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Clinic for Food Animals

Department of Clinical Veterinary Medicine

Enzootic Pneumonia in pigs

What is known for long, what is new and what is coming up?

Heiko Nathues

Danish Pig Vet Meeting, Kolding, Denmark, 03. Nov. 2016

UNIVERSITÄT BERN

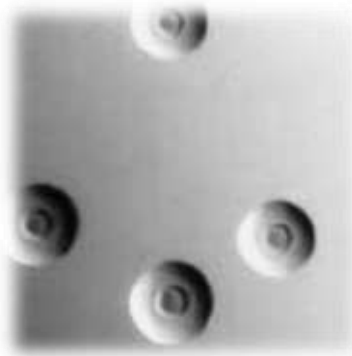
This presentation is dedicated to

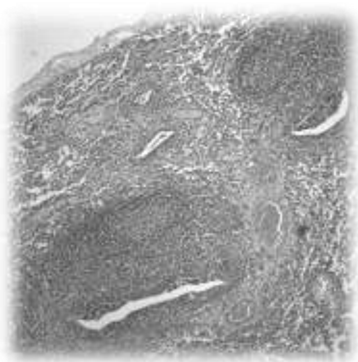
Peter Høgedal

Founding Father and former President of the
European Association of Porcine Health Management

Agenda

- **Epidemiology**
- **Diagnostics**
- **Treatment**
- **Prevention**





Epidemiology of Enzootic Pneumonia in pigs

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Mycoplasma hyopneumoniae infection

A multi-factorial disease

Management & Hygiene
- Vaccination
- Gilt acclimatisation
- Farrowing rhythm
- Cleaning & Disinfection
- Idle time of barns
- Treatments
- Farrowing control
- Castration
- Weaning time
- Replacement
- Movement
- Marketing
- Minimizing of stress

Animal
- Age
- Resistance
- Immunity (active, passive)
- Performance

Environment
- Age structure of the herd
- Structure of barns
- Housing systems
- Separation of production stages
- Separation of farrowing groups
- Pig density
- No. of pigs per pen
- Air volume per pig
- Pen barriers
- Ventilation
- Handling of liquid manure

Enzootic Pneumonia

Coinfections
- *Pasteurella multocida*
- *Streptococcus suis*
- PRRSV
- Influenza
- PCV 2

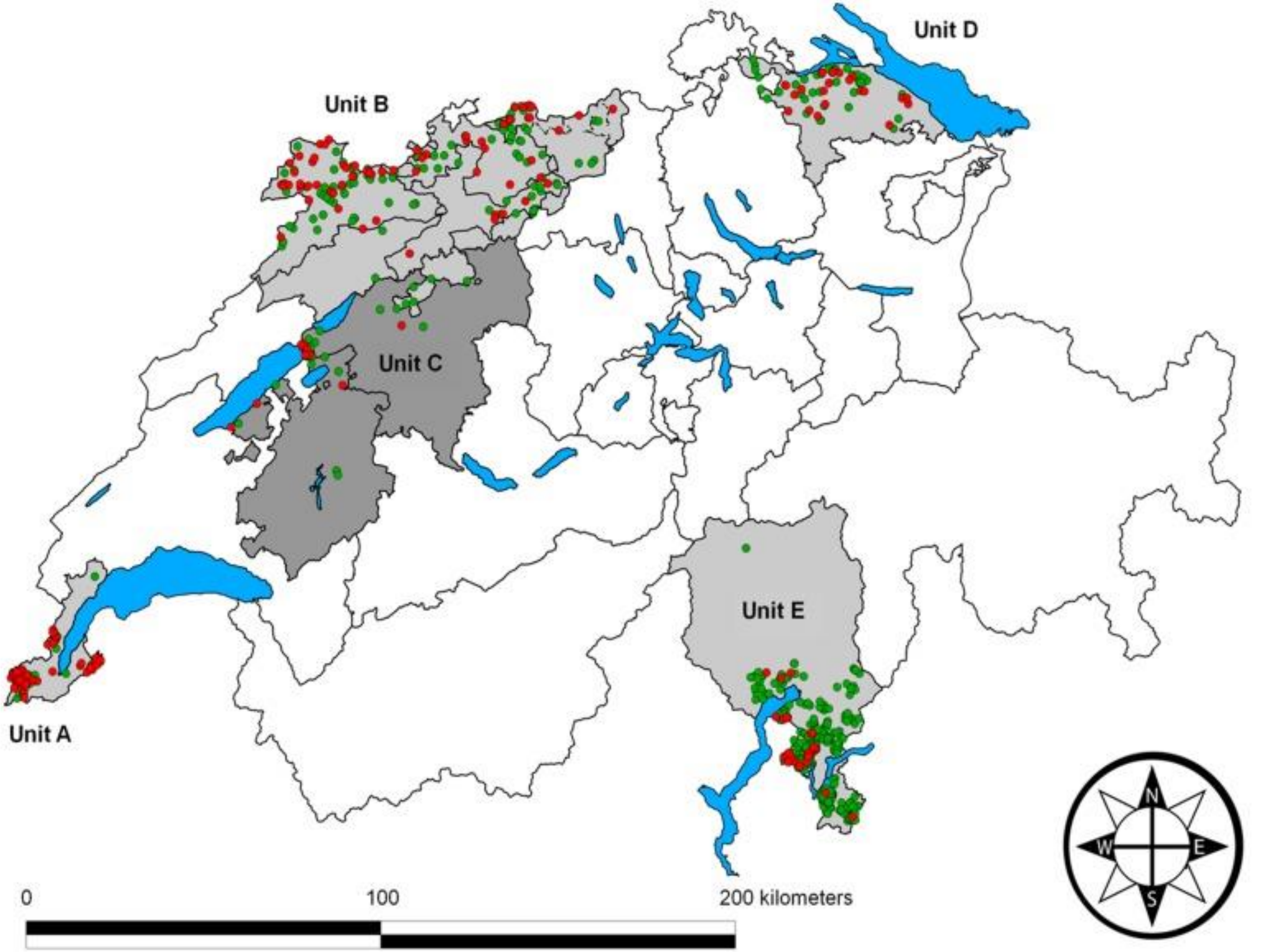
M. hyo
- Virulence
- Dose
- Resistance
- Persistence
- Tenacity

modified from Stärk, 1998

M. hyopneumoniae

- Small bacterium without cell wall
- Slow growth *in vitro*
- Slow growth *in vivo*
- Attaches to the cilia on epithelial cells in the airways
- Invades epithelial cells in the airways (?)

Spread & transmission



Batista-Linhares et al. 2015

Spread & transmission

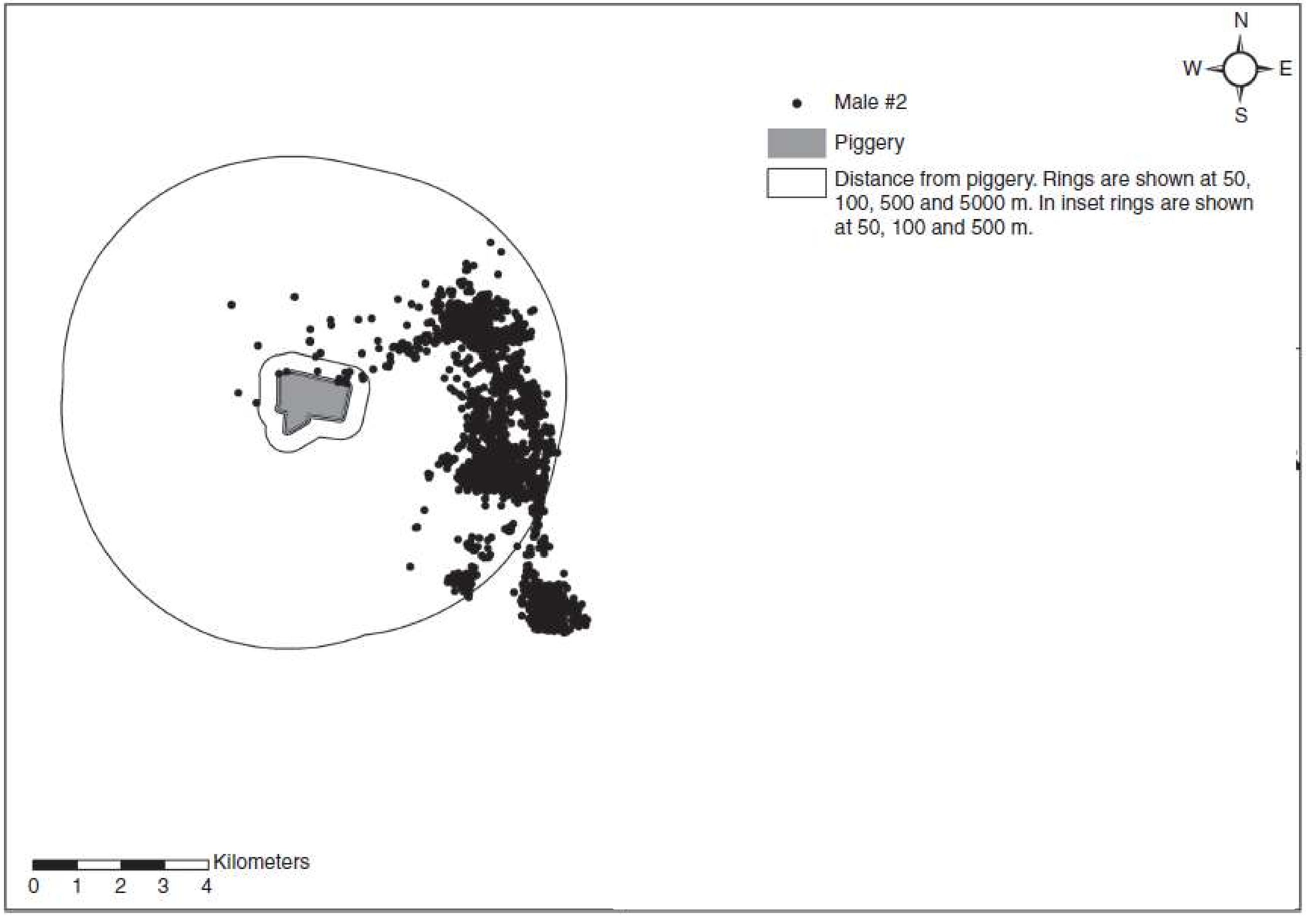
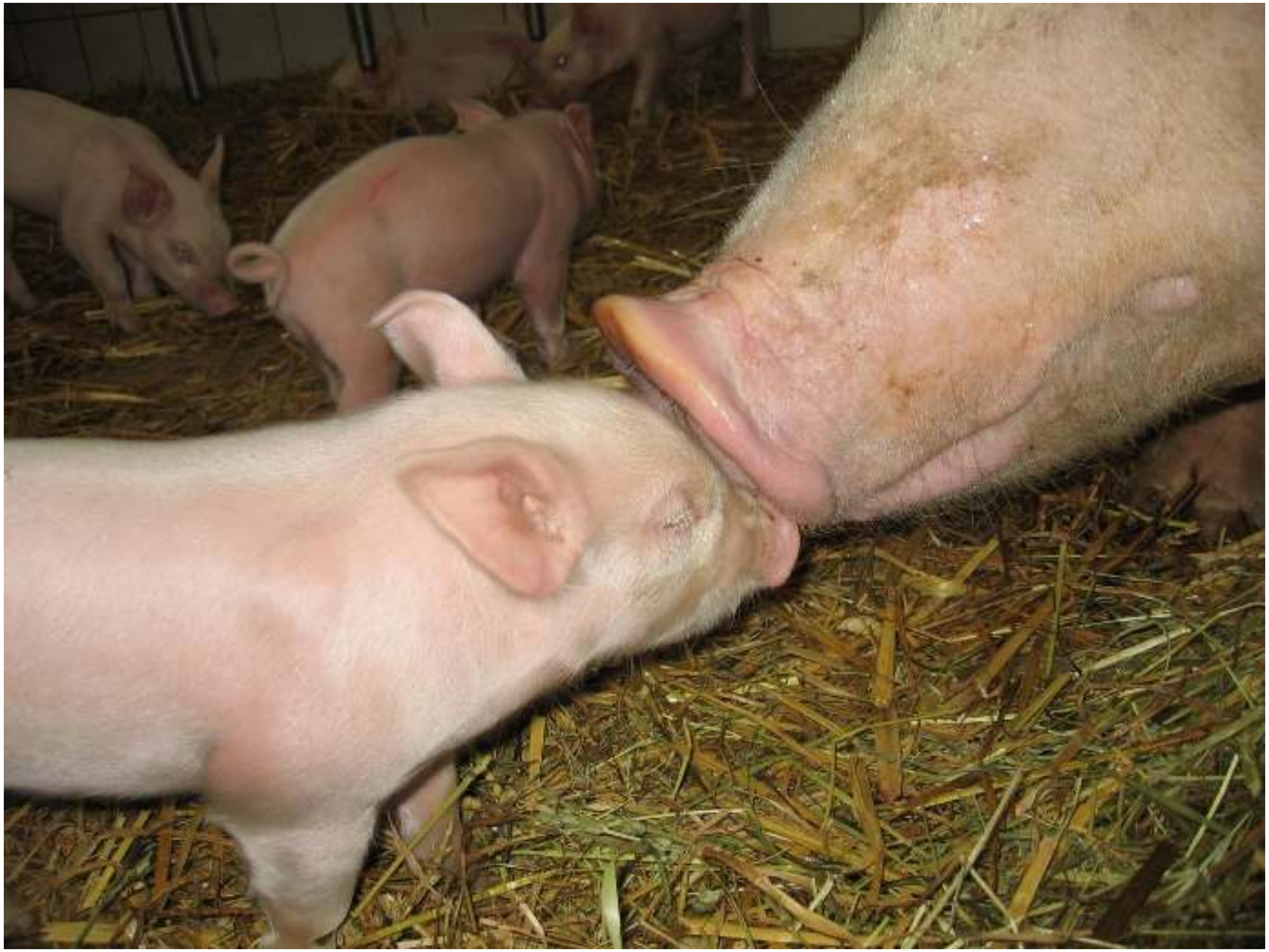


