Distance to pig farms as risk factor for community-onset livestock-associated MRSA CC398 infection in persons without known contact to pig farms – a nationwide study

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Transparency declaration

- I have nothing to declare
- I have no conflicts of interest
MRSA CC398

- MRSA CC398 type first identified 2005
- Clearly associated with pig exposure
- Denmark: 7,500 pig farms; 12.3 million pigs; 5.5 mio persons
- 88% of Danish pig farms infected with MRSA CC398 (2016)

Human cases Denmark 2007-2015

Figures and Graphs, www.ssi.dk
MRSA CC398 in Danish persons

- Most (88%) of CC398 infected persons in Denmark have known contact with pigs
- However, 12% of CC398 cases are not known to be exposed to pigs
- MRSA CC398 concentrated in rural areas
- MRSA may spread by wind from pig farms (<300 m) or from pig manure on fields
- Does direct distance to pig farms or living in a pig farming-dense area in itself (community spread) increase the risk of MRSA CC398?

Study aims: For CC398 cases without known contact with pigs to determine, if
1. Direct distance to a pig farm or to a known human source of CC398 or
2. Living in a pig farming area in itself are risk factors for CC398
Methods

- Danish National MRSA database 2006-2015
- Danish Livestock Register (location of pig farms)
- CPR register (identification and address of persons living in DK)

- Case control study:
  - Clinical cases of MRSA CC398 (screening cases excluded) without pig contact
  - Controls: Danish background population

- Distance to:
  - Nearest pig farm with >10 pigs using ArcGIS software
  - Nearest known MRSA CC398 positive person with pig contact

- Hypothesis: if CC398 is spread directly from farms via e.g. air, then should human CC398 cases without pig contact live closer than controls to pig farms and/or other MRSA CC398 cases in all parts of Denmark
Results
Distribution MRSA Denmark 2006-2015

- MRSA, all cases  
  N = 11,174
- CC398, all cases  
  N = 2,706
- CC398, clinical cases  
  N = 632
- CC398, clinical cases, no pig contact  
  N = 192
Distances for clinical cases of MRSA CC398 without pig contact - Denmark overall

<table>
<thead>
<tr>
<th>Median distance to nearest:</th>
<th>CC398 cases</th>
<th>Population controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pig farm</td>
<td>2,500 m</td>
<td>3,500 m</td>
</tr>
<tr>
<td>CC398 infected person with pig contact</td>
<td>4,500 m</td>
<td>6,000 m</td>
</tr>
</tbody>
</table>

Distance to nearest pig farm

Distance to nearest CC398 case with pig contact
Distances for clinical cases of MRSA CC398 without pig contact - within three pig farming-dense municipalities

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<tr>
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Conclusions

- MRSA CC398 cases in Denmark live mainly in pig farming areas
- In Denmark overall, MRSA CC398 cases without pig contact live closer to pig farms than population controls do
- However, within pig farming areas clinical MRSA CC398 cases without pig contact do not live closer than population controls to pig farms or known human cases of MRSA CC398 with pig contact
- Interpretation: In pig farming areas MRSA CC398 is transmitted to persons without pig contact through the community rather than direct environmental spread from neighbouring pig farms
- Concern over being neighbour to a pig farm or living downwinds from one may be eased
Thank you for your attention