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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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Background: MRSA CC398 is an emerging MRSA strain found in livestock, mainly in pigs. Direct occupational livestock contact is the principal risk factor for human MRSA CC398 infection. Nonetheless, in recent years an increasing number of human cases of MRSA CC398 has been observed in persons without known contact with pigs. Such cases, referred to as community-onset (CO), have, like livestock-onset (LO) MRSA CC398 cases, been found to be concentrated in rural, livestock-producing areas. The presence of CO MRSA CC398 cases indicates alternative and unknown MRSA CC398 transmission pathways into the community. To determine whether the emergence of CO MRSA CC398 infections observed in rural livestock-producing areas are associated with distance between households and pig producing farms (suggesting environmental pathways of transmission), or with living in an area with pig farming and possible person-to-person spread through the community, we carried out a nation-wide study of the spatial distribution of MRSA cases in Denmark with a particular focus on CO MRSA CC398.

Material/methods: The study population consisted of all MRSA cases in Denmark January 1, 2006, – February 11, 2015, (N=11,174) with the Danish population in the same period as background population. Information on pig farms was retrieved from the Central Husbandry Register. Using the ArcGIS software we mapped MRSA cases in Denmark and calculated the cumulative incidence by municipality for clinical LO and CO MRSA CC398 cases (N=440 and 192, respectively); the association between risk of clinical CO MRSA CC398 and number of pig farms and clinical LO MRSA CC398 cases in the municipality; and the distance for each clinical CO MRSA CC398 case to nearest pig farm and clinical LO MRSA CC398 case, respectively, compared with the background population.

Results: While a higher number of MRSA cases was found in the larger cities compared with rural areas, MRSA CC398 cases were clearly more often seen in rural areas than in cities. Overall, clinical CO MRSA CC398 cases lived closer to pig farms and known clinical cases of LO MRSA CC398 than controls did, but within pig farming dense areas there was no such difference between cases and controls.

Conclusions: Our findings indicate that in pig farming dense areas MRSA CC398 is transmitted to persons without contact with livestock through the community rather than direct environmental spread from neighbouring pig farms.

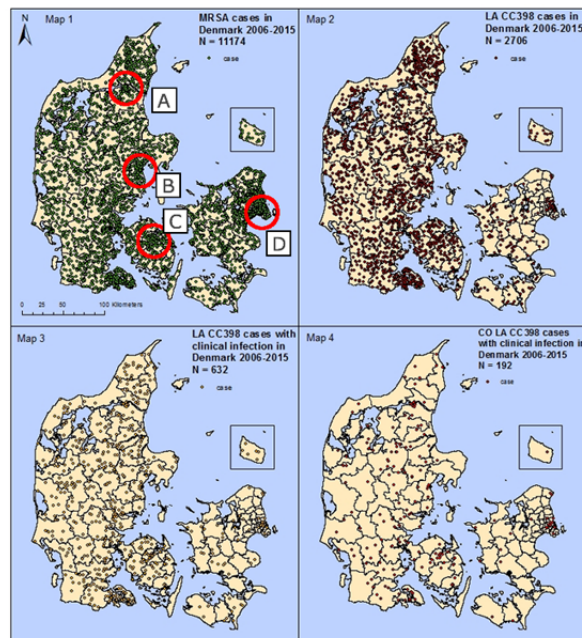


Figure. Place of living in Denmark 2006-15 for each human case of 1) MRSA infection or carriage (red circles largest cities in Denmark; A: Aalborg (peninsula Jutland), B: Aarhus (Jutland), C: Odense (island of Funen), D: Copenhagen (capital, island of Sealand); 2) MRSA CC398 infection or carriage; 3) MRSA CC398 infection (clinical cases); and 4) community-onset (CO) MRSA CC398 infection (clinical cases)