FIG 2: Total movement of a single large male feral pig in the vicinity of a commercial free-range piggery between June 2010 and December 2010 in Southern Queensland, Australia

March 29, 2014 | Veterinary Record

Spread & transmission



M. hyopneumoniae plus X

M. hyopneumoniae interacts with

- Other bacteria such as *A. pleuropneumoniae & P. multocida* (Kobisch et al. 1993, Sörensen et al. 1197)
- Viruses such as PCV2, PRRSV & SIV H1N1 (Opriessnig et al. 2004, Thacker et al. 1999, Thacker et al. 2001)
- Parasites such as *A. suum* (Steenhard et al. 2009)
- Mycotoxines such as Fumonisin B, but not DON (Posa et al. 2013, Michiels et al. 2016)

Effect of Fumonisin B

Table 1. Result of the statistical analysis of density in the regions of interest of pulmonary parenchymal areas of the lungs on the Hounsfield scale (HU means ± SD).

	Age			
Group	Day 30	Day 44	Day 58	Total
C	-638 ± 48^{A}	-756 ± 68^{aB}	-715 ± 26^{aB}	-703 ± 82^{a}
F	-648 ± 60^{A}	-775 ± 17^{aB}	-738 ± 37^{aB}	-720 ± 80^{a}
M	-634 ± 49	-637 ± 83^{b}	-656 ± 36^{b}	-643 ± 58^{b}
MF	-650 ± 57	-606 ± 115^{b}	-679 ± 26^{b}	-644 ± 84^{b}
Total	-643 ± 51^{A}	-691 ± 106^{B}	-697 ± 373^{B}	

C, control; F, fed fumonisin; M, infected with *Mycoplasma hyopneumoniae*; MF, infected with *M. hyopneumoniae* and fed fumonisin. Different indices mean significant differences ($P < .05$) between ^{a,b}groups (within the same column) or ^{A,B}age (within the same row). $n = 7$/group, except group MF on day 58, where $n = 6$ (1 animal in group MF was euthanized on day 55). Total mean and SD values are of all data in the same row (group) or column (age).

s in a pig infected with *Myco-*
wed progressive pulmonary
nd ventral consolidation (*).

Posa et al. 2013

Economic impact of EP

Heterogeneity of data from the field

- Daily weight gain of pigs infected by direct contact was reduced by 12-16% and feed conversion ratio (feed:gain) increased by 14% (Pointon et al. 1985)

- Daily weight gain of pigs decreased 38g for those being seropositive towards *M. hyopneumoniae* (Rugala et al. 2000)

- Daily weight gain of pigs decreased 37g for every 10% of lung surface affected by lesions (Straw et al. 1989)

Economic impact of EP

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Example

- Daily weight gain of pigs decreased 37g for every 10% of lung surface affected by lesions (Straw et al. 1989)

- Example herd:
  - 55% unaffected lungs: decrease of 0.0g
  - 25% lungs with score 1: decrease of 18.5g
  - 15% lungs with score 2: decrease of 74.0g
  - 5% lungs with score 3: decrease of >111g

>>> Average decrease in such a herd: 21.2g per day per pig!!

Economic impact of EP

Necessity of research

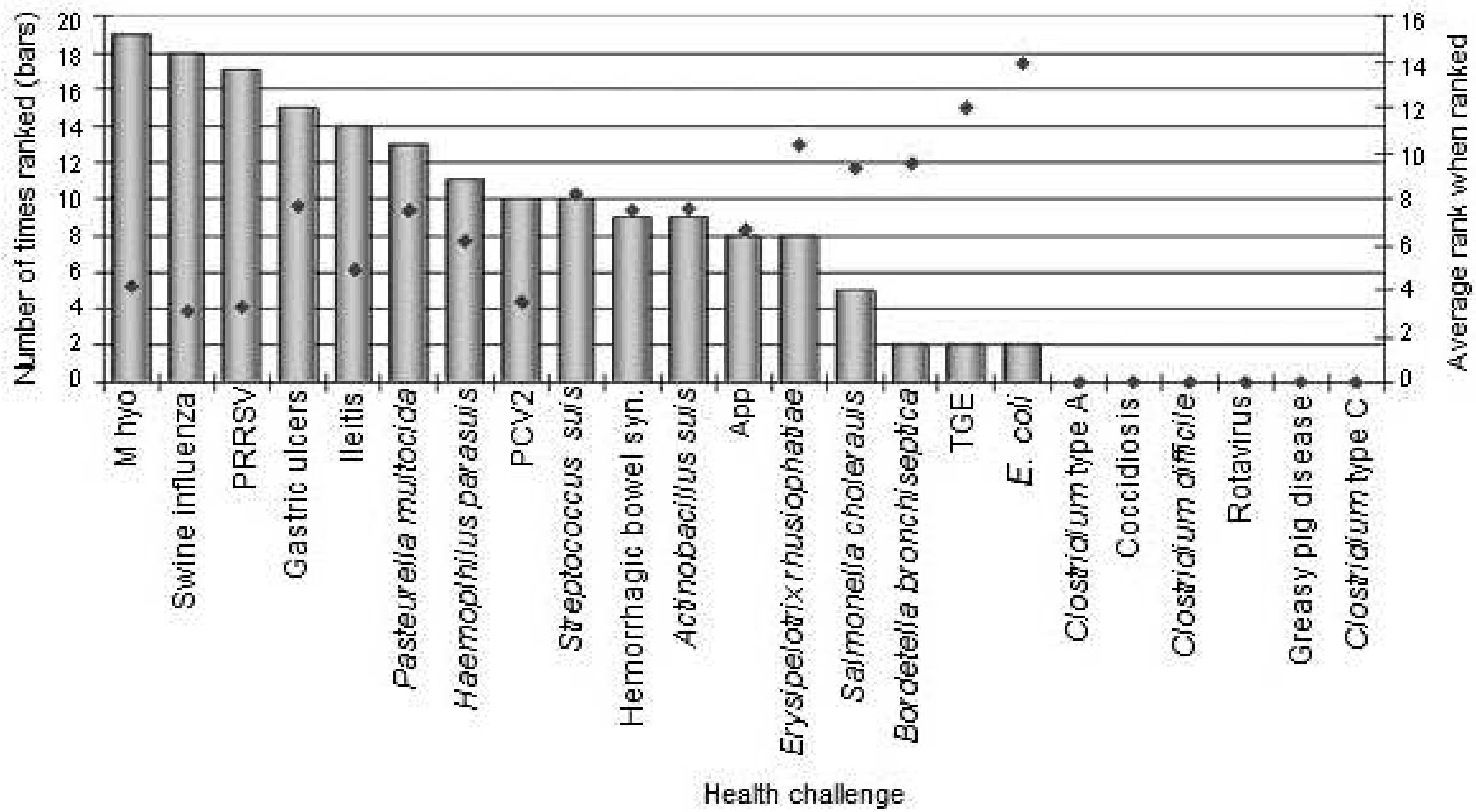

Figure 1. Rank of pathogens in the finishing herd (the most serious challenge was ranked as 1 and the other challenges were ranked in increasing order. The higher the rank, the less significant the challenge).

