CORRELATION OF SEROLOGICAL RESPONSE AFTER VACCINATION AGAINST FMDV AND PROTECTION AGAINST CHALLENGE IN PIGS

P.L. Eblé, A. Dekker, J.L. Gonzales

WAGENINGEN
UNIVERSITY & RESEARCH

Intro: FMDV vaccination

- Effective tool to combat FMD
  - Quality control
- Efficacy test FMDV vaccines
  - Cattle
    - PD50 (European Pharmacopoeia) / PPG
    - Clinical protection
- Correlation between Ab-level and protection
  - Studied extensively (serotypes, labs, homology)
  - Release vaccine batches
  - Monitor vaccination efficacy in the field

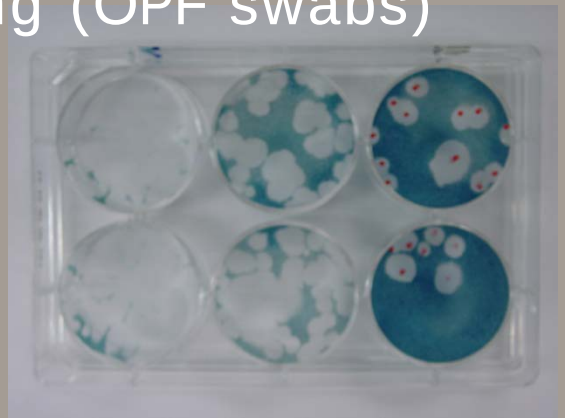
Intro: FMDV vaccination in pigs

- No prescribed efficacy test protocol
  - PD50 set-up with 5 groups of 3 pigs
  - Challenge method / ‘over challenge’?
- Correlation between Ab-level and protection
  - Not studied

- Research question:
  - Correlation between Ab-level and protection in pigs
    - protection: clinical or against virus shedding
  - Influence of - challenge method
    - heterologous vaccination

M&M: Data

- Five vaccination-challenge pig experiments (n=63)
  - Vaccine strain
  - Challenge strain → homologous or heterologous
  - Challenge method
    - ID or contact with (non-)vac infected pig
  - Ab-titres: ^{10}log VN-titres at time of challenge
  - Protection
    - Clinical protection (generalisation)
    - Virus shedding (OPF swabs)



M&M: Data set

			challenge			VNT titre		clinical	virus
exp nr	pig ID	vaccine	DPV	virus	method (I/C)	O TAW	O MAN	signs	excretion
37	4137	O TAW	7	O TAW	ID	0.6		Y	Y
37	4138	O TAW	7	O TAW	ID	<0.3		Y	Y
37	4139	O TAW	7	O TAW	ID	0.3		Y	Y
37	4140	O TAW	7	O TAW	ID	0.45		Y	Y
37	4141	O TAW	7	O TAW	ID	0.3		Y	Y
37	4132	O TAW	7	O TAW	C	1.2		N	Y
37	4133	O TAW	7	O TAW	C	0.45		Y	Y
37	4134	O TAW	7	O TAW	C	1.05		N	Y
37	4135	O TAW	7	O TAW	C	<0.3		Y	Y
37	4136	O TAW	7	O TAW	C	1.35		Y	Y
37	4127	O TAW	14	O TAW	ID	1.2		N	N
37	4128	O TAW	14	O TAW	ID	1.5		N *	N
37	4129	O TAW	14	O TAW	ID	1.35		N	N
37	4130	O TAW	14	O TAW	ID	1.65		N*	N
37	4131	O TAW	14	O TAW	ID	1.8		N	N
38	4947	O TAW	14	O TAW	ID	0.9	0.9	N	N
38	4948	O TAW	14	O TAW	ID	1.95	1.5	N	N
38	4949	O TAW	14	O TAW	ID	1.95	0.9	N	N
38	4950	O TAW	14	O TAW	ID	2.4	1.5	N	N
38	4951	O TAW	14	O TAW	ID	1.5	0.6	N	N
38	4957	O MAN	14	O TAW	ID	1.05	1.95	N	N
38	4958	O MAN	14	O TAW	ID	1.2	1.8	N	N
38	4959	O MAN	14	O TAW	ID	0.75	1.2	N	N
38	4960	O MAN	14	O TAW	ID	0.6	1.2	N	N
38	4961	O MAN	14	O TAW	ID	1.5	1.65	N	N
44	5928	O TAW	7	O TAW	ID	1.95		Y	Y
44	5929	O TAW	7	O TAW	ID	1.20		n.t	Y
44	5930	O TAW	7	O TAW	ID	0.90		Y	Y
44	5931	O TAW	7	O TAW	ID	2.25		Y	Y
44	5932	O TAW	7	O TAW	ID	1.80		Y	Y
44	5923	O TAW	7	O TAW	C	1.05		Y	Y
44	5924	O TAW	7	O TAW	C	1.05		Y	Y
44	5925	O TAW	7	O TAW	C	1.80		Y	Y
44	5926	O TAW	7	O TAW	C	1.35		Y	Y
44	5927	O TAW	7	O TAW	C	1.20		Y	Y

