Relationship between animal-based on-farm indicators and meat inspection data in pigs

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Animal welfare assessment by use of meat inspection (secondary) data?





EU Regulations 2017/625, 2019/627

BMEL, Allgemeine Verwaltungsvorschrift Lebensmittelhygiene; 2009

Why? → detect potential health hazards

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Animal welfare assessment by use of meat inspection (secondary) data?





EU Regulations 2017/625, 2019/627

BMEL, Allgemeine Verwaltungsvorschrift Lebensmittelhygiene; 2009

Why? → detect potential health hazards

What? → parts of carcass are inspected

Who? → official controllers (vets, trained personal)

When? → after slaughter

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Animal welfare assessment by use of secondary data?

Aim: Understand relationship meat inspection & on-farm

Validate use of meat inspection data

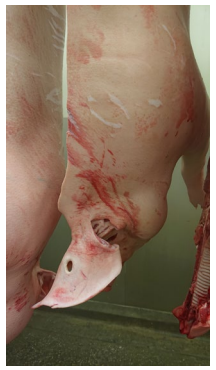
Animal welfare assessment by use of secondary data?

Part 1: Agreement between on-farm assessments & meat inspection data?

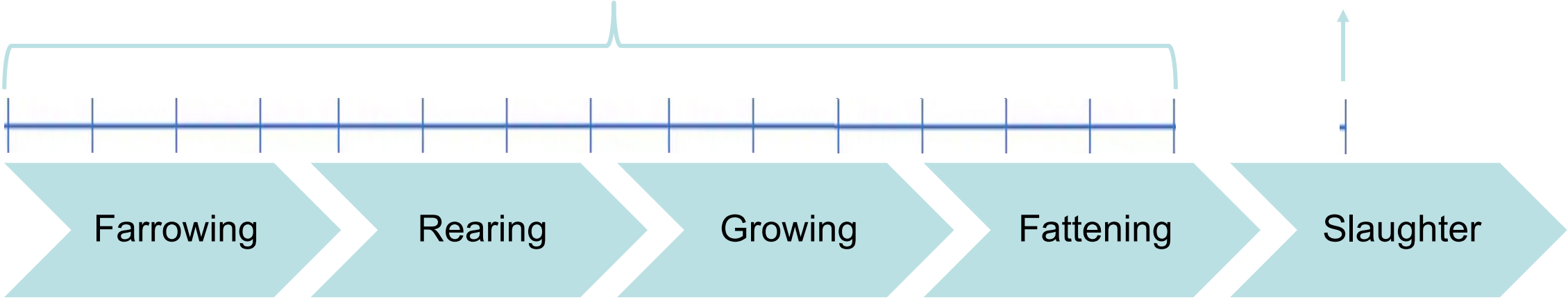
Part 2: Influence of the meat inspection data to the farm assessments?

Study design: Data collection

Weekly farm assessments



Slaughterhouse assessment



Welfare Quality® Science and society improving animal welfare

Nationales Tierwohl-Monitoring

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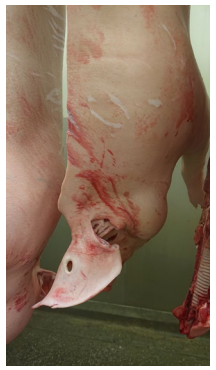
Study design: Data collection

Weekly farm assessments



Slaughterhouse assessment

628 assessed pigs (on farm & at the slaughterhouse)