Economic impact of EP

Necessity of research

Table 1. Summary of estimated economic losses for top four health challenges in all stages of production.

	Losses in affected herds (USD/pig marketed)			% of animals affected			Average loss for all pigs (USD/pig marketed)			
Health challenge	Breeding	Nursery	Finisher	Breeding	Nursery	Finishing	Breeding	Nursery	Finishing	Total
PRRSV	7.29	2.86	4.34	41.4	42.8	33.8	4.94	1.23	1.47	**7.63**
M hyo	1.52	1.92	5.84	17.6	10.0	34.3	0.39	0.19	2.00	**2.58**
Influenza	1.65	1.62	3.37	21.2	26.8	29.9	0.50	0.43	1.00	**1.94**
PRRS + Mhyo			6.69			18.1			1.21	**1.21**

Source: https://www.pig333.com/what_the_experts_say/economic-impact-of-mycoplasma-hyopneumoniae-on-pig-farms_8936/

Diagnosis of Enzootic Pneumonia

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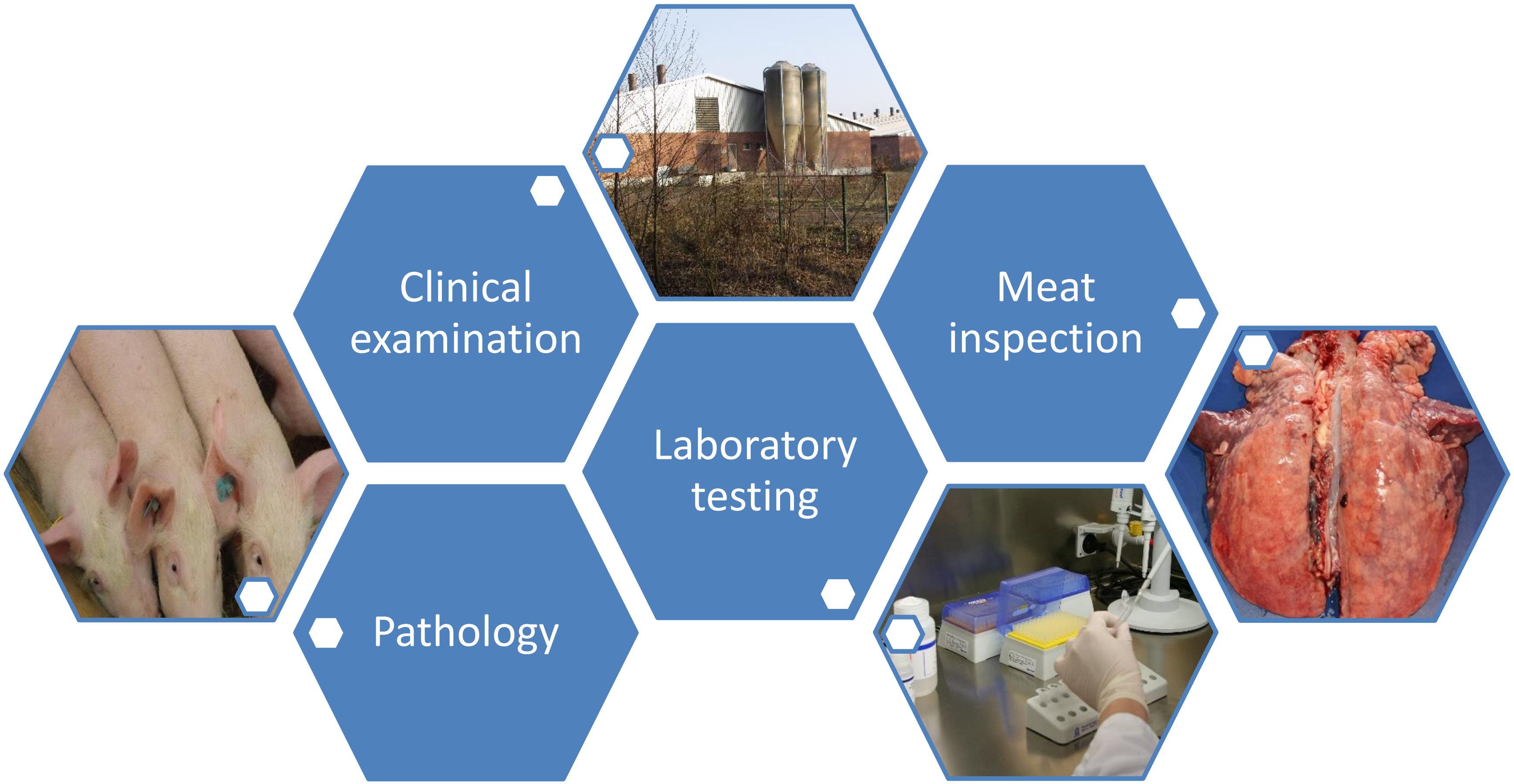
Diagnostic approach



Clinical examination on-farm

- Increased body temperature °C
- High morbidity, but low mortality %
  - except for high virulent strains
- Reduced weight gain g/day
- Increased feed conversion ratio kg/kg

- Chronic dry and non-productive coughing C_{ind}
  - spontaneously occuring
  - can be provoked by enforcing the pigs to move

Value of clinical examination on-farm

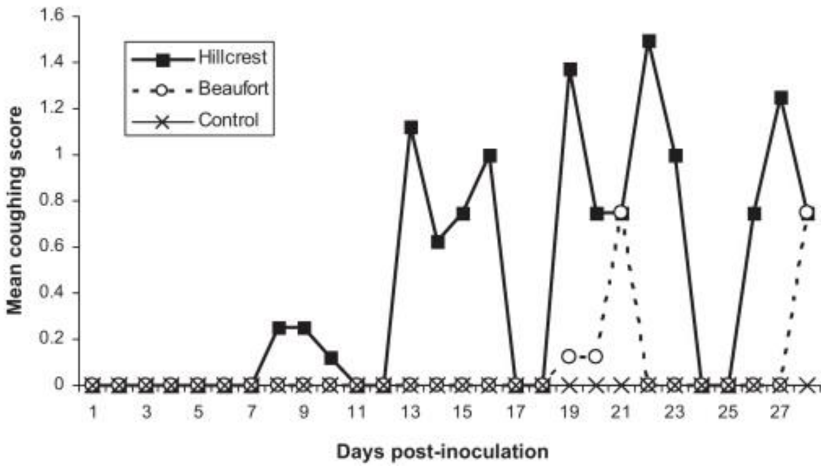
Table 1
Distribution of herds by prevalence of *M. hyopneumoniae*, detected by PCR and ELISA, and the mean coughing index of each group.

		ELISA (<50% prevalence)	ELISA (⩾50% prevalence)
PCR (<50% prevalence)	Number of herds Coughing index (%)	10 1.22 (SD 1.19)	8 2.10 (SD 1.59)
PCR (⩾50% prevalence)	Number of herds Coughing index (%)	9 2.86 (SD 1.75)	32 2.95 (SD 1.79)

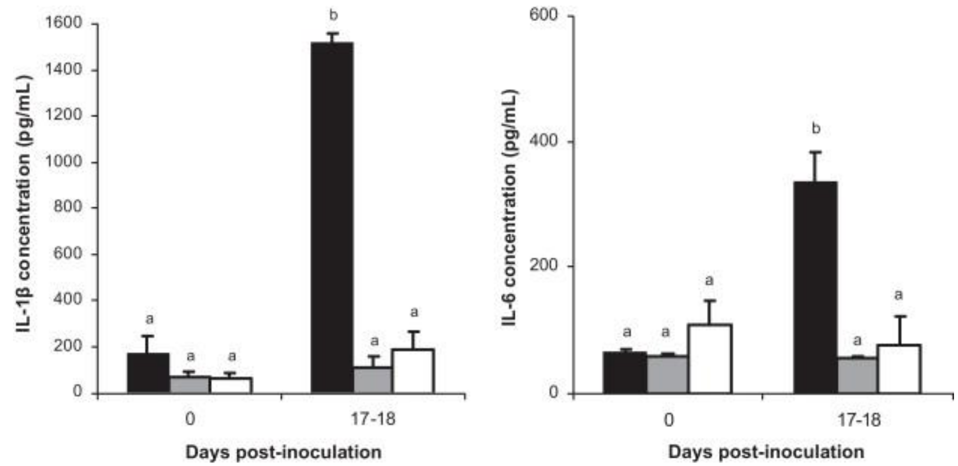
If PCR positivity was >50%, then the risk for high C_{Ind} was increased by 76%
(odds ratio: 1.762; 95% CI: 1.141-2.719)
If ELISA positivity was >50%, then the risk for high C_{Ind} was increased by 50%
(odds ratio: 1.501; 95% CI: 1.026-2.195)

Nathues et al. 2012

Clinical impact of EP



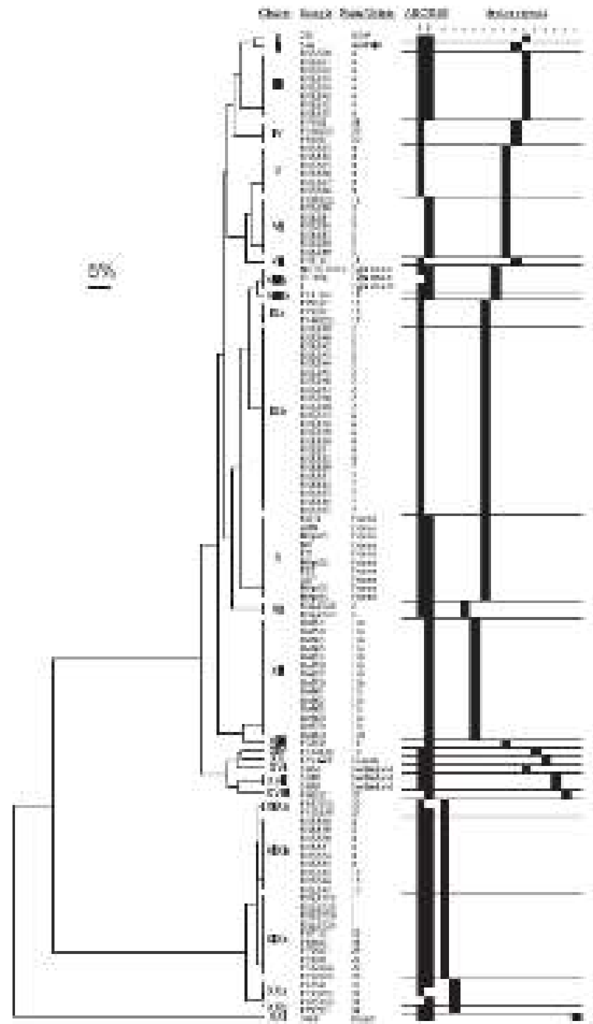
Temporal mean coughing scores among treatment groups (Hillcrest, Beaufort, Control) from 1 to 28 days post-inoculation, based on twice-daily recording of individuals on a scale of 0 (normal), 1 (mild abnormal) or 2 (severe abnormal).



