



Clostridium difficile type 078 in pigs, a threat for farmers, their relatives, and employees



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Cross-Sectional study on 40 pig farms

- ❑ Goal of this research
 - Investigate the intestinal colonization with *C. difficile* of pig farmers, their relatives, employees, and their pigs
 - Analyze the relatedness of the isolates.





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Inclusion of pig farms

- ❑ Longitudinal intervention study involving several zoonotic agents
- ❑ Recruitment through the Dutch Farmer's Association, or through their own veterinarian
- ❑
- ❑ Farms were either closed farms or multipliers
- ❑ Questionnaire data were collected on farm management procedures, including cleaning and disinfection, antimicrobial usage





Inclusion of pig farmers, their relatives, and employees

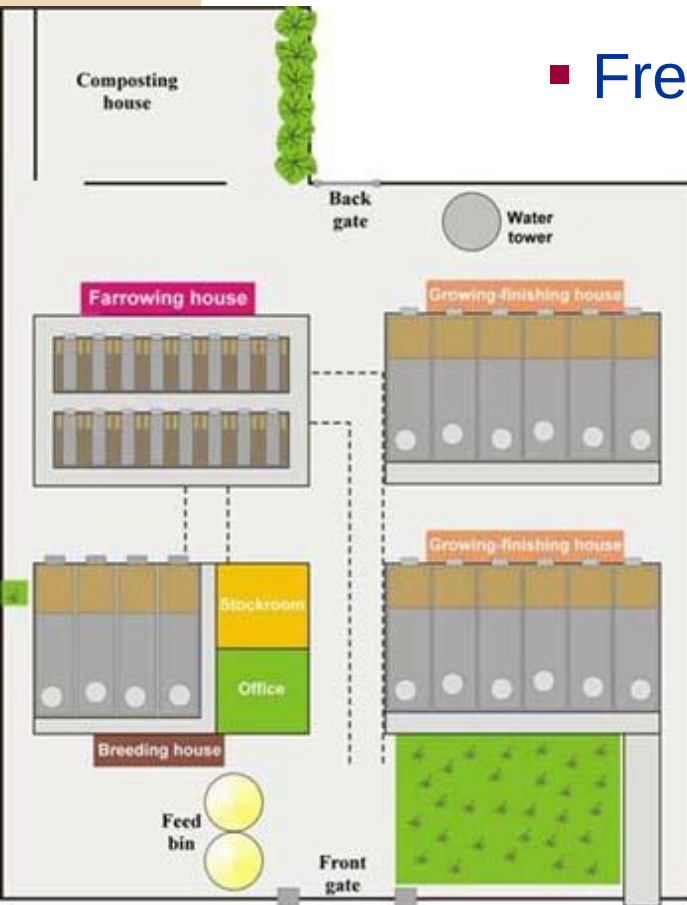
- ❑ Participants should work and/or live on the farm
- ❑ Questionnaires:
 - Health status of the participants, including history of diarrheal episodes
 - Admittance to hospitals
 - Visits to GP's
 - Contact with pigs, contact with other animals, etc. etc. etc.





Sampling procedure on the farm

- 10 pig wards per farm (40 farms)
- Fresh fecal samples from the floor





Sampling procedure, humans

Stool samples from farmers (40),
employees (15), partners (29),
and their children (44) from 32 farms





Sample distribution

- ❑ Multiplier farms: 16
- ❑ Closed farms: 24

Distribution	No. Of farms
Farmer	6
Farmer, partner	5
Farmer, partner, children	8
Farmer, partner, children, employees	7
Random combinations	7





Culturing and identification



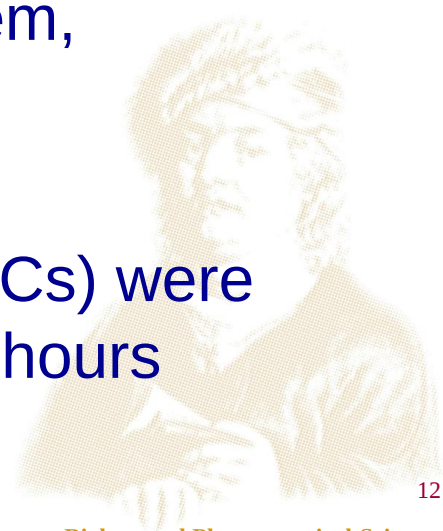
- Enrichment (7 days) and culture on CLO plates
- Gram staining and ribotyping of all isolates (Bidet et al., 2000)





