Social Networks in the pig barn

Implications for the infection dynamics of MRSA

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Introduction

IP5: Studies and development of models for pig-to-pig and pig-to-human spread of MRSA on farms

Prof. Dr. Thomas Selhorst

Maike Will

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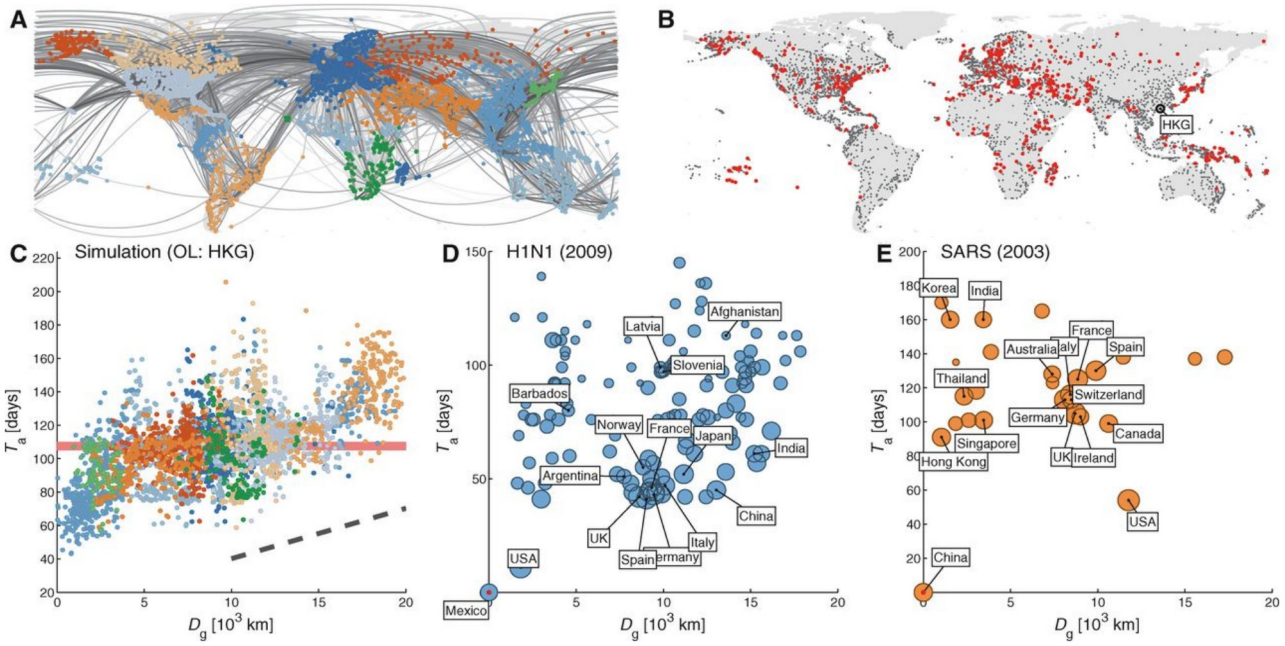
Motivation

Networks are a powerful tool in epidemiology:

e.g. global transportation networks[1]

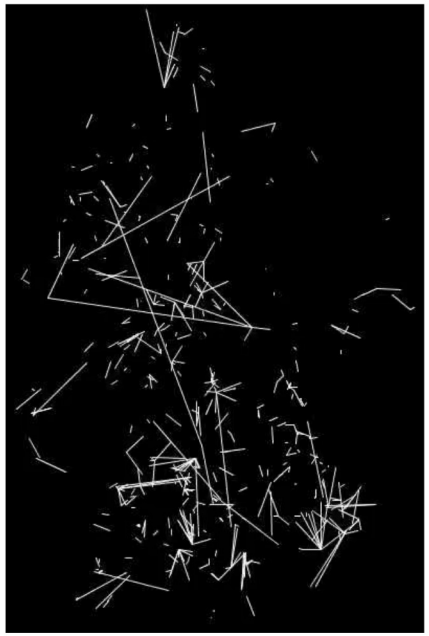


[1] Dirk Brockmann, *The Hidden Geometry of Complex, Network-Driven Contagion Phenomena*, Science 2013

Motivation

Networks are a powerful tool in epidemiology:

or livestock trade networks[1]