Cytokine responses for IL-1β (left) and IL-6 (right) in tracheobronchial lavage fluid of Hillcrest- (black bars), and Beaufort- (grey bars) challenged pigs before and 17–18 days after challenge, compared with controls given sterile medium (white bars) (mean ± S.E.M.). Within each graph, different letters above the columns indicate group means are significantly different as determined by ANOVA ($P < 0.001$).

Woolley et al. 2012

Detection of *M. hyopneumoniae* by PCR



- *M. hyopneumoniae* shows high genotypic varaince among isolates from different countries, regions and farms

Mayor et al. 2007

TABLE 2. Summary of results for PCR assays tested against a panel of *M. hyopneumoniae* isolates

M. hyopneumoniae isolate	Result for indicated PCR assay[a]														
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
J ATCC 25934, type strain	+	+	+	−	−	+	+	+	+	+	+	+	+	+	+
232-2A3 (pig passage of strain 11)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
37-9	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
96MP0001	−	−	−	−	−	+	+	+	+	+	+	+	−	+	+
96MP0002	+	+	+	−	−	+	+	+	+	+	+	+	+	+	+
05MP0601	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
06MP0001D	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
3-14	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
00MP1301	+	+	+	+	+	+	+	+	+	+	+	+	−	+	+
05MP2301	+	+	+	−	−	+	+	+	+	+	+	+	+	+	+
95MP1501	−	−	−	+	+	+	+	+	+	+	+	+	+	+	+
95MP1502	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
97MP0001	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
95MP1503	+	+	+	−	+	+	+	+	+	+	+	+	+	+	+
95MP1511	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
95MP1504	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
95MP1505	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
95MP1506	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
95MP1507	+	+	+	+	−	+	+	+	+	+	+	+	+	+	+
95MP1509	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
95MP1510	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
00MP0001	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
00MP0002	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
00MP0003	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
05MP2302A	+	+	+	−	−	+	+	+	+	+	+	+	+	+	+
05MP2303	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
06MP0002	+	+	+	+	+	+	+	+	+	+	+	+	−	+	+
06MP2501	+	+	+	−	−	+	+	+	+	+	+	+	+	+	+
00MP1502	+	+	+	+	+	+	+	+	+	+	+	+	−	+	+
P-1814-10	−	−	−	+	+	+	+	+	+	+	+	+	−	+	+
P-5398-1	+	+	+	−	−	+	+	+	+	+	+	+	−	+	+
P-5782	−	−	−	+	+	+	+	+	+	+	+	+	+	+	+
P-6053-2	+	+	+	−	−	+	+	+	+	+	+	+	−	+	+
P-11318-6	+	+	+	+	+	+	+	+	+	+	+	+	−	+	+
P-12895-2	+	+	+	+	+	+	+	+	+	+	+	+	−	+	+
P-13129-6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Strait et al. 2008

Indirect detection of *M. hyopneumoniae*

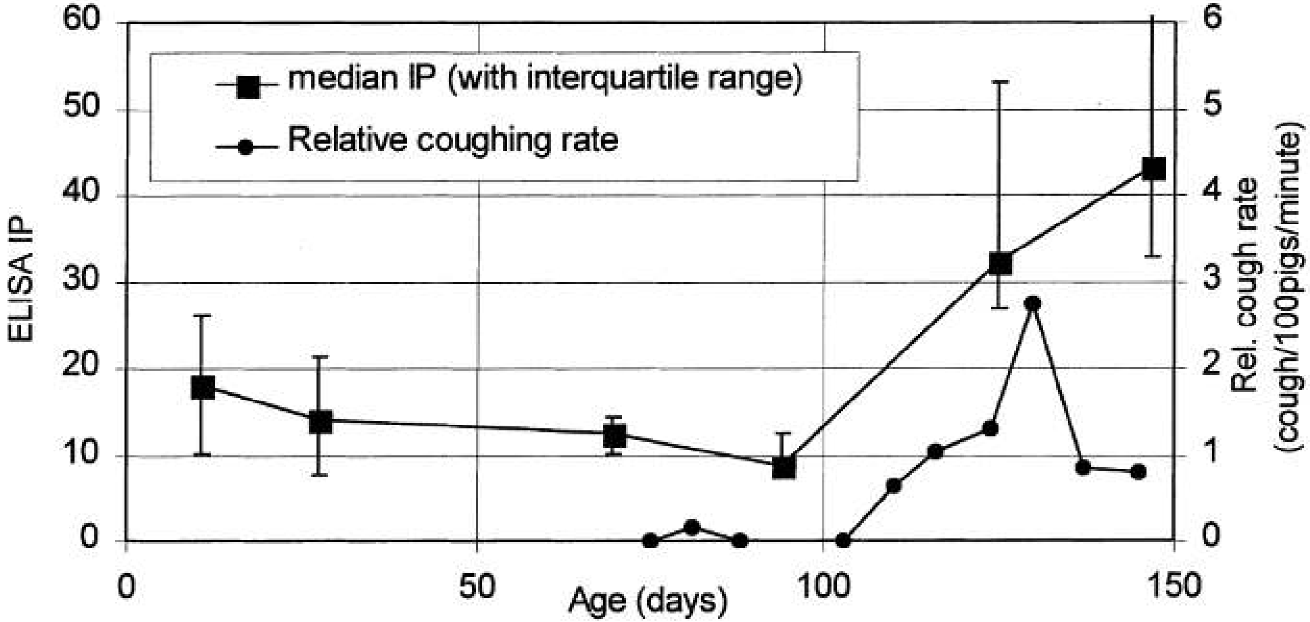


Fig. 1. Median (interquartile range) ELISA IP's for antibodies against *M. hyopneumoniae* and coughing rates of the group of pigs on farm A.

