Source attribution of human campylobacteriosis in Sweden -2012

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Prior findings - Sources of human *Campylobacter* infection

- Poultry 50-80%
- Cattle 15-30%
- **Sheep**, Pigs, Wildlife, Surface water, Other environmental sources <15%

- Interventions to reduce human cases?
- Improvements in external biosecurity
- Freezing of meat

- New Zealand
- England
- The Netherlands
- Finland
- Denmark
Methods - Analysis

- Summaries of findings in each source
- Asymmetric island model (Wilson et al.)
  - Phylogenetic based approach
  - Probabilistic assignment of cases to source
  - Based on between and within group heterogeneity
Results

- Low prevalence sources:
  - Pigs
    - 2 *jejuni* isolates identified (103 *C. coli*)
    - ST-21, ST-1775
  - Dogs
    - 5 *jejuni* isolates identified (53 *C. upsaliensis*)
    - All identified in humans, 4 in other sources
  - Bathing water
    - No campylobacter identified
    - Methodology in question
Results

• Sources with unique MLST types:
  – Wild birds and surface water
  – These two types were the most separate from the rest of the sources
  – Little overlap between them
    • 5 isolates – also common to other sources

• Sources with common types:
  – Sheep, Cattle, Poultry
Sheep

- 63/417 positive
- 59 C. jejuni
- 3 C. coli
- 1 C. lari
Sheep

- 59 isolates
- 17 types
- Only 2 not shared with humans
- 10 uniquely shared with humans
Cattle

• 48 isolates
• 16 types
• 4 unique
• 4 uniquely shared with humans
• Remainder shared with poultry types
276/2475 positive
227 C. jejuni
8 C. coli
1 C. upsaliensis
Broiler chickens

- 68 types
- 39 not shared with humans
- 18 uniquely shared with humans
Imported retail chicken

- 53/77 C. jejuni
- Denmark
- Estonia
- Holland
- Finland
- France

- 9 new poultry types
- Of which 4 were also identified in humans.
Humans

Poultry

Wild birds

Cattle

Sheep

Raw water

Pigs

Dogs

Imported chicken

All isolates
Asymmetric island model

- Assign humans isolates to source groups

Wild birds
Dogs
Sheep
Cattle
Imported chicken
Poultry
Raw water
Human cases
Source probability
Confidence in attribution of cases?
Cross-validation:

• Re-run model many times
• Each iteration:
  • Leave out one source isolate
  • Re-label it ‘human’
  • Run model
• Does the model classify the isolate correctly?
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<th>WATER</th>
<th>SHEEP</th>
<th>FOOD</th>
<th>DOG</th>
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Is it valid?
Conclusions

- Poultry and imported poultry meat are important
- Cattle importance is likely underestimated?
  - Cases going to sheep
- **Model overestimates importance of Sheep**
  - Taking cases from cattle and poultry
- Highlights difficulty of attribution of individual human cases
  - Using classification for future research is dangerous
- Need more than isolate information?
- Future work:
  - Cut-off value to classify into unknown category
Questions?