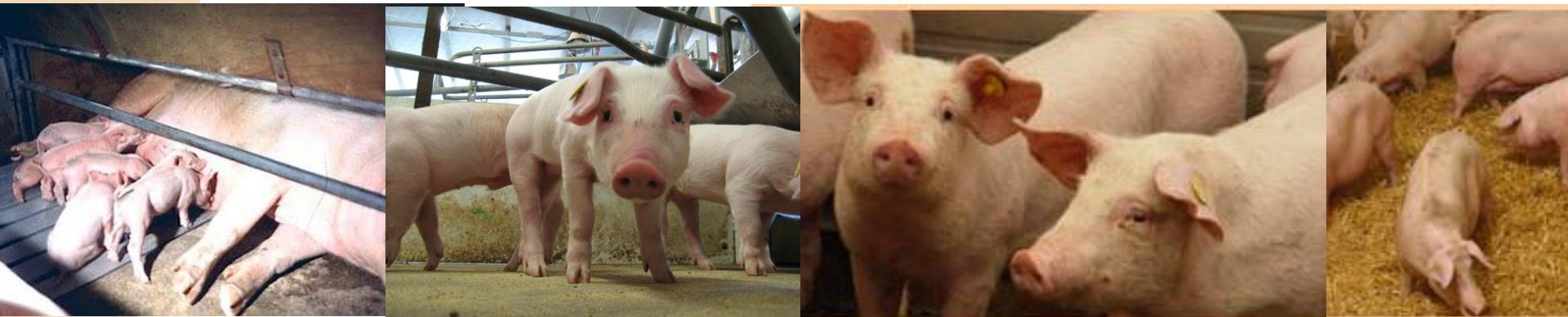
Comparison of human and porcine isolates

- MLVA on a selection of isolates of humans and pigs (Bakker et al., 2010)
- E test antimicrobial susceptibility testing of the same selection of isolates to moxifloxacin, clindamycin, co-trimoxazole, imipenem, tetracycline, erythromycin
- Minimal inhibitory concentrations (MICs) were determined after an incubation of 48 hours (CLSI, 2012)