Leon et al. 2001

Indirect detection of *M. hyopneumoniae*

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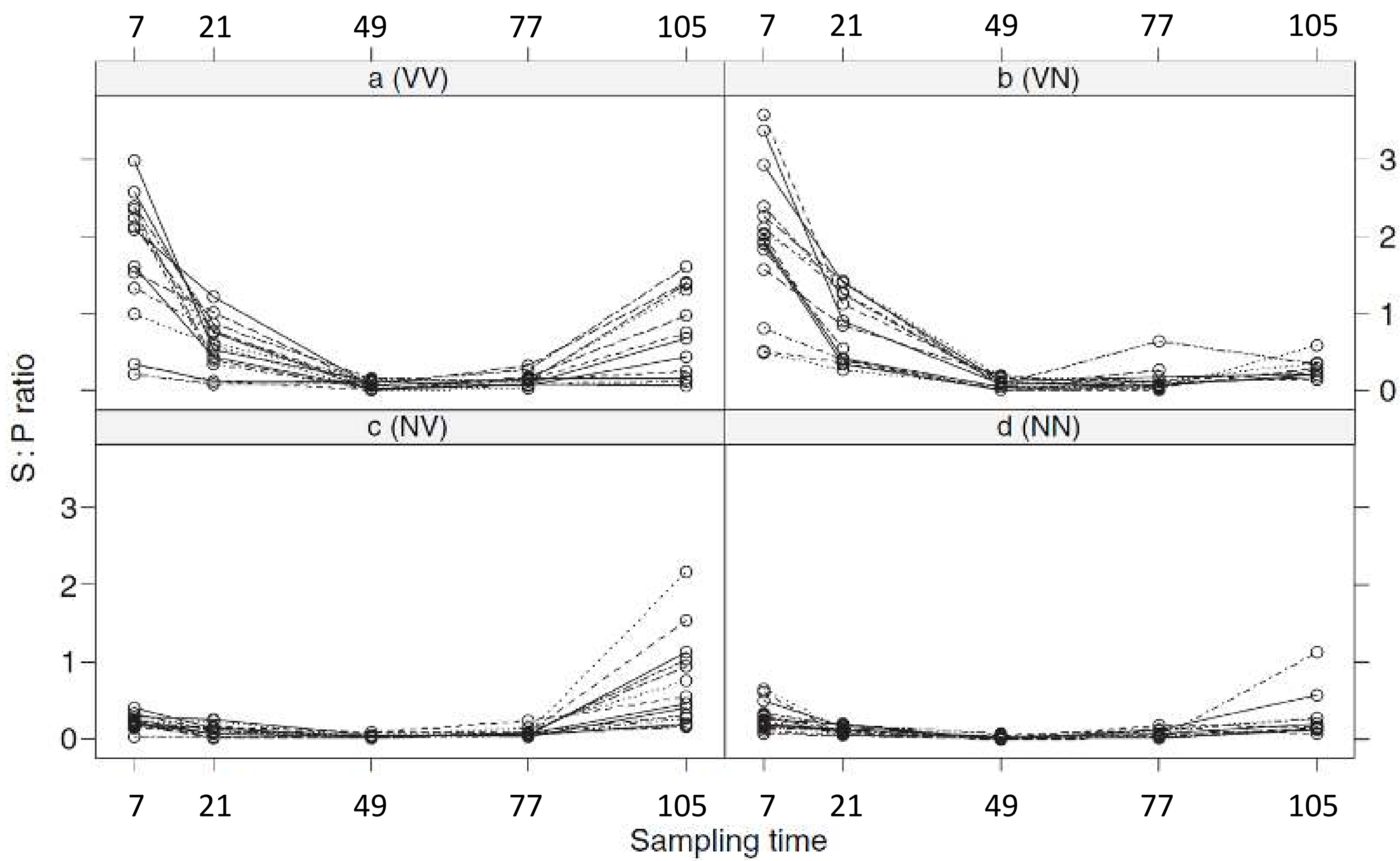
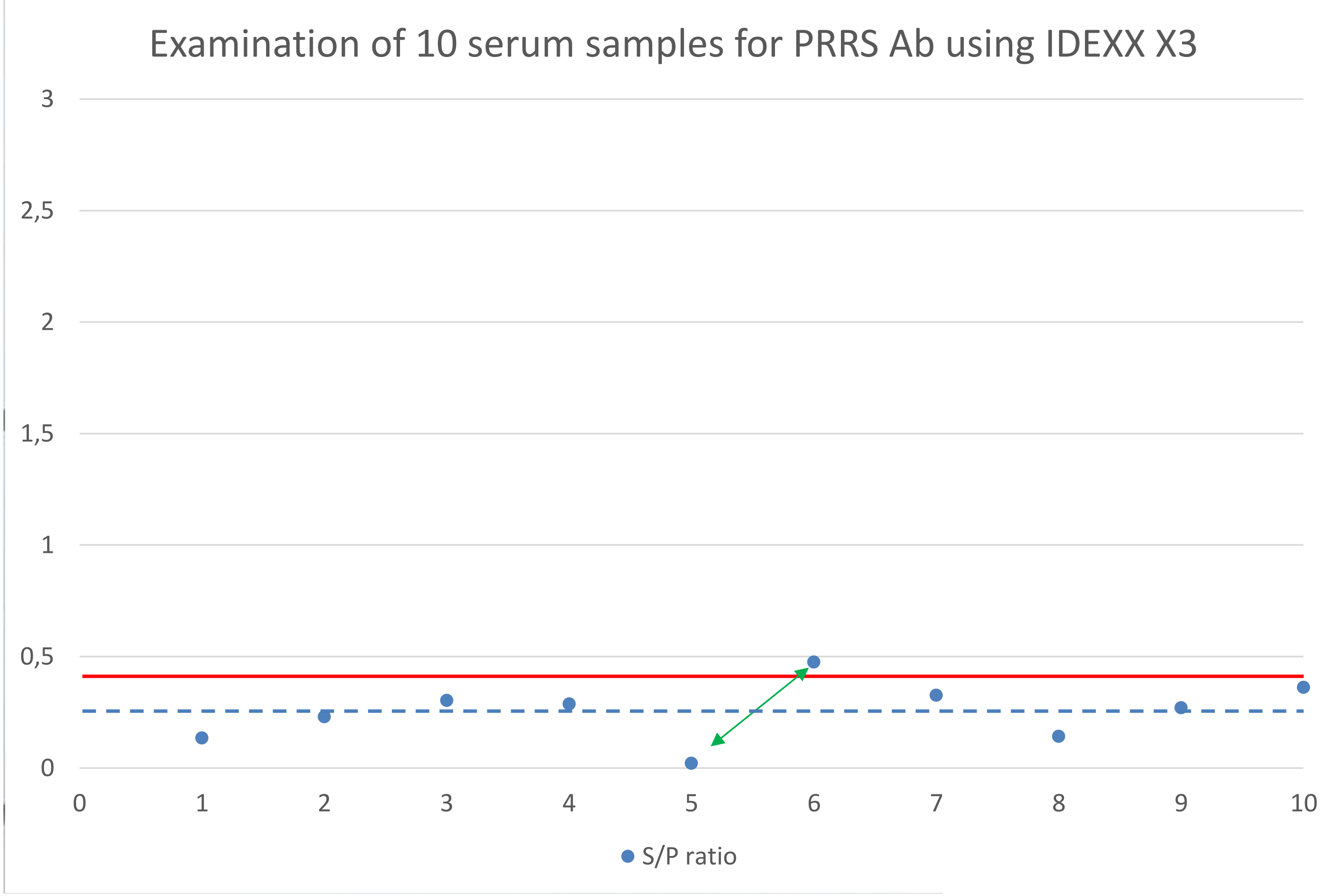


Martelli et al. 2006

Interpretation of laboratory reports

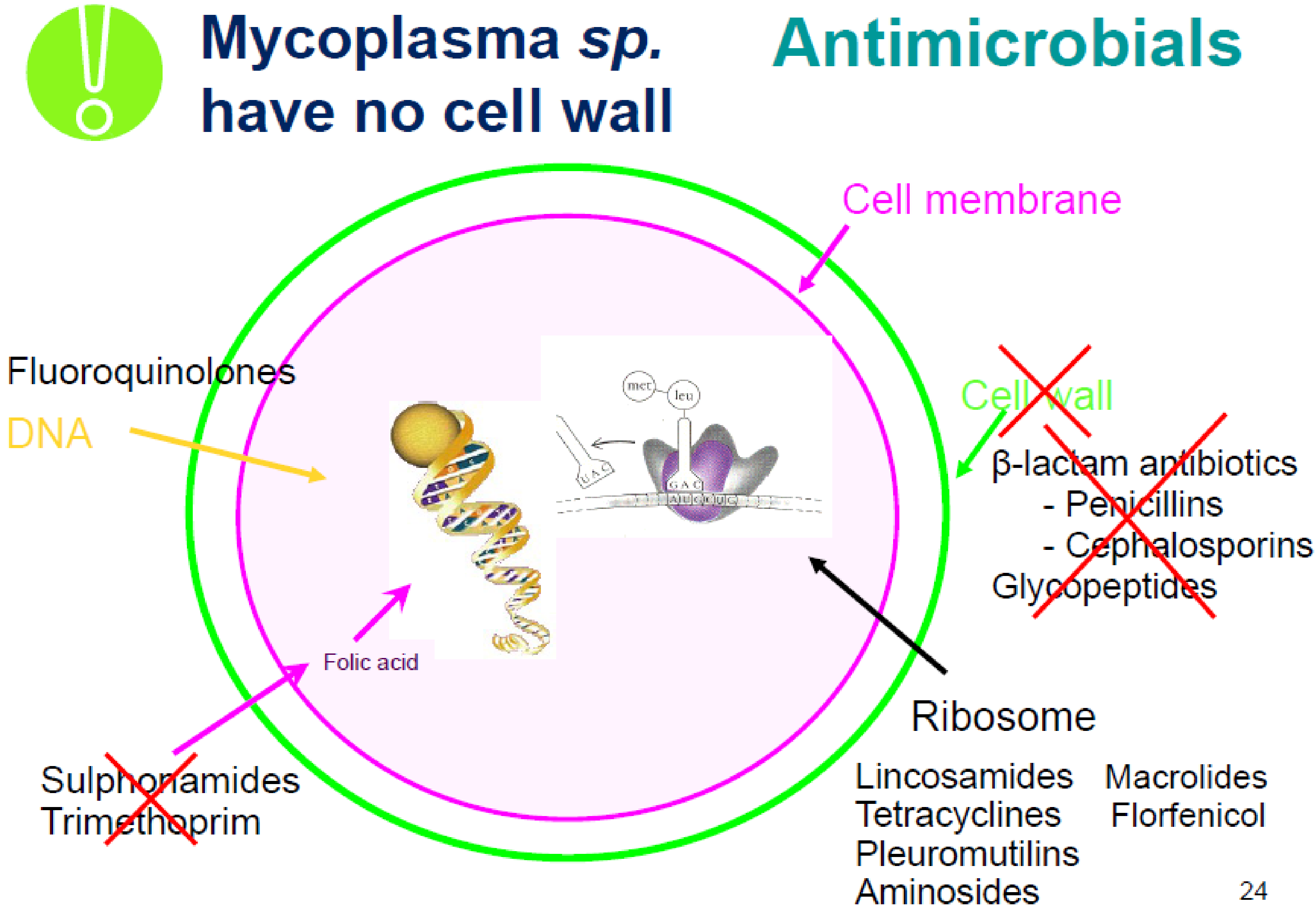


Treatment of Enzootic Pneumonia

Basic concepts of treatment

- **Individual treatment**
- **Group treatment**

Mode of action of different antimicrobials



Maes et al. 2013

Resistance of *M. hyopneumoniae*

Table 1. Frequency distribution of minimal inhibitory concentrations (MICs) of 12 antimicrobials for 159 Thai isolates of *M. hyopneumoniae* isolated during 2006–2011

Drug	Number of strains with MIC (μg/ml) of																MIC (μg/ml)	
	400	200	100	50	25	12.5	6.25	3.12	1.56	0.78	0.39	0.2	0.1	0.05	0.025	0.013	Strain J	Break point[c)]
Tiamulin										1		4	54	60	22	18(≤)	0.05	≥16
Lincomycin						2(>)				10	32	80	32	2	1(≤)		0.05	NA
Tylosin						2(>)			1	10	15	37	60	21	13(≤)		0.05	≥4
Spiramycin					2	1	1		4	25	61	51	14				0.39	NA
Josamycin						2(>),1		3	5	39	53	35	21				0.2	NA
Kitasamycin						1(>),1	2	3	35	77	33	6	1				0.39	NA
Erythromycin	2(>)[a)],11	23	14	40	55	10	4										25	≥4
Florfenicol							1	2	100	50	3	3					0.39	≥8[d)]
Doxycycline							24	79	46	9	1						0.39	NA
Oxytetracycline						8	82	52	13	4							0.78	≥16
Chlortetracycline			8	44[b)]	60	39	4	4									3.12	NA
Enrofloxacin					1	1	24	50	17	18	27	4	17				0.2	≥2

a) >: equal or higher than MIC indicated. ≤: equal or lower than MIC indicated. b) The underline indicates that the group includes macrolides and lincomycin resistant strain. c) Data from Hannan (2000) [5]. d) Data from CLSI (2010) [2]. NA: Not available.