[1] Thomas Selhorst, *personal communication*

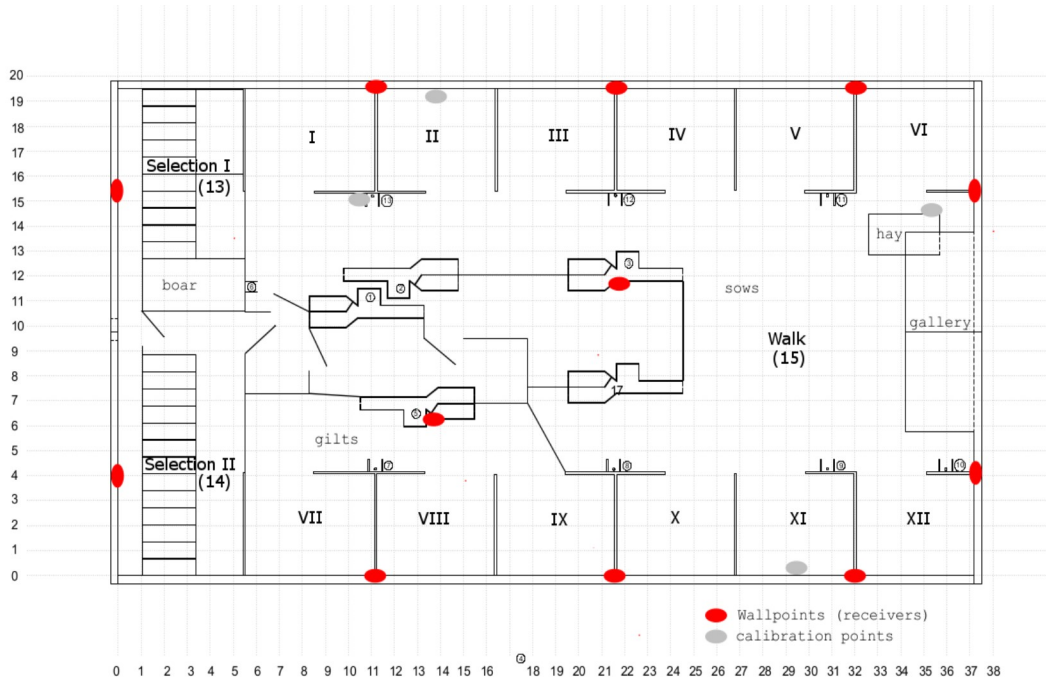
Our project - IP5

LVZ Futterkamp[1] - A look at the single farm level

[1] Lehr- und Versuchszentrum Futterkamp, Landwirtschaftskammer Schleswig-Holstein Link.

Our project - IP5

- barn with ~200 pregnant sows
- ongoing production, weekly cycle



Our project - IP5

We use eartags to track the positions of the sows.[1]

[1]M. Will et al.; *Accuracy of a real-time location system under practical conditions: Prospects to track group-housed sows*; Computers and Electronics in Agriculture (submitted)

Our project - IP5

We use eartags to track the positions of the sows.

Pigs are very social animals.

