

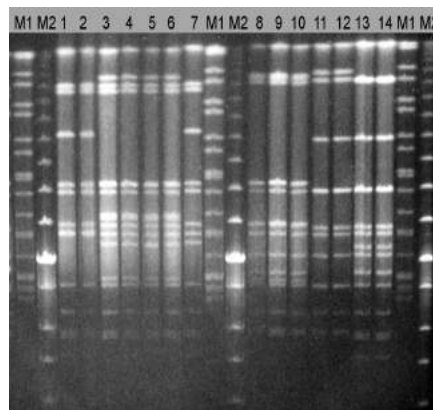
*Staphylococcus aureus*  
("Staph aureus")

- 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



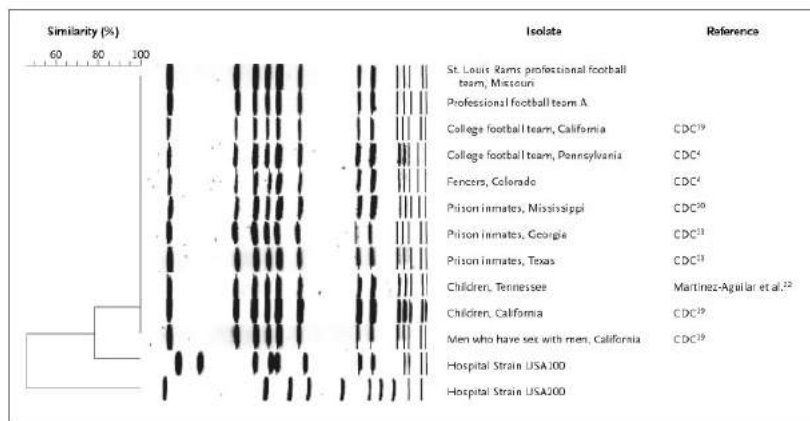
## Whole Genome Sequencing (WGS)

- 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

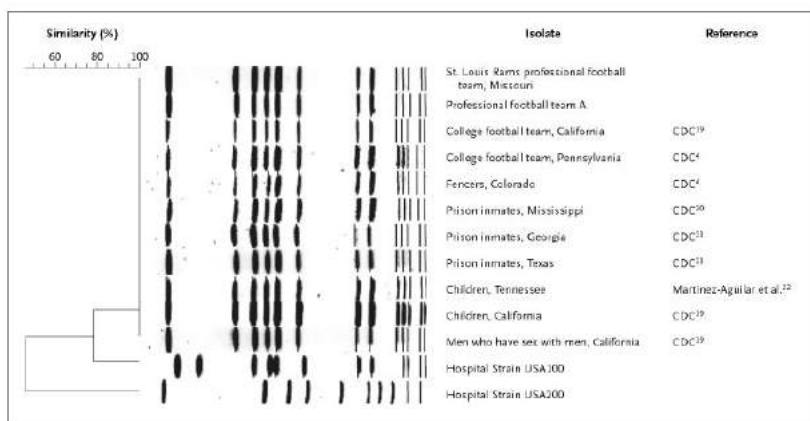


Why is this better?

## Why is this better?

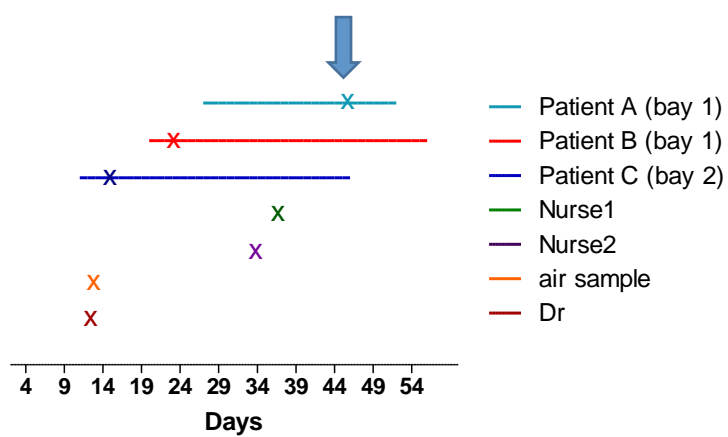


Kazakova SV et al. N Engl J Med 2005;352:468-475.