Thongkamkoon et al. 2013

Prevention of Enzootic Pneumonia

A strategic approach is needed

- Elimination of risk factors
  - Purchase policy
  - Stocking density
  - Biosecurity measures

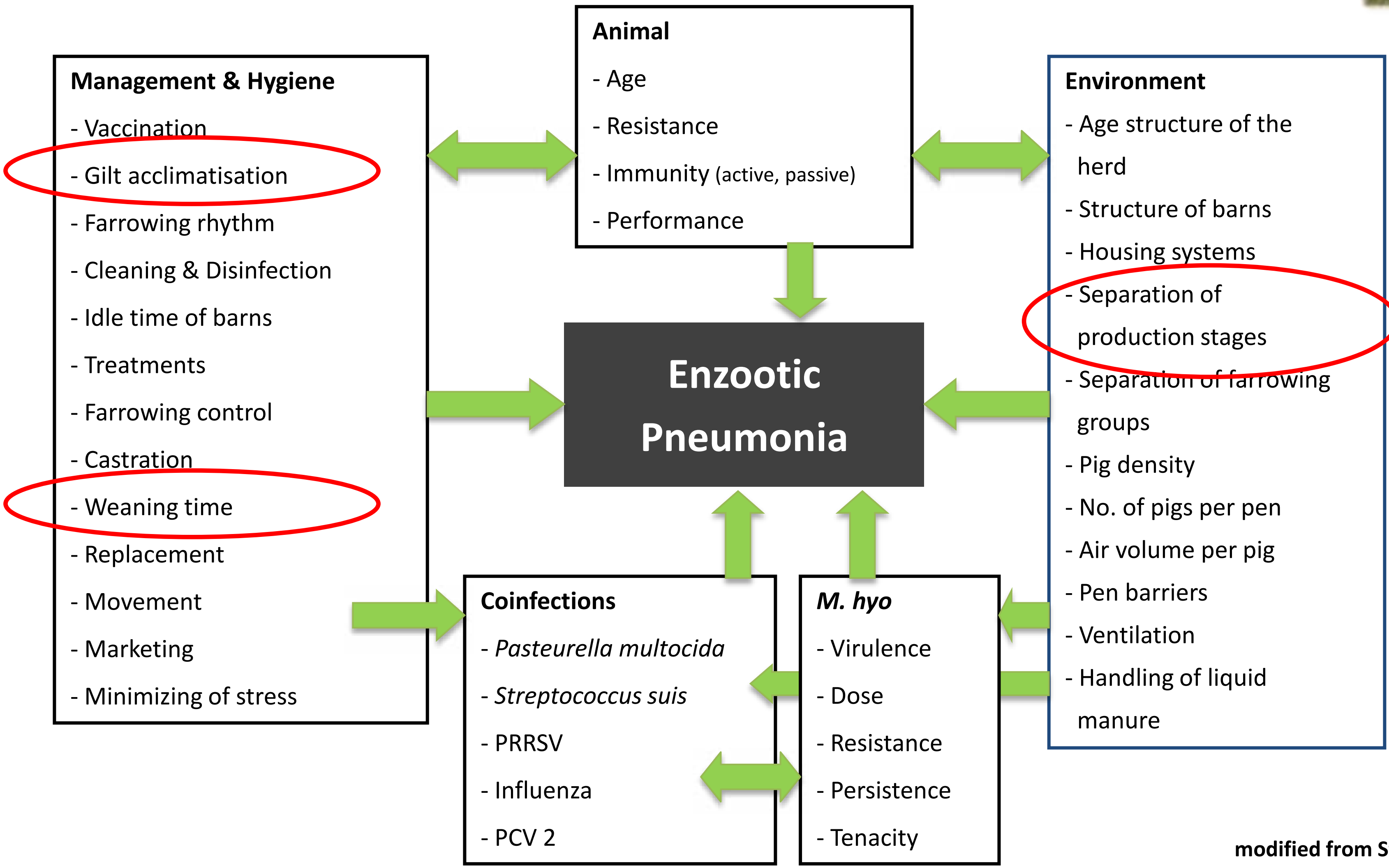
  Easy to implement

  - Herd size
  - Pig density in the region
  - Seasonal influence

  Difficult to change

- Vaccination
- Eradication

A multi-factorial disease



modified from Stärk, 1998

Assessment of biosecurity

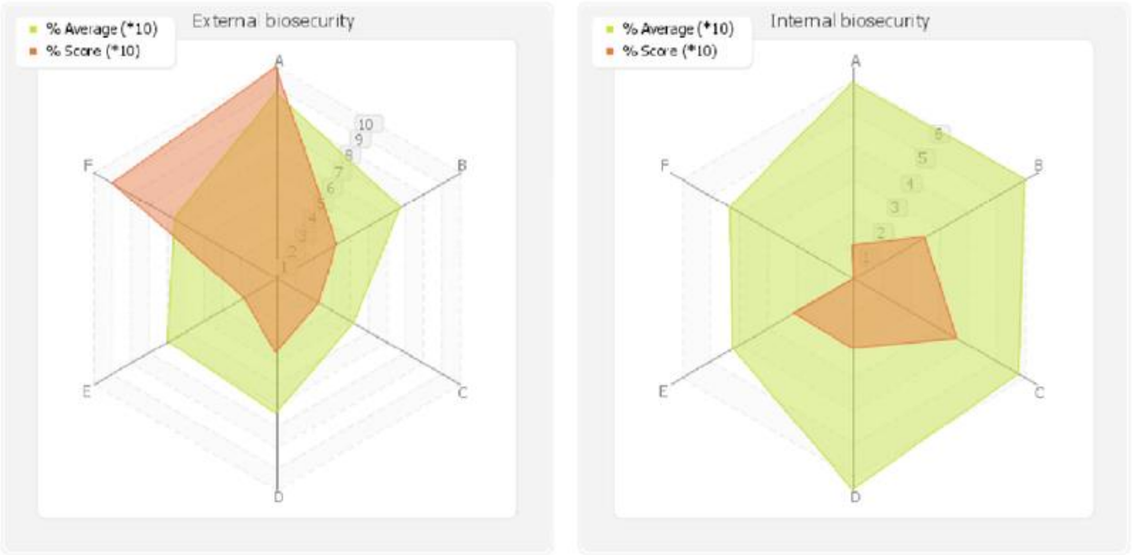


Figure. Visual report after completion of the online tool

1.	**External biosecurity**	**2.**	**Internal biosecurity**
A.	Purchasing policy	A.	Management of diseases
B.	Removal of animals, manure and carcasses	B.	Farrowing and suckling period
C.	Supply of fodder, water and equipment	C.	Nursery unit
D.	Access check	D.	Fattening period
E.	Vermin and bird control lines	E.	Compartmentalizing, working lines
F.	Location and environment	F.	Cleaning and disinfection

PROHEALTH

http://www.fp7-prohealth.eu

Impact of different risk factors

- Acclimatisation of gilts (**Acc**)
  - In a recent study it was shown that suckling pigs are 10 times more likely being infected with *M. hyopneumoniae*, when gilts in the particular herd do not have contact to living animals during their acclimatisation period
- Length of suckling period (**Suc**)
  - The likelihood of transmission of *M. hyopneumoniae* from sows to their offspring exponentially increases with the length of the suckling period, which is equal to the time under exposure
- Vaccination of suckling pigs against *M. hyopneumoniae* (**Vac**)
  - When suckling pigs get vaccinated against *M. hyopneumoniae*, the basic reproductive rate of the infection is lowered by approximately 20%
- Contact between growing and fattening pigs of different age during restocking of compartments (**Con**)
  - The contact between pigs of different age during restocking of fattening compartments has been shown effectively increasing the spread of the infection in this age group (OR: 13.8)
- Co-infections in growing and fattening pigs (**Inf**)
  - Knowledge about the impact is rare. An expert opinion was utilized in order to include this risk factor in the model basically working on the β of growing and fattening pigs

Estimates from a SEIR model regarding EP

Scenario	Risk factor					Suckling period	Nursery period	Growing period	Finishing period	Whole life time
No.	Vac	Acc	Suc	Con	Inf	Median	Median	Median	Median	Median
1	-	-	+	+	+	0.01	0.10	0.03	0.13	0.09
2	+	-	+	+	+	0.01	0.10	0.02	0.11	0.08
3	+	+	+	+	+	0.00	0.01	0.00	0.00	0.00
4	+	+	-	+	+	0.00	0.02	0.01	0.07	0.04
5	+	+	+	-	+	0.00	0.01	0.00	0.03	0.02
6	+	+	+	+	-	0.00	0.01	0.00	0.11	0.05
7	+	+	-	-	+	0.00	0.02	0.01	0.16	0.12
8	+	+	+	-	-	0.00	0.01	0.01	0.27	0.20
9	+	+	-	+	-	0.00	0.03	0.02	0.30	0.14
10	+	-	-	+	+	0.03	0.21	0.04	0.12	0.11
11	+	-	-	-	+	0.03	0.20	0.04	0.13	0.11
12	+	-	-	+	-	0.03	0.23	0.08	0.24	0.18
13	**+**	**-**	**-**	**-**	**-**	0.03	0.23	0.08	0.25	0.20
14	+	-	+	-	+	0.01	0.10	0.02	0.15	0.12
15	+	-	+	-	-	0.01	0.11	0.04	0.30	0.24
16	+	-	+	+	-	0.01	0.11	0.04	0.30	0.17
17	**+**	**+**	**-**	**-**	**-**	0.00	0.03	0.02	0.34	0.25
18	-	+	-	-	-	0.00	0.03	0.02	0.34	0.26

Role of gilts I

- **Gilts** have been identified being the most critical factor for the infection of <u>suckling pigs</u> with *M. hyopneumonniae*

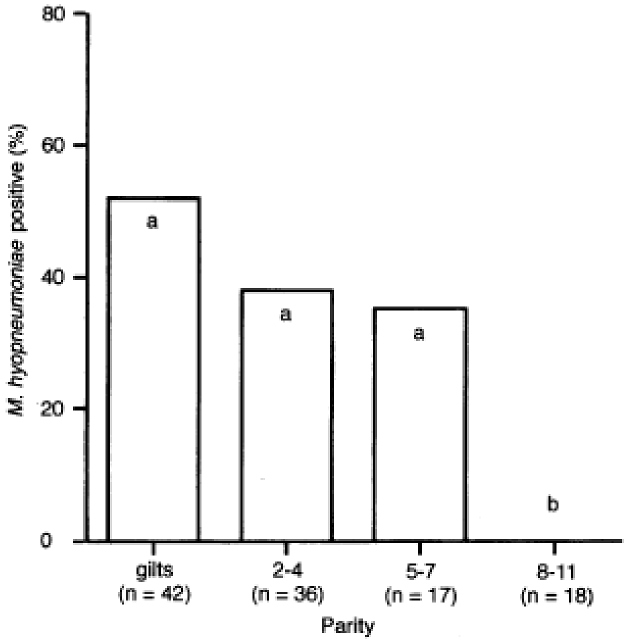


FIG 1: *Mycoplasma hyopneumoniae* colonisation distribution by parities. Cumulative data of the three different visits were grouped and colonisation was assessed by a nested polymerase chain reaction specific for *M hyopneumoniae*. a, b Bars with different letters indicate significant differences (P<0·05)

Calsamiglia et al. 2002

Role of gilts II

vetsuisse-fakultät

- **Gilts** have been identified being the most critical factor for the infection of suckling pigs with *M. hyopneumonniae*

Risk Factors for Enzootic Pneumonia Among Fattening Pigs — H. Nathues et al.