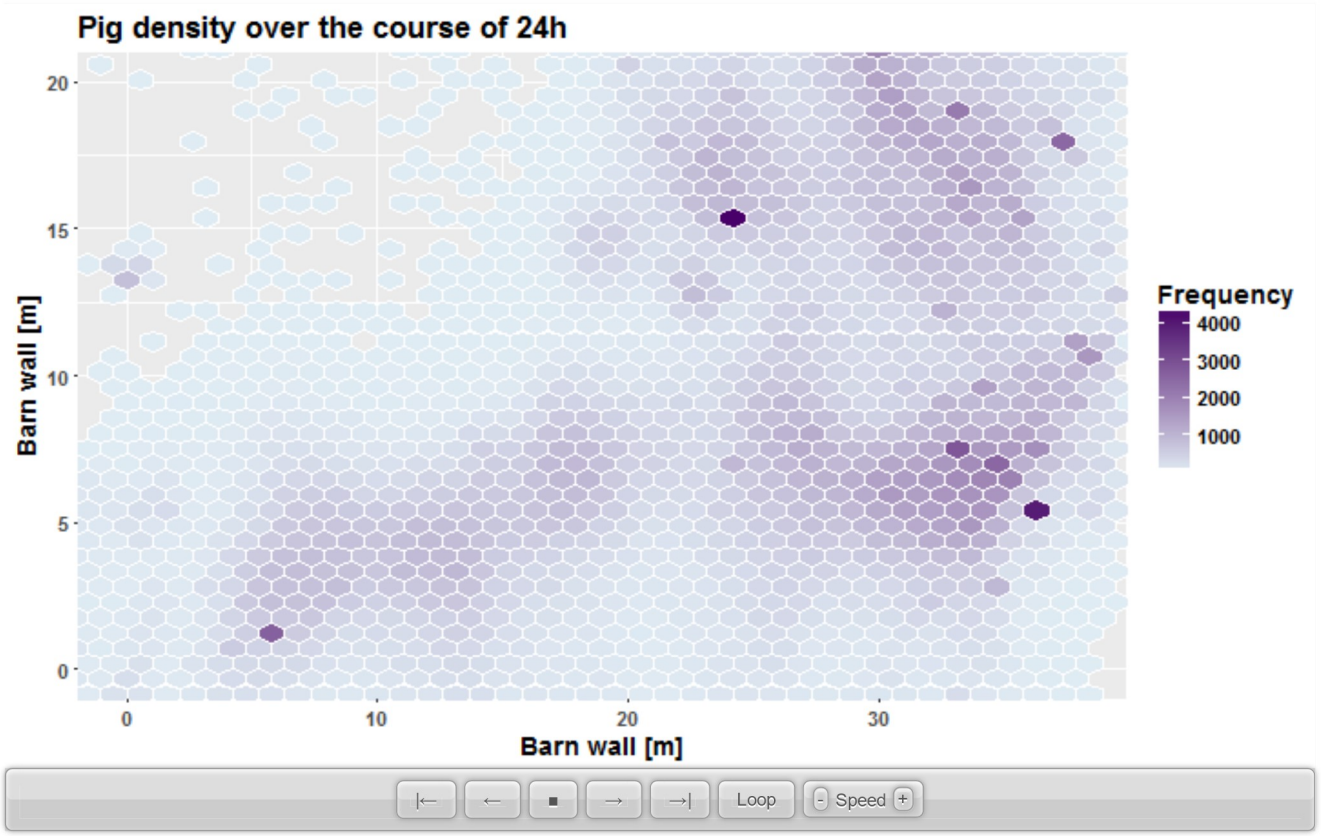
Our data

From May to September 2016 we measured $1.1 \cdot 10^9$ pig positions.

A glimpse at our data base:

id	id_pig	dat_timestamp	float_xpos	float_ypos
1541573	3267	2016-05-20 20:12:52	20.25	27.89
1756975	3272	2016-05-20 08:02:54	21.02	30.31
7033709	5881	2016-05-20 09:48:28	0.32	8.07
9003071	5941	2016-05-20 04:51:10	3.53	20.96
12489577	6057	2016-05-20 13:19:36	2.16	32.80

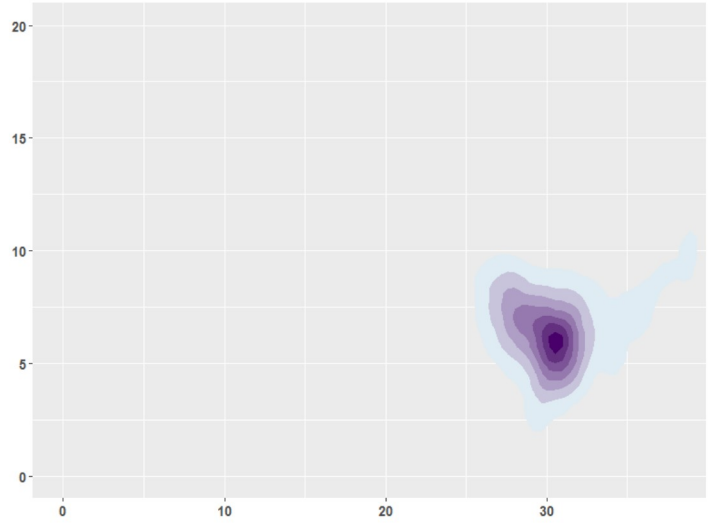
Our data


Pig density over the course of 24h
Barn wall [m]
Barn wall [m]
0
5
10
15
20
0
10
20
30
Frequency
4000
3000
2000
1000
|←
←
■
→
→|
Loop
- Speed +