Presence of *C. difficile* in pigs



C. difficile was found at 39 farms (124/400, 31%)

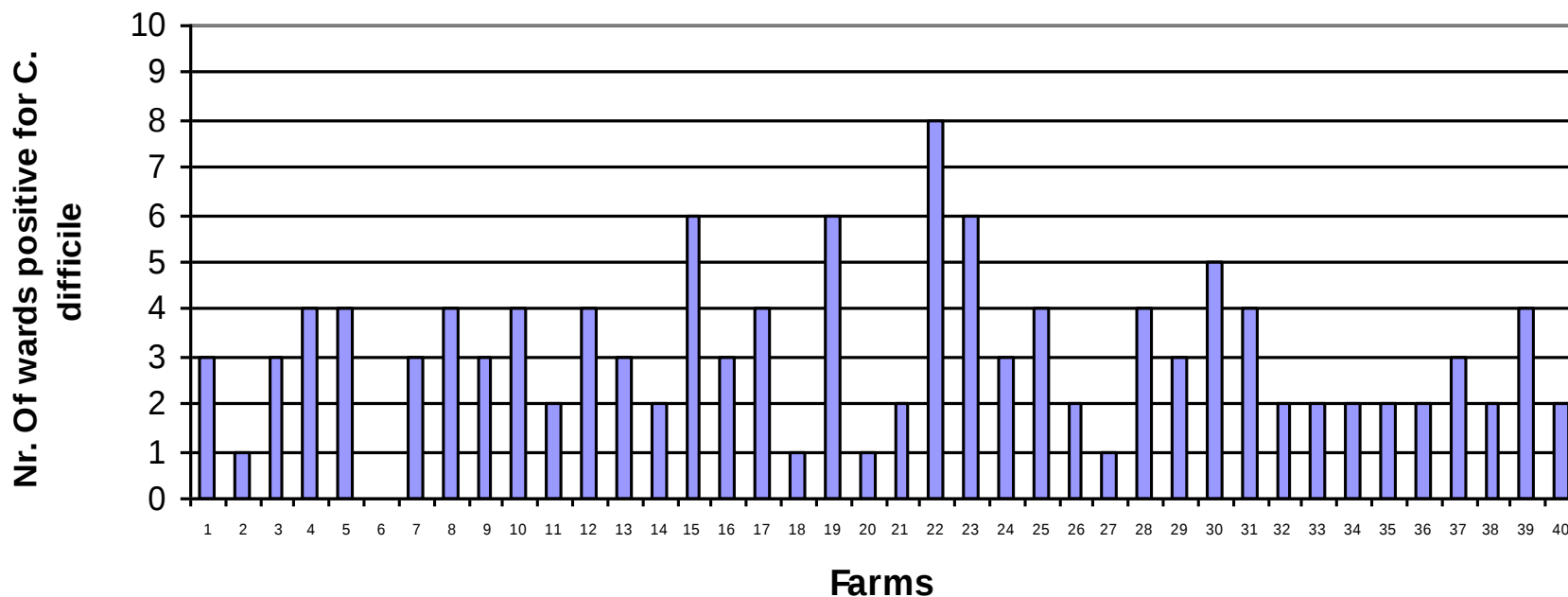
- farrowing ward (49 / 87, 56.3%)
- weaned piglets ward (31/98, 31.6%)
- juvenile sow ward (16 / 68, 23.5%)
- pregnant sow ward (15/59, 25.4%)





Prevalence per farm

presence of *C. difficile* per farm





Presence of *C. difficile* in humans

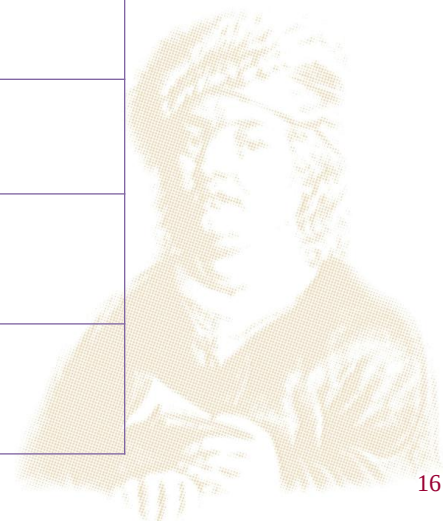
- ❑ *C. difficile* was cultured from 18 humans at 16 of the 32 farms.
- ❑ Presence of *C. difficile* in farmers (13/24%), partners (5/16%) and children (0).
- ❑ Corresponding ribotypes were found in humans and pigs