Table 4. Risk factors identified in the final multinomial logistic regression model

Control I (base outcome)	RRR	SE	*z*	*P* > |z|	95% CI
Control II					
Increase of the age of piglets at weaning	**1.37**	0.185	2.32	0.020	1.05–1.78
Increase of the age of the nursery unit	**0.74**	0.093	−2.42	0.016	0.57–0.94
Exposing gilts to living animals	**0.05**	0.056	−2.68	0.007	0.01–0.45
Increase in weaned piglets per sow and year	**0.52**	0.129	−2.64	0.008	0.32–0.85
Contact between fattening pigs of different age during restocking of compartments	6.00	6.068	1.77	0.076	0.83–43.5
Case					
Increase of the age of piglets at weaning	**1.36**	0.190	2.19	0.029	1.03–1.79
Increase of the age of the nursery unit	0.91	0.105	−0.78	0.437	0.73–1.15
Exposing gilts to living animals	**0.03**	0.033	−3.03	0.002	0.00–0.28
Increase in weaned piglets per sow and year	**0.57**	0.142	−2.25	0.025	0.35–0.93
Contact between fattening pigs of different age during restocking of compartments	**13.8**	14.62	2.48	0.013	1.7–109.9

RRR, relative risk ratio, values with $P < 0.05$ marked in bold.
Number of herds in the model = 63; Log likelihood = −46.4; Pseudo R^2 = 0.33.

Nathues et al. 2012

Sow to piglet transmission

vetsuisse-fakultät

- The **length of the suckling period** is the most important issue in regard to *M. hyopneumoniae* infection in nursery pigs

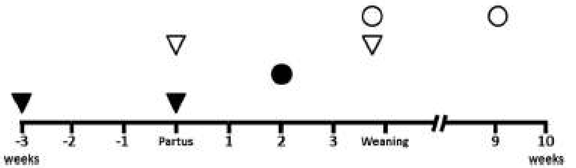
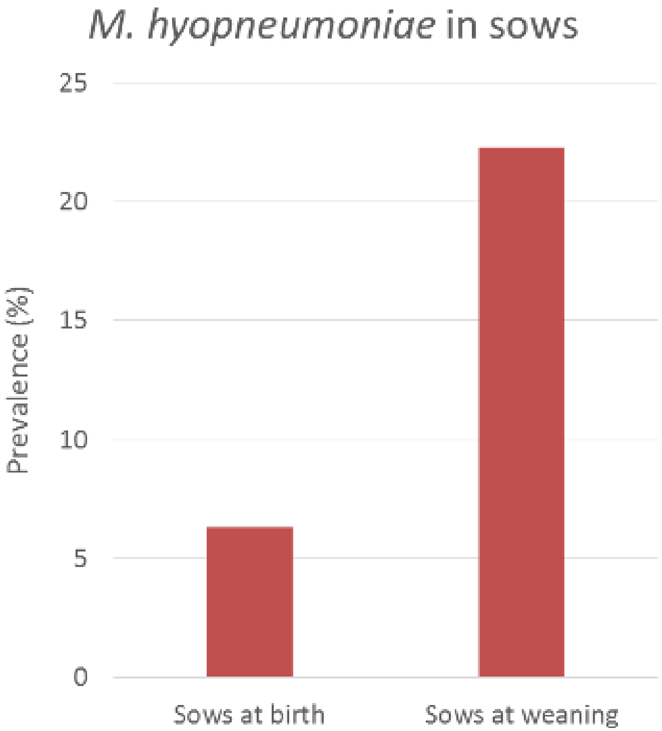


Figure 1 Time schedule of sample collection from sows (triangles) and offspring (circles). Filled symbols represent blood samples and unfilled symbols represent nasal swabs.



Nathues et al. 2013

Separation of age groups

- Considering the overall impact of the disease, the **all-in-all-out principle** is most important in terms of preventing the transmission of *M. hyopneumoniae* in closed pig herds

Table 4. Risk factors identified in the final multinomial logistic regression model

Control I (base outcome)	RRR	SE	*z*	*P* > |z|	95% CI
Control II					
Increase of the age of piglets at weaning	**1.37**	0.185	2.32	0.020	1.05–1.78
Increase of the age of the nursery unit	**0.74**	0.093	−2.42	0.016	0.57–0.94
Exposing gilts to living animals	**0.05**	0.056	−2.68	0.007	0.01–0.45
Increase in weaned piglets per sow and year	**0.52**	0.129	−2.64	0.008	0.32–0.85
Contact between fattening pigs of different age during restocking of compartments	6.00	6.068	1.77	0.076	0.83–43.5
Case					
Increase of the age of piglets at weaning	**1.36**	0.190	2.19	0.029	1.03–1.79
Increase of the age of the nursery unit	0.91	0.105	−0.78	0.437	0.73–1.15
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RRR, relative risk ratio, values with $P < 0.05$ marked in bold.
Number of herds in the model = 63; Log likelihood = −46.4; Pseudo R^2 = 0.33.

Prevention of «instability»

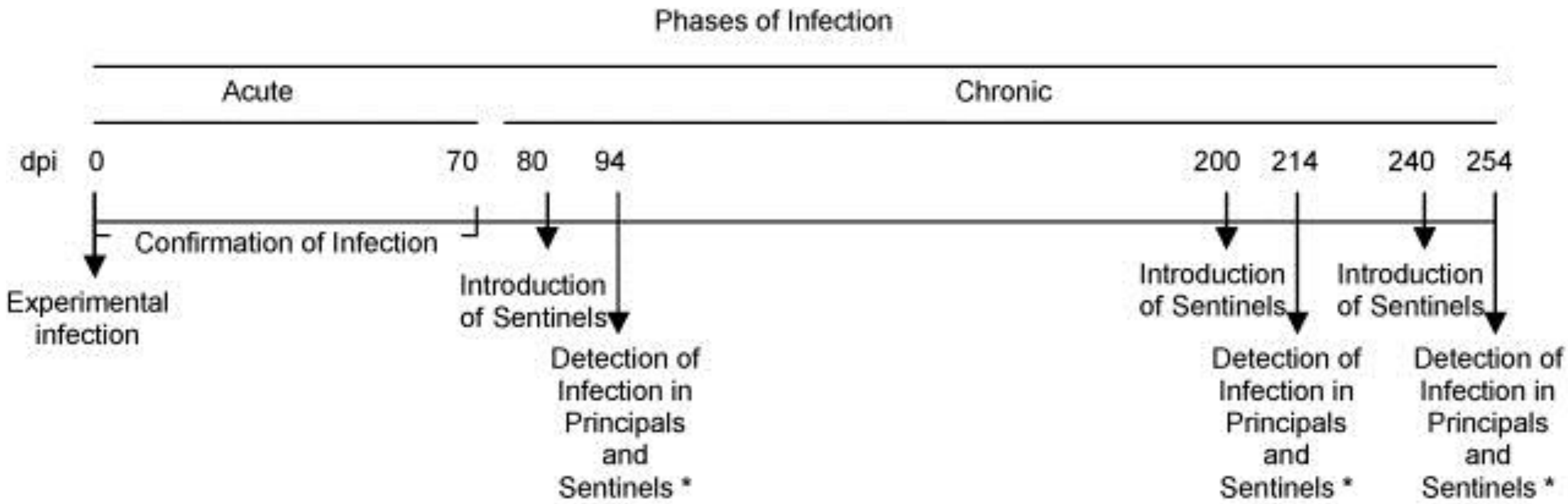


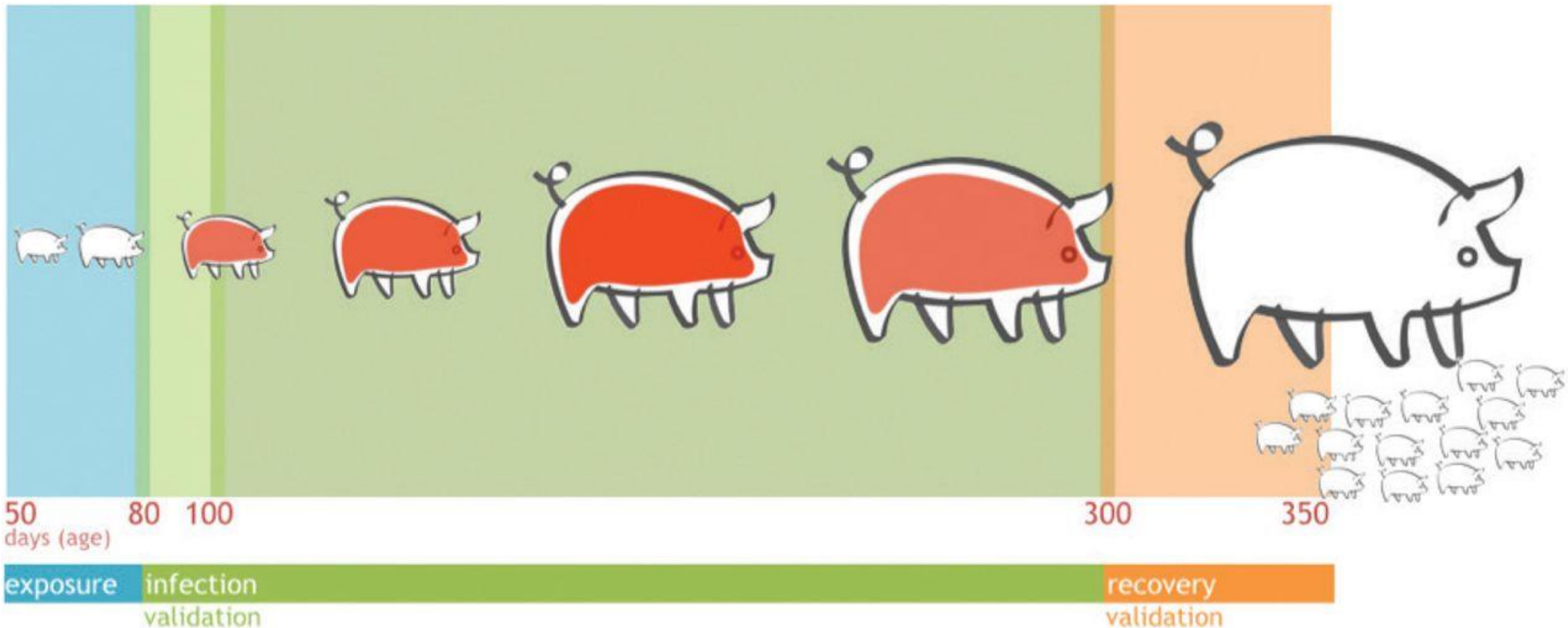
Fig. 1. Experimental design for the assessment of the duration of M. hyopneumoniae infection in an experimentally infected population of pigs. *Principals (n = 18) and sentinels (n = 15) at each time point were humanely sacrificed, M. hyopneumoniae DNA and ant...