			challenge			VNT titre		clinical	virus
exp nr	pig ID	vaccine	DPV	virus	method (I/C)	O TAW	O MAN	signs	excretion
44	5938i	O TAW	7	O TAW-4	ID	2.1		N*	Y
44	5939i	O TAW	7	O TAW-4	ID	2.25		N*	Y
44	5940i	O TAW	7	O TAW-4	ID	2.1		Y	Y
44	5941i	O TAW	7	O TAW-4	ID	1.8		N*	Y
44	5942i	O TAW	7	O TAW-4	ID	2.1		N*	Y
44	5933c	O TAW	7	O TAW-4	C	2.1		Y	Y
44	5934c	O TAW	7	O TAW-4	C	1.8		N	N
44	5935c	O TAW	7	O TAW-4	C	2.1		N	N
44	5936c	O TAW	7	O TAW-4	C	1.8		N	Y
44	5937c	O TAW	7	O TAW-4	C	1.8		Y	Y
62	8658	O MAN	14	O NET	C with NV		1.05	Y	Y
62	8662	O MAN	14	O NET	C with NV		1.65	Y	Y
62	8666	O MAN	14	O NET	C with NV		0.45	Y	Y
62	8668	O MAN	14	O NET	C with NV		1.35	Y	Y
66	9521	O MAN	14	O NET	C with NV		0.9	Y	Y
66	9522	O MAN	14	O NET	C with NV		1.65	N	Y
66	9523	O MAN	14	O NET	C with NV		1.2	N	Y
66	9524	O MAN	14	O NET	C with NV		1.05	Y	Y
66	9525	O MAN	14	O NET	C with NV		1.2	N	Y
66	9526	O MAN	14	O NET	C with C1		1.5	N	Y
66	9527	O MAN	14	O NET	C with C1		1.05	Y	Y
66	9528	O MAN	14	O NET	C with C1		0.75	Y	Y
66	9529	O MAN	14	O NET	C with C1		0.75	N	Y
66	9530	O MAN	14	O NET	C with C1		0.75	Y	Y
66	9536	O MAN	14	O NET	C with NV		1.2	Y	Y
66	9537	O MAN	14	O NET	C with NV		1.2	Y	Y
66	9538	O MAN	14	O NET	C with NV		1.5	N	Y
66	9539	O MAN	14	O NET	C with NV		1.2	Y	Y
66	9540	O MAN	14	O NET	C with NV		1.65	N	N
66	9541	O MAN	14	O NET	C with C1		1.65	N	N
66	9542	O MAN	14	O NET	C with C1		0.6	Y	Y
66	9543	O MAN	14	O NET	C with C1		1.05	N	Y
66	9544	O MAN	14	O NET	C with C1		1.35	Y	Y
66	9545	O MAN	14	O NET	C with C1		1.8	N	Y

