RISKSUR

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

Classical Swine fever in wild boar: Surveillance strategies under the microscope

K. Schulz, J. Sonnenburg,
B. Schauer, T. Vergne, M. Peyre,
C. Staubach, F.J. Conraths

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General:

- Classical Swine Fever (CSF) is a highly contagious viral disease
- Wild boar play role in disease introduction into commercial pig holdings
- CSF outbreak huge economic impact

- Need for reliable and cost-effective surveillance
- Case study within European project RISKSUR (http://www.fp7-risksur.eu/) with focus on risk-based approaches

Case study:

- Last case in wild boar in Germany in 2009
- Vaccination stopped in 2012
- Since 2012 => Germany officially free of CSF
- Council directive (2002/106/EG) => 95% confidence, 5% prevalence
  - Theoretically 59 samples/year at district level
  - Currently examined serologically and virologically (usually PCR)
  - Recommendations: sampling all “passive” animals
- Implementation depended on federal states

Evaluation:

- Evaluation of surveillance system in wild boar and alternative, risk-based surveillance strategies
- Testing of sensitivity and timeliness by using a simulation model
- **Sensitivity**
  - The probability that the disease will be detected if it is present in the population at a certain level (design prevalence)
- **Timeliness**
  - Defined as the time between introduction and detection of infection

Risk factors:

- Risk factor analysis by
  - Literature review
  - Statistical analysis

- Identified risk factors for infection with CSF and detection of CSF:
  - **Age** (Piglets; Sub-adults; Adults)
  - **Population density**
    - Only sampling in districts with a population density above defined threshold
    - Sample size dependent on population density
  - **Season** (Hunting season; Quarterly)
  - **Passive**

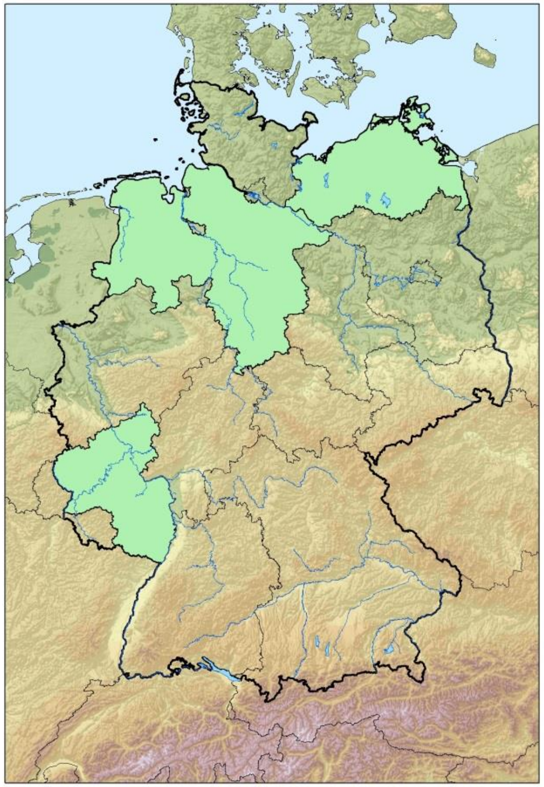
- Different surveillance strategies with regard to the risk factors

Simulation model:

- Simulation of introduction of CSF virus in an unvaccinated wild boar population which is free from disease

- Model data resulted from data of three different federal states of Germany:

    - Rhineland-Palatinate (RP)
    - Mecklenburg-Western Pomerania (MV)
    - Lower Saxony (NI)



Simulation model:

1. Generation of wild boar population

a) Population size estimates
b) Population structure (age, gender, type of carcass)

2. Simulation of infection

a) One district randomly chosen for start of infection
b) Serological prevalence in the start month at 5%
c) Animals were randomly selected to be marked as serologically positive and one month prior to that as virologically positive
d) Infection runs for one year (start from month of introduction to 12 months later)

Simulation model:

3. Simulation of hunting

a) On the basis of averaged hunting data, animals of generated population were randomly chosen

4. Simulation of different surveillance strategies

a) 69 strategies developed on basis of risk analysis
b) Sampling a. randomly distributed; b. on the basis of real data
c) Examination a. only serologically; b. only virologically; c. both
   I. Test sensitivity and specificity were assumed to be 100%