Acute infection
0 - 70 days

Chronic infection
70 - 240 days

Pieters et al. 2009

«50-350 management of gilts»



Proposed timeline for gilt acclimation in a reproductive herd where recipient sows are positive to M hyopneumoniae and newly introduced gilts are free of the pathogen and disease, or obtained from a low prevalence multiplier.

Pieters et al. 2016

Vaccination

Universität Bern | Universität Zürich
vetsuisse-fakultät

- Reduction of *M. hyopneumoniae* in the lung tissue after vaccination, but no elimination of the pathogen

Table 1 Scoring of the presence of macrophages, T- lymphocytes and B-lymphocytes in bronchus-associated lymphoid tissue (BALT) and the number of *M. hyopneumoniae* organisms (log) in the bronchoalveolar lavage (BAL) fluid[1]

	Score T-lymphocytes (0-3)		Score B-lymphocytes (0-3)		Score macrophages[2] (0-3)		Log of number of *M. hyopneumoniae* organisms in BAL fluid (log qPCR)[2]	
Weeks PI	4	8	4	8	4	8	4	8
control	1.0 ± 0.0	0.0 ± 0.0	0.5 ± 0.5	0.5 ± 0.5	0.0 ± 0.0[a, b]	0.3 ± 0.2	-0.76 ± 0.21[a]	-0.69 ± 0.41[a]
nvLV	1.2 ± 0.2	0.5 ± 0.5	2.0 ± 0.5	0.8 ± 0.7	0.7 ± 0.5[a, b]	1.3 ± 0.8	1.25 ± 0.74[a, b]	2.41 ± 0.59[b]
nvHV	1.4 ± 0.2	1.2 ± 0.3	2.8 ± 0.2	1.6 ± 0.3	1.6 ± 0.9[b]	1.0 ± 0.4	3.44 ± 0.35[b]	1.89 ± 0.71[a, b]
vLV	0.8 ± 0.4	0.5 ± 0.2	1.4 ± 0.6	0.9 ± 0.2	0.0 ± 0.0[a]	0.1 ± 0.1	0.97 ± 0.53[a, c]	2.29 ± 0.39[b]
vHV	1.0 ± 0.3	1.0 ± 0.2	1.6 ± 0.4	1.5 ± 0.2	0.0 ± 0.0[a]	0.2 ± 0.1	1.96 ± 0.43[b, c]	1.80 ± 0.48[b]

nv non-vaccinated; v vaccinated; LV low virulent challenge strain; HV highly virulent challenge strain

[1] Scoring was performed on samples of vaccinated and non-vaccinated pigs at 4 and 8 weeks after endotracheal inoculation with a low or highly virulent *M. hyopneumoniae* strain. A non-vaccinated and non- infected control group was also included.

[2] Different lowercase letters correspond to significantly different values between the groups within a column

Vranckx et al. 2012

Interference with maternal immunity I

J. Vet. Med. B 53, 229–233 (2006)

ISSN 0931–1793

Department of Animal Health, Faculty of Veterinary Medicine, University of Parma, Parma, Italy

Antibody Response to *Mycoplasma hyopneumoniae* Infection in Vaccinated Pigs with or without Maternal Antibodies induced by Sow Vaccination

P. Martelli[1,4], M. Terreni[2], S. Guazzetti[3] and S. Cavirani[1]

This pattern of immune responsiveness (i.e. the collective results of Groups A, B, C and D) suggested that vaccination of pigs had primed their immune system for subsequent exposure to *M. hyopneumoniae*, and that passively acquired antibody had little or no effect on either a vaccine-induced priming or a subsequent anamnestic response. According to the statistical analysis **sow serological status did not interfere with the antibody response in early vaccinated piglets**. In conclusion, the results pointed out that early vaccination of piglets may assist *M. hyopneumoniae* control independently from the serological status of sows.

Interference with maternal immunity II

Effektivität von Impfungen gegen *Mycoplasma hyopneumoniae* bei Schweinen von geimpften resp. nicht geimpften Sauen

S. Lehner, D. Meemken, H. Nathues, E. grosse Beilage
Außenstelle für Epidemiologie (Leiter: Prof. Dr. T. Blaha) der Stiftung Tierärztliche Hochschule Hannover

Tierärztl Prax 2008; 36 (G): 399–406

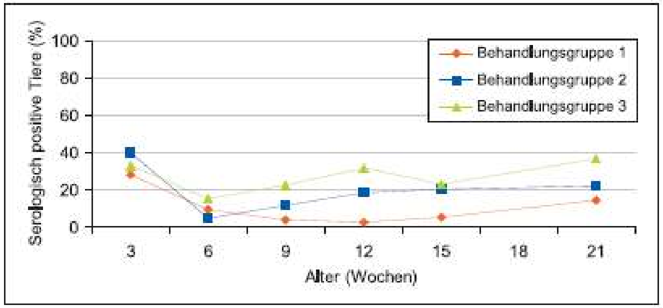


Abb. 1
Anteil serologisch positiver Schweine (%) bei Nachkommen ungeimpfter Sauen, die selbst nicht (Behandlungsgruppe 1) resp. in der 3. (Behandlungsgruppe 3) oder 6. Lebenswoche (Behandlungsgruppe 2) mit Ingelvac® M. hyo geimpft wurden

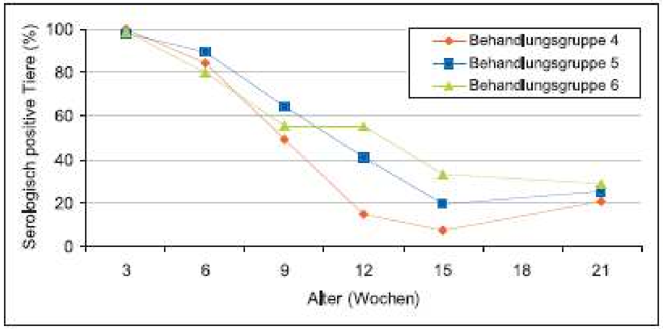


Abb. 2
Anteil serologisch positiver Schweine (%) bei Nachkommen der mit Ingelvac® M. hyo geimpften Sauen, die selbst nicht (Behandlungsgruppe 4) resp. in der 3. (Behandlungsgruppe 6) oder 6. Lebenswoche (Behandlungsgruppe 5) mit Ingelvac® M. hyo geimpft wurden

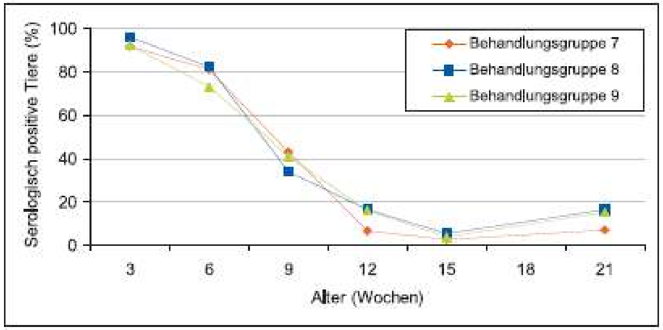


Abb. 3
Anteil serologisch positiver Schweine (%) bei Nachkommen der mit Impfstoff A geimpften Sauen, die selbst nicht (Behandlungsgruppe 7) resp. in der 1. (Behandlungsgruppe 8) oder 3. Lebenswoche (Behandlungsgruppe 9) mit Impfstoff A geimpft wurden

Tab. 3
Zuwachs (kg/Tag) im Zeitraum von der 3. bis 21. Lebenswoche

Behandlungsgruppe	Tiere (n)	Zuwachs* (kg/Tag)	SD	Minimum	Maximum	Differenz zu BG 5 (p-Wert)
1	99	0,575	0,101	0,302	0,807	0,0588
2	98	0,589	0,095	0,270	0,800	0,3718
3	94	0,593	0,093	0,342	0,772	0,5606
4	86	0,596	0,083	0,341	0,796	0,7013
5	92	0,601	0,093	0,294	0,797	–
6	89	0,589	0,086	0,306	0,764	0,3561
7	97	0,561	0,096	0,306	0,775	0,0037
8	97	0,571	0,092	0,333	0,834	0,0265
9	97	0,567	0,090	0,306	0,755	0,0113

* arithmetischer Mittelwert; BG = Behandlungsgruppe; SD = Standardabweichung

Tab. 4 Lungenbefunde zum Zeitpunkt der Schlachtung

Behandlungsgruppe	Lungen (n)	Score* (Mittelwert)	SD	Minimum	Maximum	Differenz zu BG 3 (p-Wert)
1	68	6,68	5,62	0	21	0,0020
2	76	5,20	4,57	0	22	0,0248
3	61	3,79	3,92	0	18	–
4	59	6,92	5,92	0	21	0,0012
5	65	4,88	4,61	0	20	0,1789
6	57	5,30	4,86	0	21	0,0368
7	76	7,32	4,95	0	23	< 0,0001
8	71	6,08	4,20	0	16	0,0003
9	74	7,05	5,14	0	20	< 0,0001

* Lungenscore nach Madec und Kobisch (1982); BG = Behandlungsgruppe; SD = Standardabweichung; signifikante Differenzen (p < 0,01)

Take home message for today

Based on recent studies …

… we can say that

- **Gilts** can become the most critical factor for the infection dynamics
- Considering the overall impact of the disease, the **all-in-all-out principle** is most important in terms of preventing the transmission of *M. hyopneumoniae* in closed pig herds
- **Vaccination** is an excellent tool in prevention programs for EP, but cannot work alone without implementation of additional measures

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