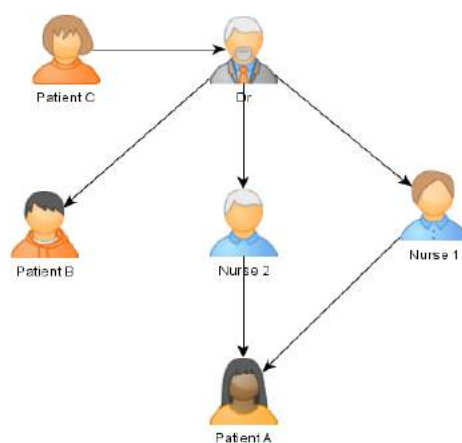


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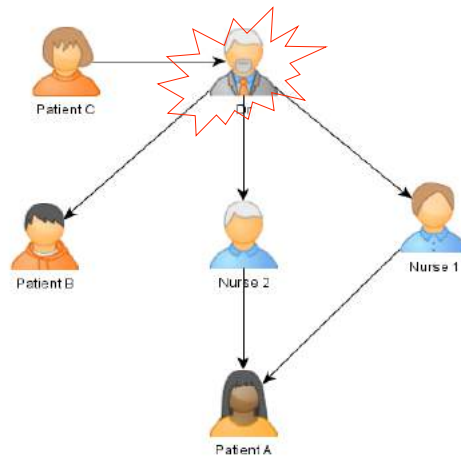
## Outbreak case study



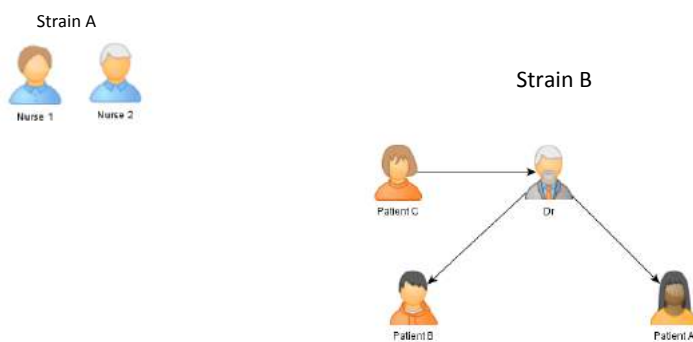
## Where did patient A get MRSA from?



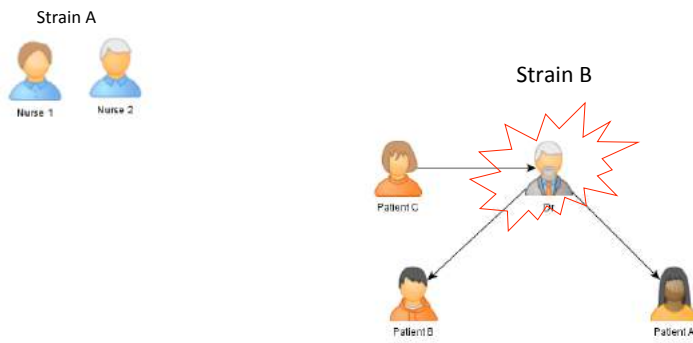
Where did patient A get MRSA from?