5. 1000 repetitions of simulation were done

Simulation model:

6. Sensitivity of surveillance strategies

Determined by calculating the detection probability (Det)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ø	Det
0	0	0	0	0	0	1	0	4	2	1	2	0.83	99,92%

7. Timeliness of surveillance strategies

For all simulation runs in which the infection was found, it was calculated how many months after the start month of infection the infection was detected

Sensitivity analysis:

- Change in population structure
- Prevalence increase in the month 2-12
- Change in start prevalence
- Change of number of hunted animals
- Increase of animals found passive

Sensitivity:

- ≥ 95% detection probability (se = serological investigation, vi = virological investigation)
  - Conventional (59 se)
  - Age (59 adult/subadult se)
  - Season (59 NDJ se; 59 Quarterly)
  - Population density (samples size; threshold)
  - Combination (All passive + 59 se; 50% passive + 59 se)
-

Sensitivity:

- < 50% detection probability (vi = virological investigation)
    - All passive vi
    - 50% passive vi
    - 59 piglets vi
    - 59 vi only in districts with a population density > 4 wild boar/km²

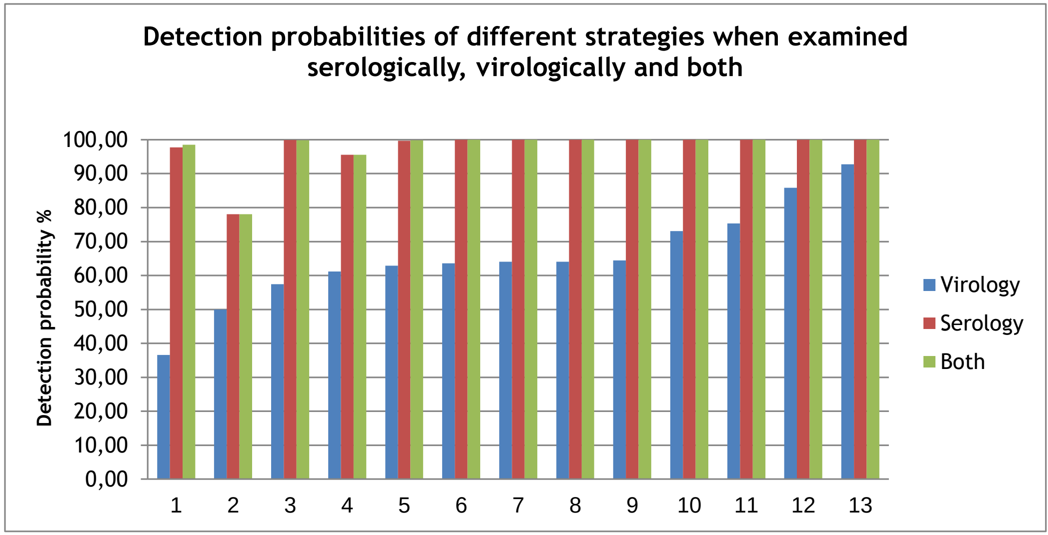
Timeliness:

Weighted average: (1*0+2*1+3*2+4*3+5*4+6*6+7*8+8*12+9*13+10*15+11*16+12*20)/78

	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ø
Month of infection	33%	0%	5%	5%	18%	11%	5%	16%	0%	35%	67%	38%	20%
1. following month	0%	6%	6%	21%	9%	5%	17%	0%	43%	52%	14%	24%	16%
2. following month	6%	7%	23%	12%	6%	19%	0%	42%	48%	8%	10%	0%	15%
…	…	…	…	…	…	…	…	…	…	…	…	…	…
11. following month	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%

Sensitivity and Timeliness:

- Random sampling shows slightly better results then real distributed sampling
- “Only serological” examination similar to “both”, “only virology” clearly worse
- Sensitivity analysis showed that all parameters are robust



- Risk based approaches show slightly better results in timeliness
- Including more evaluation attributes and economic evaluation are necessary
- Feasibility due to biological limitations has to be considered e.g. population estimates
- In times of disease freedom and in an unvaccinated population no need for serological AND virological examination
- Passive surveillance needs improvement
    - Incentives for hunters
    - Easier sampling methods

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