Affliation Networks

Pigs and Pens

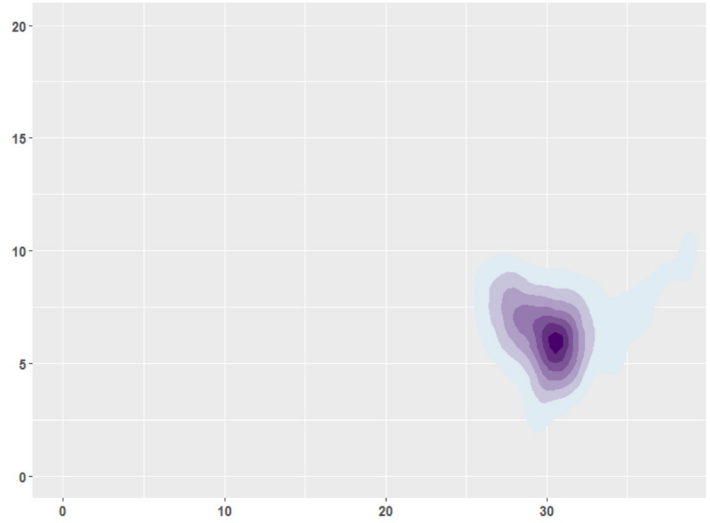
Ping density for a single pig over the course of 24h

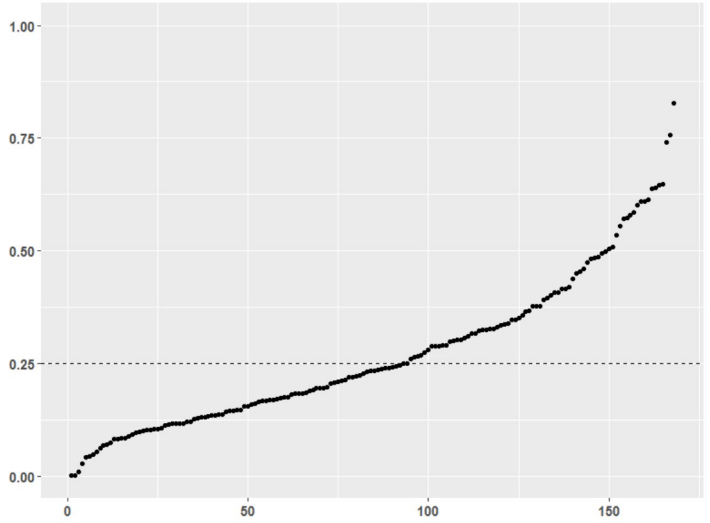


Affliation Networks

Pigs and Pens

Ping density for a single pig over the course of 24h





portion of a day spend in the same pen

Affliation Networks

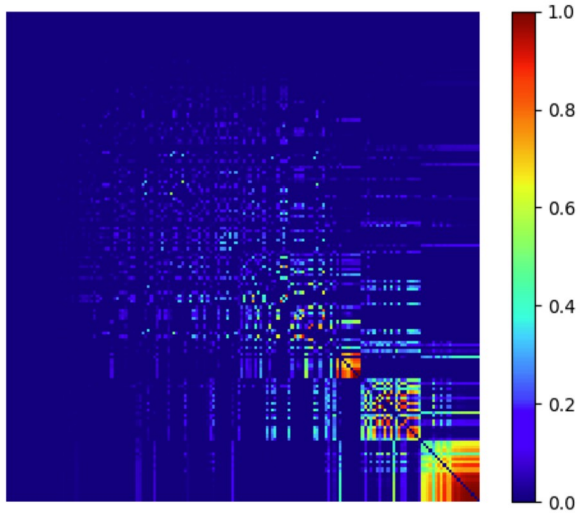
Pigs and Pens

Are pigs together with the same group in the same pen?

