Whole Genome Sequencing as a Tool for Infection Prevention and Control

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**Microbiological Screening**

- Universal screening on admission:
  - Faeces (stool sample)
  - Nose and Throat swabs

- Targeted screening during admission based on symptoms:
  - Diarrhoea
  - Respiratory symptoms
  - Site specific

- Neutropenic screening during admission, weekly:
  - Faecal screening to identify carriage of gentamicin resistant organisms

**Microbiology Assessment**

- Organism identification
  - API or MALDI-ToF

- Antimicrobial resistance identification
  - Resistance to Gentamicin + any of
    - Ciprofloxacin
    - Ceftazidime
    - Piptazobactam or resistance to Amikacin/ Carbapenems irrespective of Gentamicin resistance

**Infection Prevention Control Assessment**

- Manual review of all positive microbiology results:
  - Healthcare acquired vs community acquired
  - Isolation + appropriate precautions
  - Further site screening
  - Cleaning advice
  - Patient alerting (retained until de-alerting criteria met)
  - Isolate sent for typing

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**Source detection**

- Environmental screening + environment evaluation
  - Ward level patient screening + contact review
    - Antimicrobial stewardship review
Molecular Microbiology

- Host Exome sequencing
- Transcriptomics
- T-cell receptor structure
- Metagenomic Sequencing
- 16S rDNA profiling
- Pathogen enrichment (Viral Genome sequencing)
- PCR for bacterial, fungal, viral gene targets and AMR targets
- Whole genome sequencing
- Genotyping

Slide credit Kathryn Harris
Why Is Typing Crucial Clinically?

What Information Can Typing Provide?

- Did the organism come from:
  - Prior colonisation?
  - New infection?
  - Spread from another patient or somewhere else?

Interventions

- Antibiotic policy
- Care bundle adherence
- Hand hygiene
- Probiotics/Prebiotics
- Selective digestive decontamination

- Isolation adherence
- Cleaning
- Hand hygiene
- Environmental screening
- Patient screening

Right intervention = right use of resources
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Right intervention = right use of resources
Phenotypic info:
- Organism identification
- Antibiogram

Single locus typing

Genomic fragment typing techniques

Whole genome sequencing
What Difference Could Improved Typing Make?

Points where improved typing would have helped

*Klebsiella pneumoniae* outbreak timeline by month. Green = un-colonised period of admission, Red = colonised period of admission. (manuscript in preparation)
Whole Genome Sequencing of *Mycobacterium abscessus* isolated in CF patients

- Infection and inflammation
  - Lung damage
  - Lung transplantation
- Mycobacterium abscessus
- 10% CF patients
- Increased rate of lung function decline
- Lung Tx contraindicated at some centres for CF patients with MA

1 in 2,500 babies born with CF in UK

Most common life-shortening genetic disease in caucasians

Lung Tx contraindicated at some centres for CF patients with MA
Eleven CF patients with *Mycobacterium abscessus* infection have undergone lung transplantation at GOSH

Slide credit Kathryn Harris

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