

Bovine tuberculosis in cattle and red deer in Southern Bavaria, Germany - can network analysis explain the routes of transmission?

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**Purpose:** Although bovine tuberculosis has been controlled in many European countries, it still plays a role in some European countries, especially due to wildlife reservoirs. Germany has achieved official TB-free status in 1997. Increasing numbers of disease outbreaks were reported in the region of Allgäu, South Germany, from the year 2000 onwards. The disease was observed in cattle and in wild-living red deer and results of DNA fingerprinting indicated a transmission both within species as well as across host species. However, the routes of transmission are not yet sufficiently understood. The purpose of this study was to gain more information about the epidemiology of bovine tuberculosis in that area.

**Methods:** Movement data of cattle from affected farms and the contacts with cattle from other herds were analysed retrospectively using network analyses. Network analyses are often used to describe trade networks, identifying farms that are potential spreaders of the disease. In our study we used network analysis to describe the spread and transmission of the disease amongst cattle, overlaying the geographical information of cattle grazing areas and locations of hunted deer. Movement data from 2010 to 2014 were obtained from the national cattle movement database (HI-Tier).

**Results:** Most farms were connected through cattle movements, especially through summer pasture farms grazing cattle from different herds. Such pastures are located in areas, which are also known to be the habitat of red deer. No information is available on direct contact between the two species, but indirect contact is highly likely in these areas.

**Conclusions:** Network analyses helped to understand the epidemiology of bovine tuberculosis in cattle in Southern Germany. In this context, trade contact with alpine summer pastures seemed to represent a hazard for cattle holdings. However, data on red deer was too sparse to show transmission patterns between red deer and cattle.

**Relevance:** Network analysis can provide valuable insights into possible connections between farms and transmission pathways.