Welfare Quality® Science and society improving animal welfare

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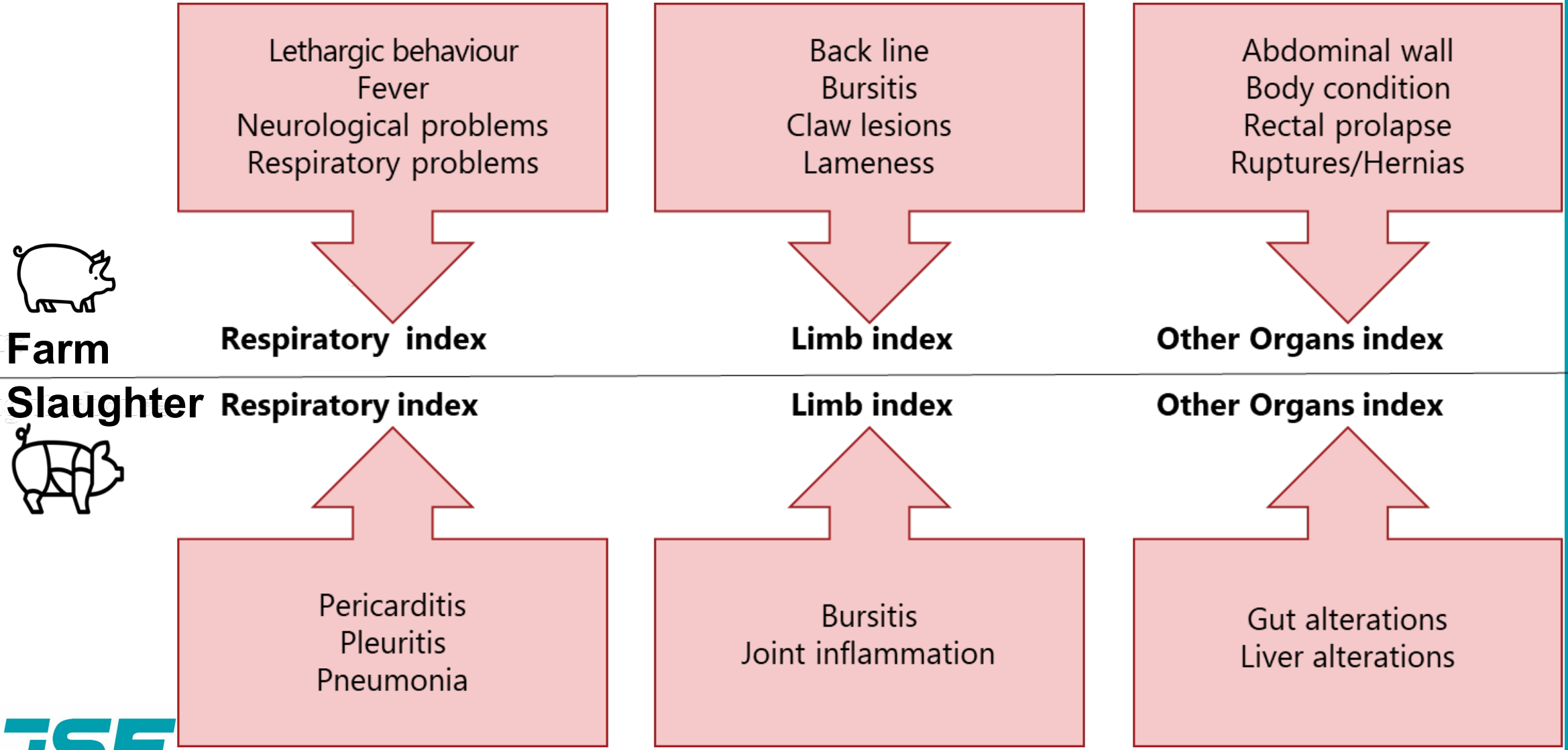
Study design: Data collection and aggregation



Study design: Data collection and aggregation

Farm

Lethargic behaviour
Fever
Neurological problems
Respiratory problems

Respiratory index

Back line
Bursitis
Claw lesions
Lameness

Limb index

Abdominal wall
Body condition
Rectal prolapse
Ruptures/Hernias

Other Organs index

Slaughter

Respiratory index

Pericarditis
Pleuritis
Pneumonia

Limb index

Bursitis
Joint inflammation

Other Organs index

Gut alterations
Liver alterations

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Study design: Data collection and aggregation

Farm

Respiratory index | **Limb index** | **Other Organs index**

Slaughter

Respiratory index | **Limb index** | **Other Organs index**

Part 1: Agreement: Between on-farm & slaughterhouse indices?
Percent agreement and Prevalence Adjusted Bias Adjusted Kappa (PABAK)

Results & discussion: Part 1 (Agreement)

Production stage	Respiratory index		Limb index		Other Organs index	
	Percent agreement	PABAK	Percent agreement	PABAK	Percent agreement	PABAK
Farrowing (Week 1-4)	**0.94**	**0.53**	**0.94**	**0.53**	0.80	0.39
Rearing (Week 5-12)	0.89	0.05	**0.91**	0.06	0.85	0.15
Fattening (Week 13-30)	**0.94**	**0.46**	**0.93**	**0.45**	**0.90**	**0.40**

