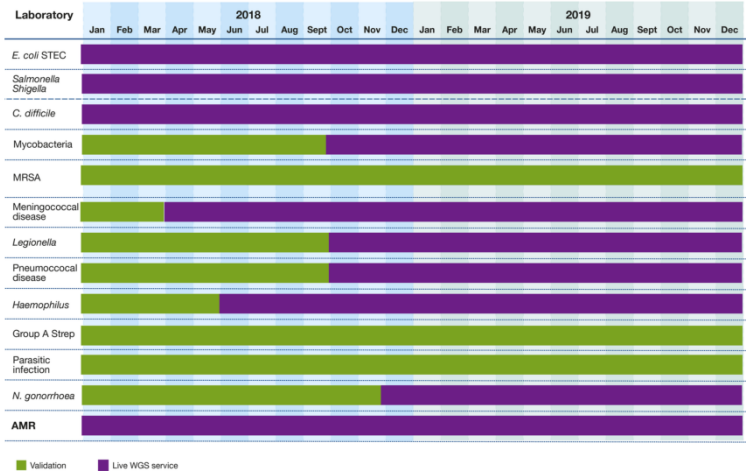
Document Type: Planning documentation

WGS Service Transformation in the Reference Laboratories



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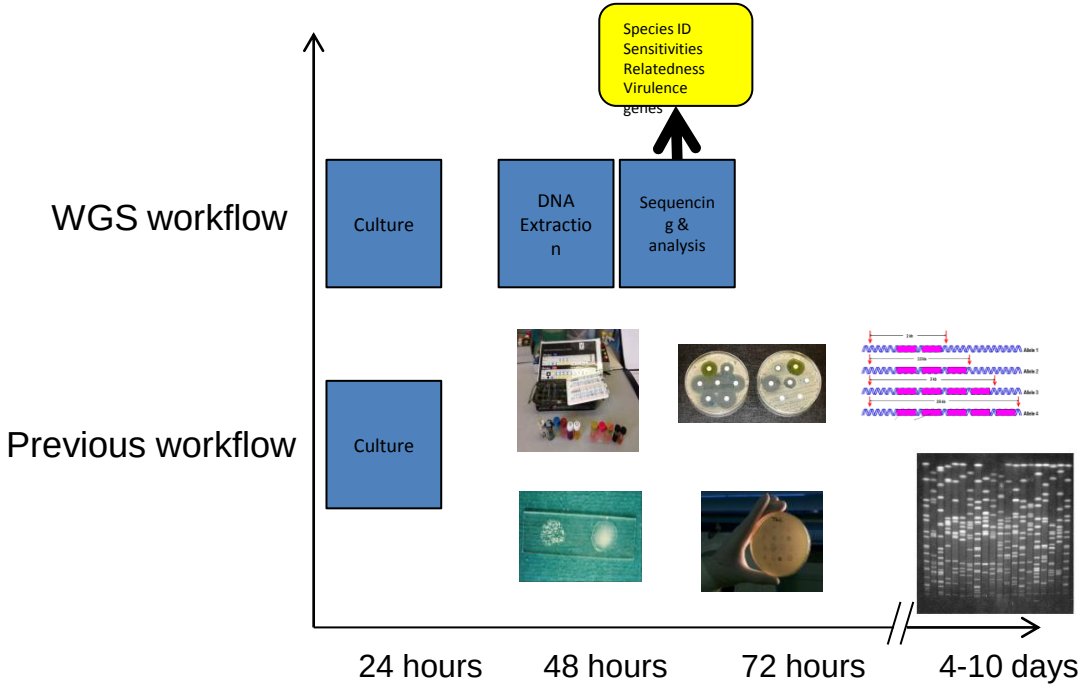
Amalgamation of workflows onto a single platform (WGS)

- Biotyping
- Phage typing
- Serotyping
- Antibiogram typing
- Organism specific techniques

WGS

Illumina MiSeq benchtop sequencer

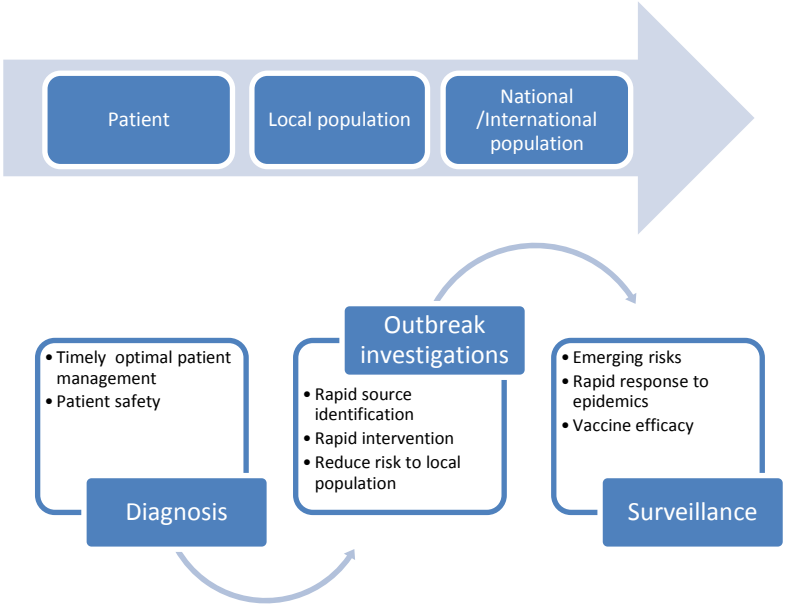
Amalgamation of workflows and reduced turnaround time



Benefits to staff

- Less work in “silos” and **more work in multi-service teams** (e.g. involvement in *Salmonella*, STEC, TB, MRSA etc)
- **Less person-dependency** as many staff can carry out the generic WGS functions
- More focus on the **scientific specialist role** (at all staff grades) in the epidemiology of communicable diseases as spending less time at the laboratory bench
- Possible advantages for career progression and job flexibility

Clinical and public health benefits



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Benefits to patients and the public health from WGS since August 2017

Diagnosis

STEC

Salmonella/*Shigella*

AMR profile

Optimal treatment

Outbreak investigations

20 STEC & 21 *Salmonella* clusters

Distinguish local from national/UK outbreaks (e.g. links to UK-distributed burgers and dog food)

Intervention at source

Rapid analysis for colistin resistance

Salmonella Agona -EU investigation of infant milk powder

Salmonella PT2 in eggs distributed across Europe

Rapid resolution and intervention

Improved patient outcome - Number of infections prevented?

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Acknowledgements

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