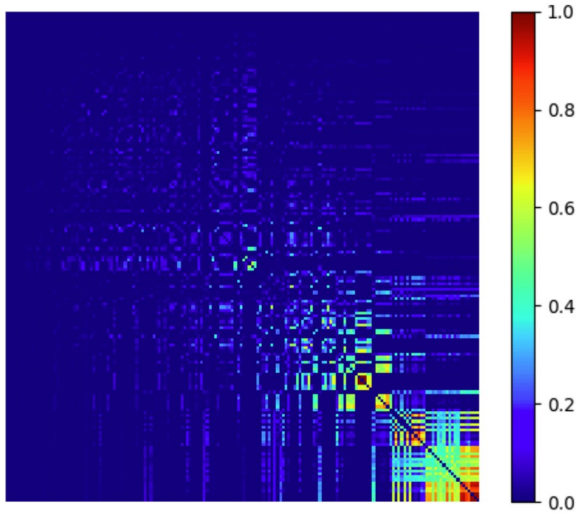
Affliation Networks

Co-affliation in pens

Each Pixel represents a pair of pigs and the coloring indicates how much time they spend together in the same pen.



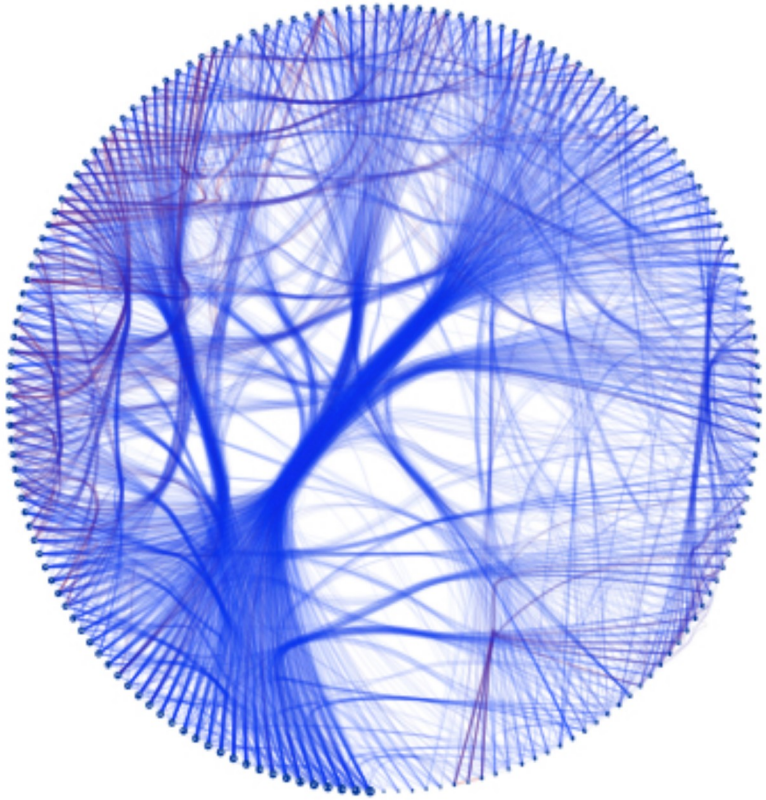
10min



60min

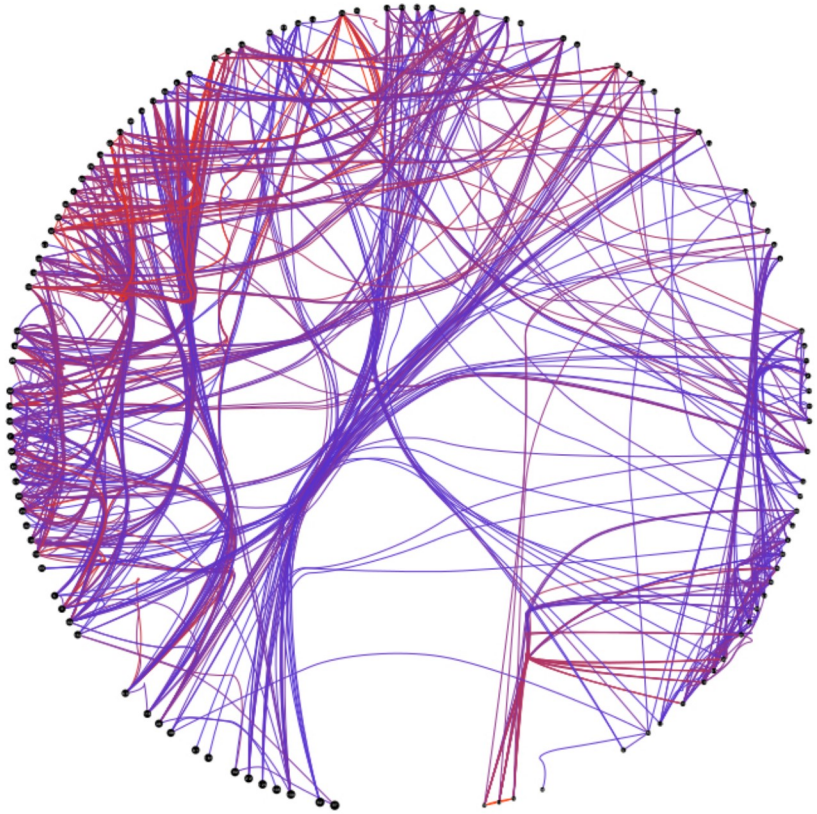
Affliation Networks

Social ties among the pigs as indicated by their co-affliation.



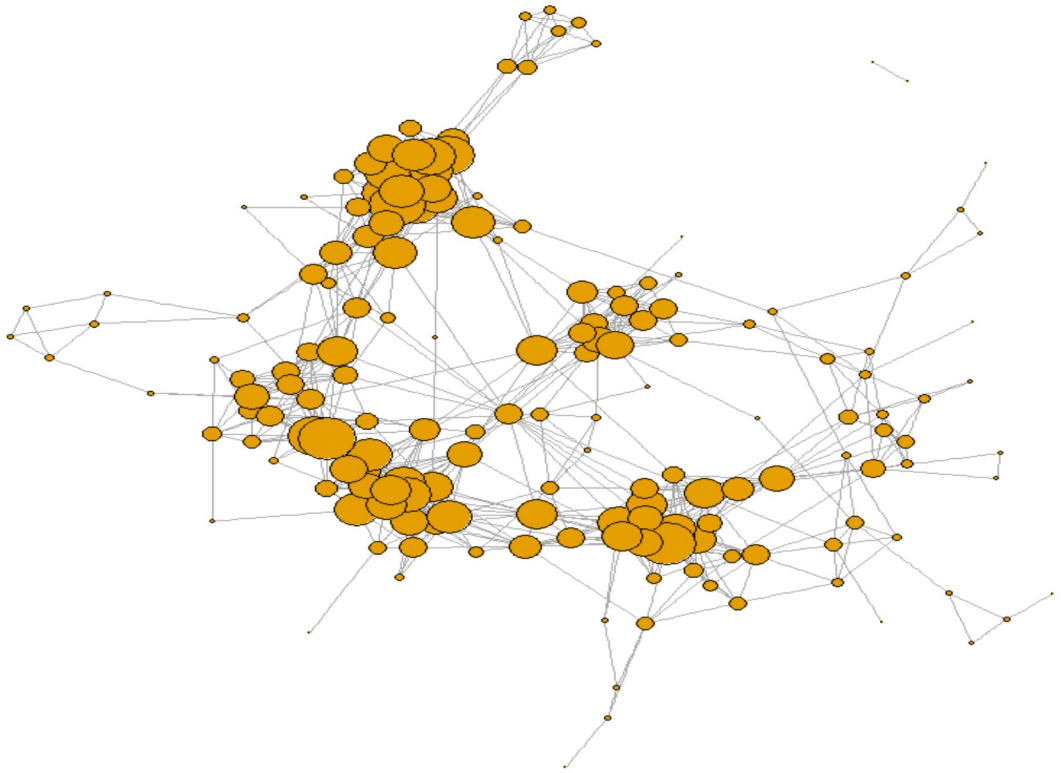
Affliation Networks

Social ties among the pigs as indicated by their co-affliation, with threshold.



Outlook

A static snapshot of a pig contact network realization.



Outlook

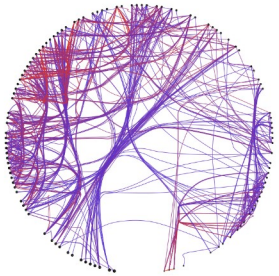
IP will go on till 2018!

We want to look at:

- possible influence of social status on a desease spread
  - strong bonds in groups
  - hierarchical low pigs in the walk
  - disruption during the production cycle

Outlook

- combination of social networks with additional metadata
  - breeding race
  - age (reproduction cycles)
  - MRSA status (collaboration with IP3)
- simulations of infection dynamics on the pig networks



Acknowledgment

My work group at the BfR **FG**

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MedVet-Staph

Bundesministerium
für Bildung
und Forschung

Thank You!

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