Sequencing

*Staphylococcus aureus*

Claire Gordon
Clinical Research Fellow

*Staphylococcus aureus* ("Staph aureus")

- Major healthcare and community problem
- High levels of carriage (everyone is exposed)
- Can cause
  - Skin infection, pneumonia, bloodstream infection, abscesses
- Can cause outbreaks
- May be multidrug resistant (MRSA)
• Hypothesis: whole genome sequencing (WGS) can give us all the information we need to diagnose, treat and investigate illness due to *S. aureus*

• To date we have used WGS to
  - study outbreaks / person to person spread
  - test for antibiotic resistance
  - look for genes and mutations causing severe disease

---

**Outbreaks studies: standard tests**

• Try to find which group the strains belong to
  - MLST
  - spa type
  - phage typing
  - SCCmec typing
  - Pulsed field gel electrophoresis
Whole Genome Sequencing (WGS)

- Use entire genetic code
- Look at individual single base differences (SNPs)
- Not based on single genes / combinations
- Can easily compare results from different laboratories / regions

Why is this better?
Why is this better?

Outbreak case study

Where did patient A get MRSA from?
Where did patient A get MRSA from?

Using standard tests (PFGE)
Using standard tests

Strain A

Strain B

Using sequencing

→ Dr did not transmit MRSA to patient A
Using sequencing

Dr did not transmit MRSA to patient A

Sequencing for antibiotic testing

- **Current method**
  - Grow the bacteria
  - Add antibiotic
  - See if the bacteria will grow in the presence of antibiotic

- **Sequencing**
  - (grow the bacteria)
  - Extract and sequence DNA
  - Use computer programs to look for genes which cause resistance
• Compared results from routine laboratory testing with whole genome sequencing results for 992 S. aureus strains

• Overall: genetic testing 99% correct

• Slightly better at saying “definitely resistant” than “not resistant”
  • 99.7% vs 98%
Conclusion

• In *S. aureus* outbreak studies
  • Sequencing confirms known outbreaks
  • Sequencing provides better information than current tests and showed that person to person spread had not occurred

• In *S. aureus* antibiotic testing
  • Sequencing gives similar results to standard testing

Questions?