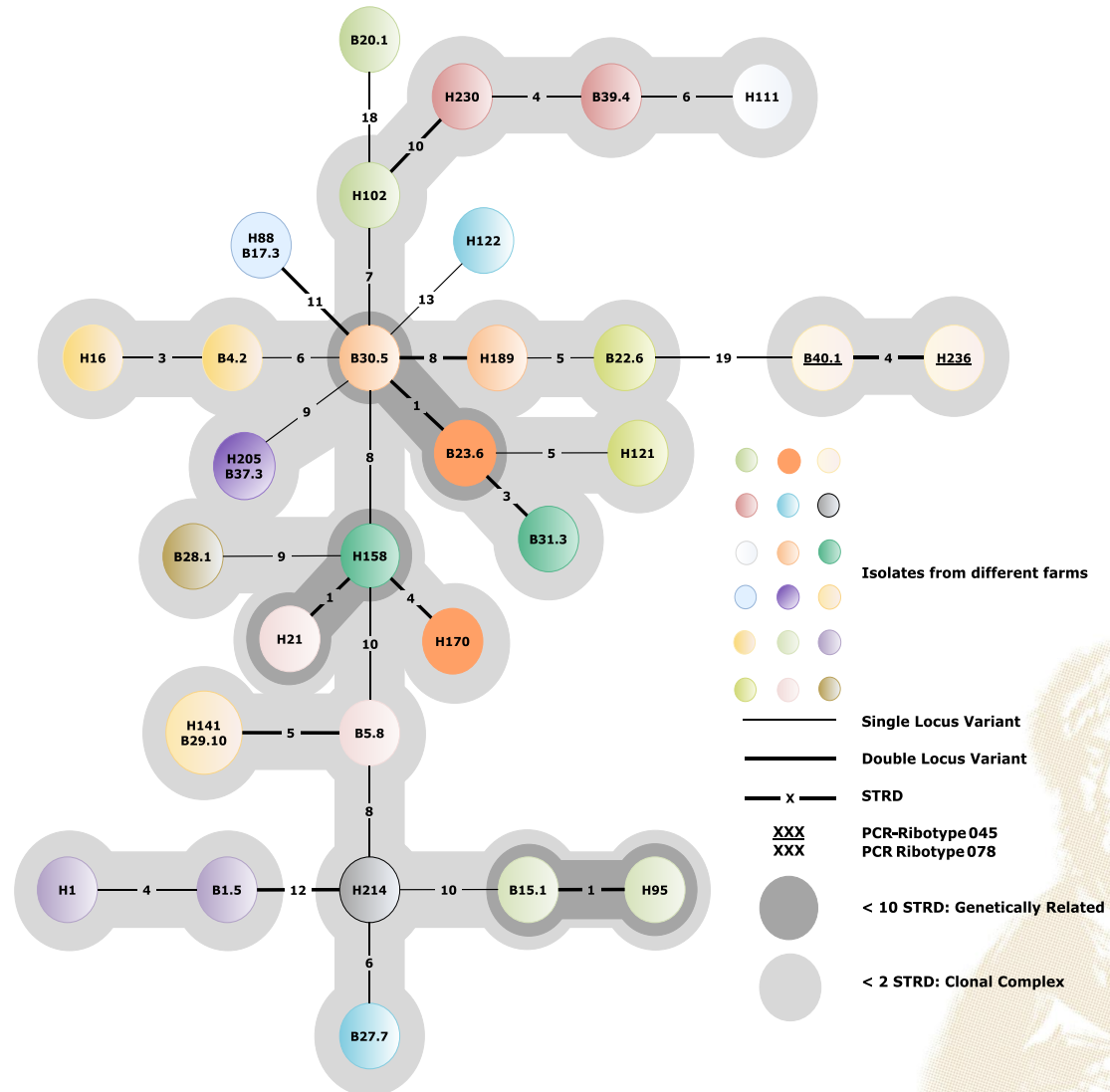
Ribotypes in humans and in pigs

Ribotype	No. Farms with positive pig wards	No. Humans (farms)
078	37	17 (15)
078 + 126	1	-
078 + 001	1	-
078 + 045	2	-
Unrecognized type	1	-
045	1	1 (1)





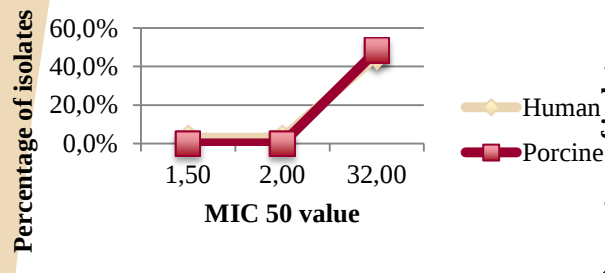
- Type 045 (1 human, 1 porcine isolate)
- Type 078 (16 humans, 15 porcine isolates)



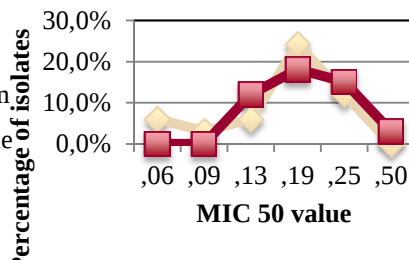


Antimicrobial susceptibility patterns; porcine (15) vs human (17)