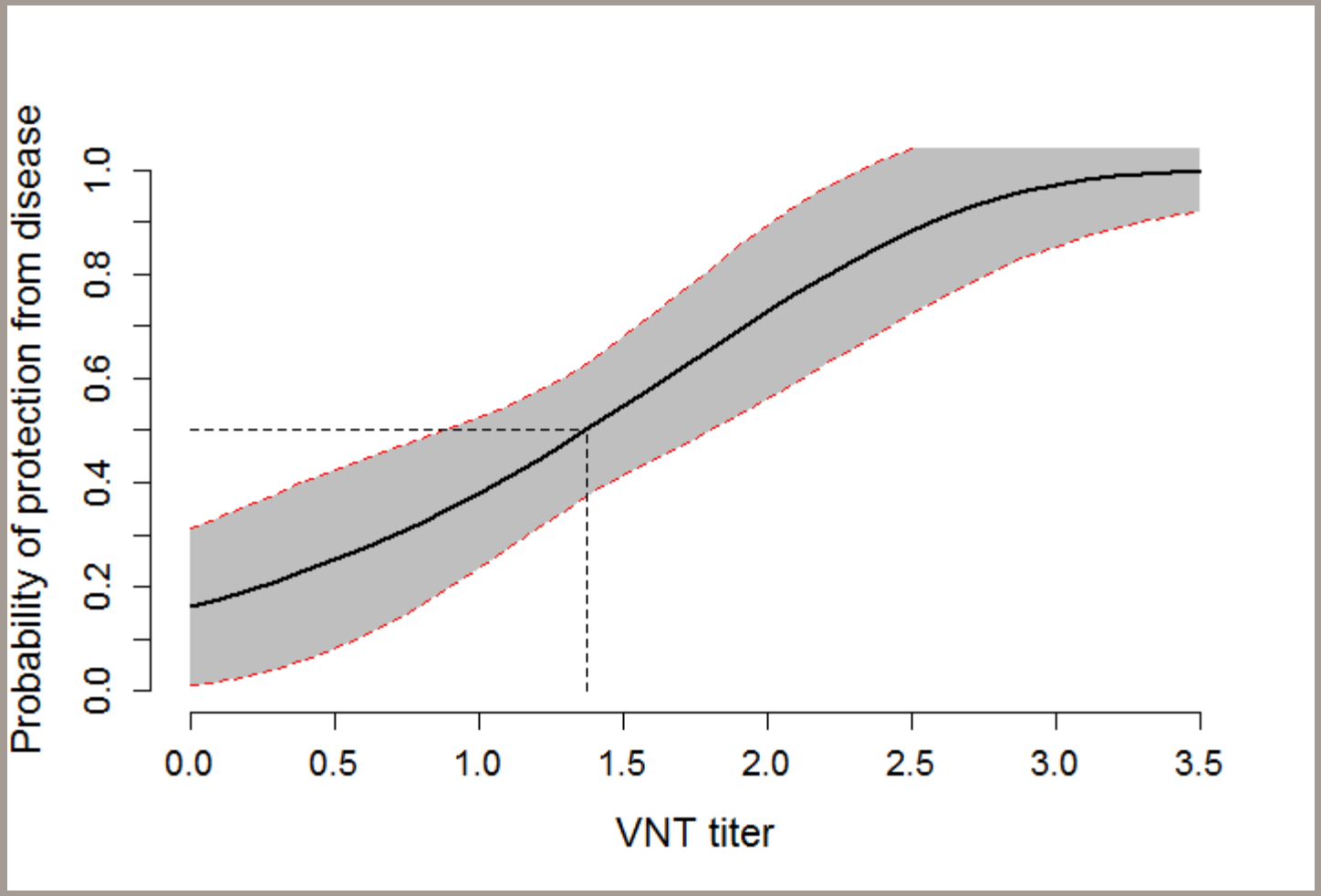
M&M: Mathematical models

- Two binomial regression models
  - Response variable: Protection
    - Clinical protection
    - Protection against virus shedding
  - Explanatory variable: Ab-titre (^{10}log VN-titre)
  - Additionally we added
    - Type of challenge (homologous / heterologous)
    - Challenge method (inoculated / contact)
- With final model results
  - Calculation of the VNT50
    - VN-titre at which 50% of the pigs were protected

Results

- Significant correlation between Ab-titre and protection
- In our model, no effect of:
  - Type of challenge (homologous / heterologous)
  - Challenge method (ID inoculation / contact)
- VNT50 protection against virus shedding > VNT50 clinical protection