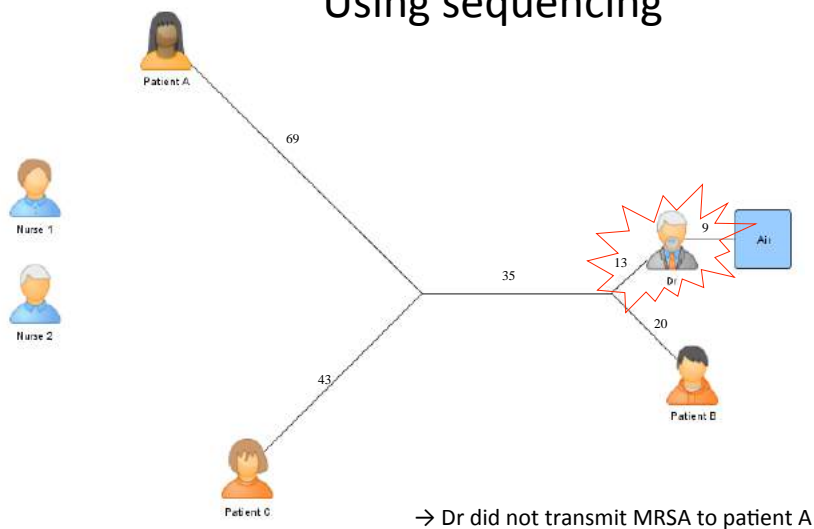
Using standard tests (PFGE)

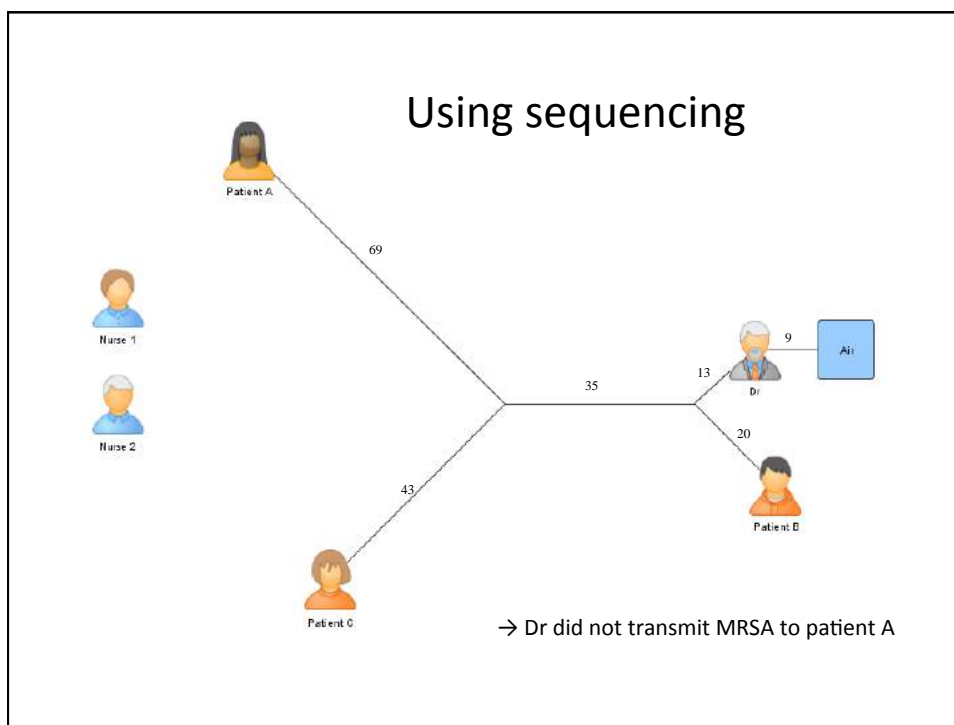


### Using standard tests



### Using sequencing





## 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





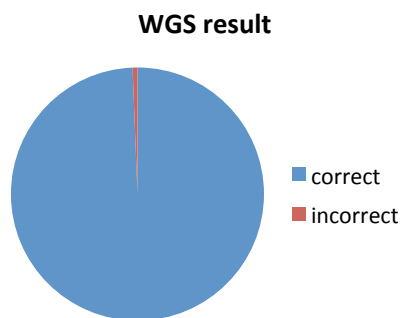
- Compared results from routine laboratory testing with whole genome sequencing results for 992 *S. aureus* strains



vs



- 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?