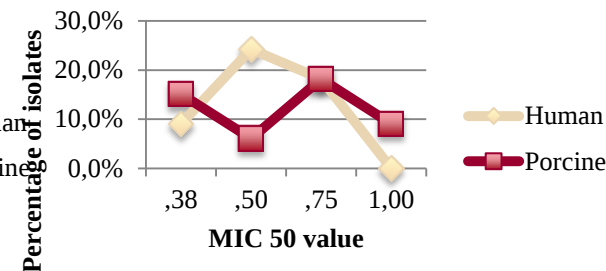
Imipenem



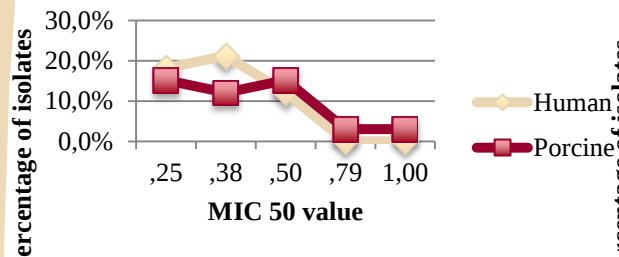
Co-trimoxazole



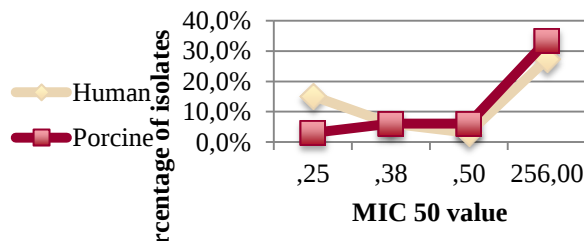
Clindamycin



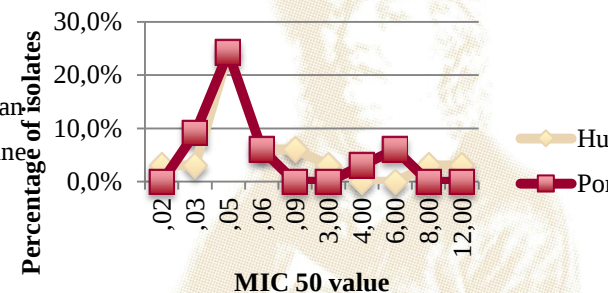
Moxifloxacin



Erythromycin



Tetracyclin





Antimicrobial susceptibility patterns at 15 farms; porcine vs human

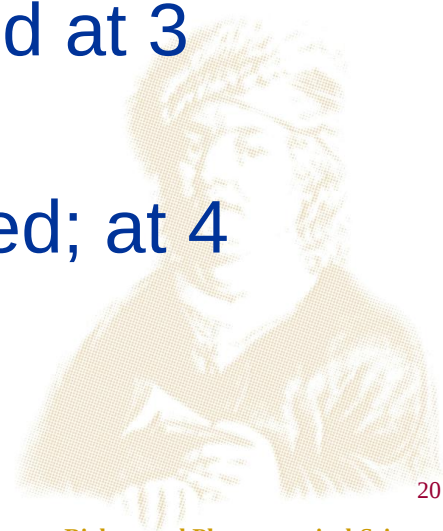
- ❑ Identical antimicrobial susceptibility patterns at 9 farms
- ❑ At 6 farms human and porcine isolates differed for one antimicrobial
 - Erythromycin (4 farms)
 - Imipenem (2 farms)





Antimicrobial susceptibility patterns at 15 farms

- ❑ Low MIC values to moxifloxacin, clindamycin, co-trimoxazole
- ❑ Highly resistant to imipenem (except 2 isolates from different farms)
- ❑ MIC >2 for tetracycline was found at 3 farms
- ❑ MIC values to erythromycin varied; at 4 farms all isolates had MIC <1





Conclusion

- ❑ Carriage rate of *C. difficile* in the human population with direct contact to pigs is higher than in the general population.
- ❑ The presence of phenotypically and genotypically similar isolates of *C. difficile* in humans working with pigs and in pigs indicates that transmission, either via direct contact or the environment, likely occurs.





Point for discussion

- ❑ Should antimicrobial prescription guidelines be altered for pig farmers?





Acknowledgements

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