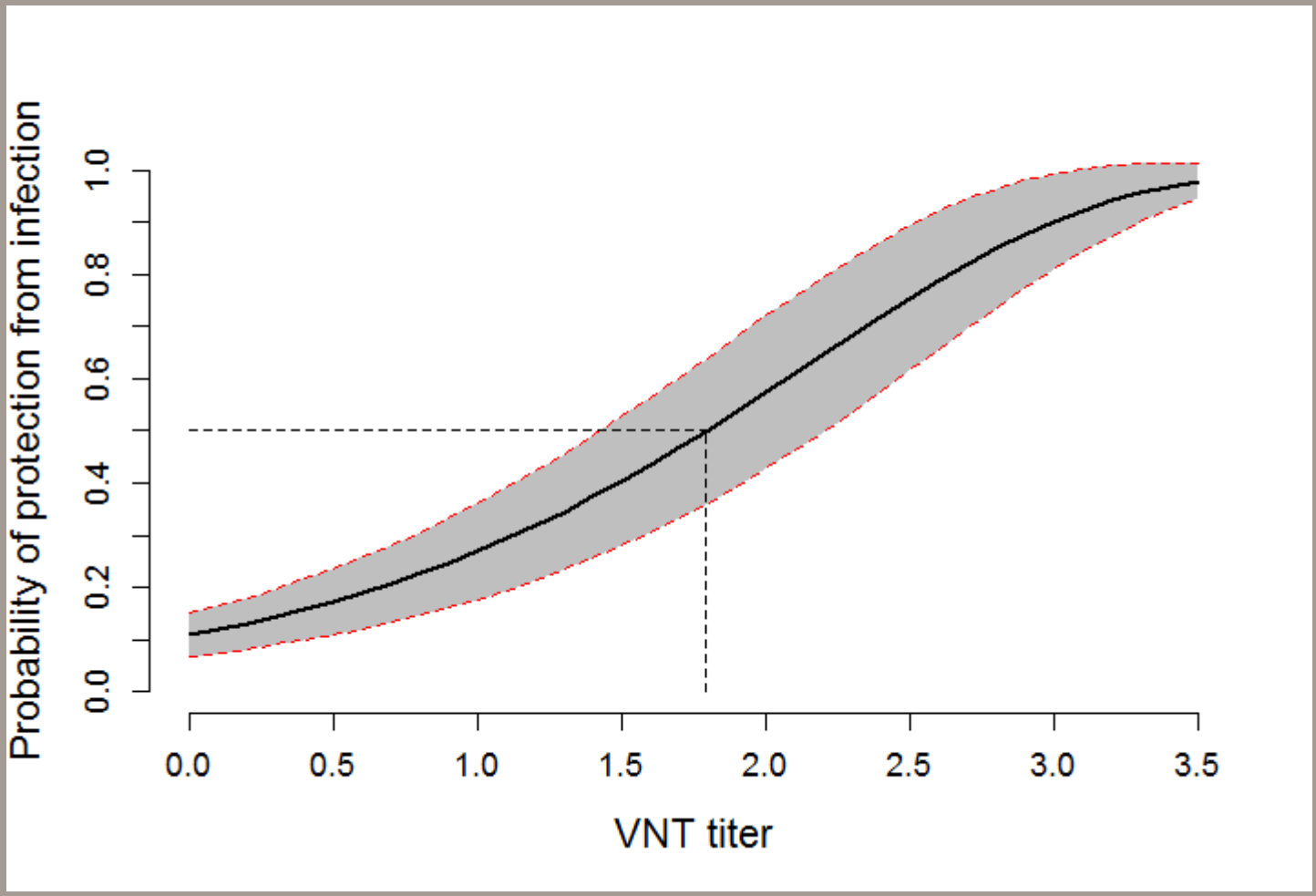
Results: Protection against clinical disease



- VNT50 = 1.4 (1.0 – 1.7)

WAGENINGEN
UNIVERSITY & RESEARCH

Results: Protection against virus shedding



- VNT50 = 1.8 (1.4 – 2.2)

Conclusions

- Also in pigs, there is a significant correlation between Ab-titre and protection against FMD
  - VNT50's can be established
- Difference in VNT50 for protection against clinical disease and protection against virus shedding
- The developed models / antibody thresholds might, in the future, be used to assess vaccine efficacy

Further research

- More data are needed!!
  - Larger dataset
- Other serotypes
  - Serotype differences
- Other labs
  - Laboratory differences

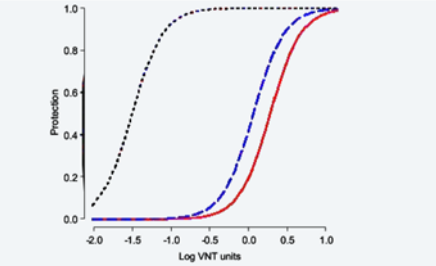


Figure 2: Comparison of protection and the VNT units of sera collected 3 weeks post vaccination. In dashed blue the results obtained in Brussels, solid red the results of the laboratory in the Netherlands and dotted black the results obtained in Pirbright.

Thank you for your attention!

Questions?

CORRELATION OF SEROLOGICAL RESPONSE AFTER VACCINATION AGAINST FMDV AND PROTECTION AGAINST CHALLENGE IN PIGS