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Good: PA≥0.95, PABAK≥0.60; **Acceptable**: PA≥0.90, PABAK≥0.40

Results & discussion: Part 1 (Agreement)

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Fattening (Week 13-30)	0.94	0.46	0.93	0.45	0.90	0.40
Fattening (22nd week)	0.91	0.09	0.93	0.06	0.93	0.06
Fattening (26th week)	0.94	0.54	0.95	0.53	0.95	0.53

TSF RESEARCH

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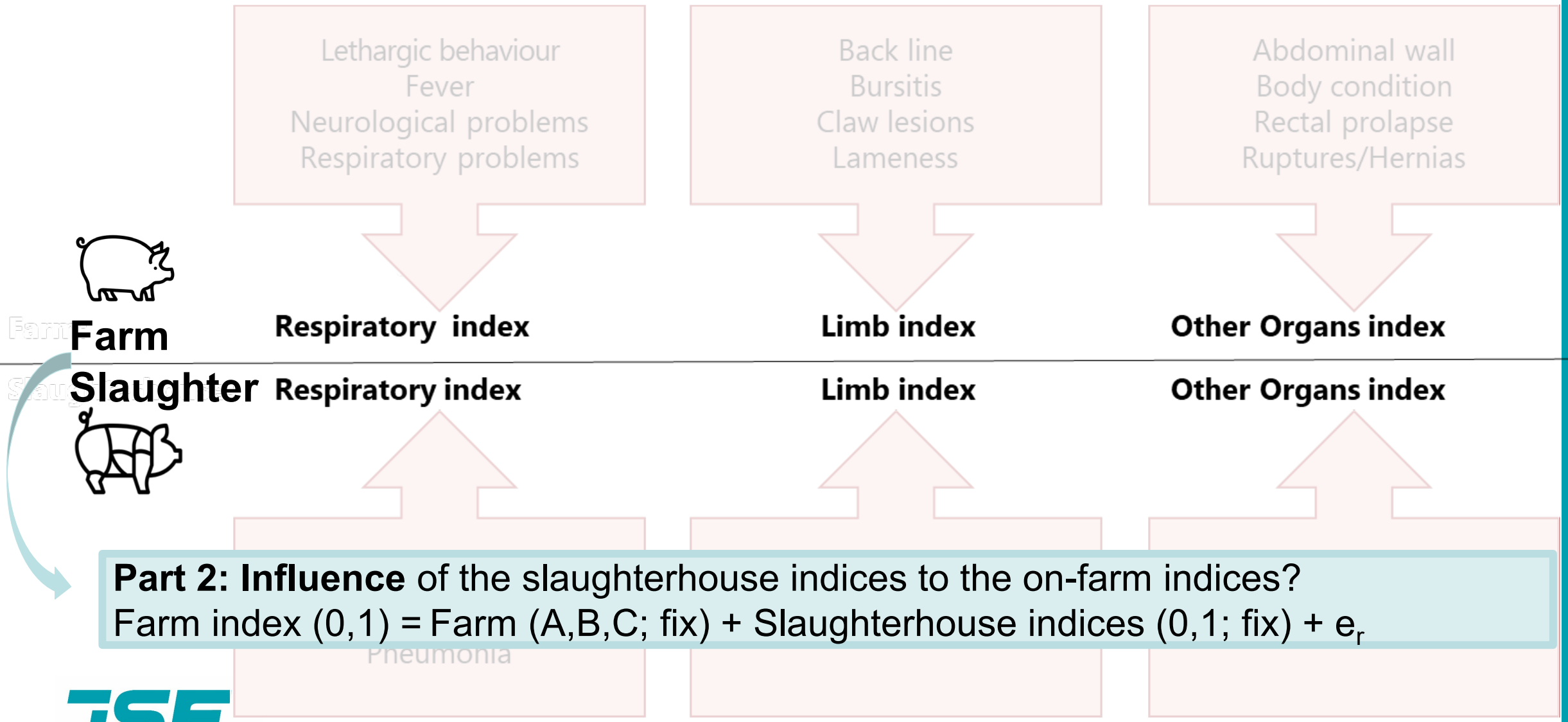
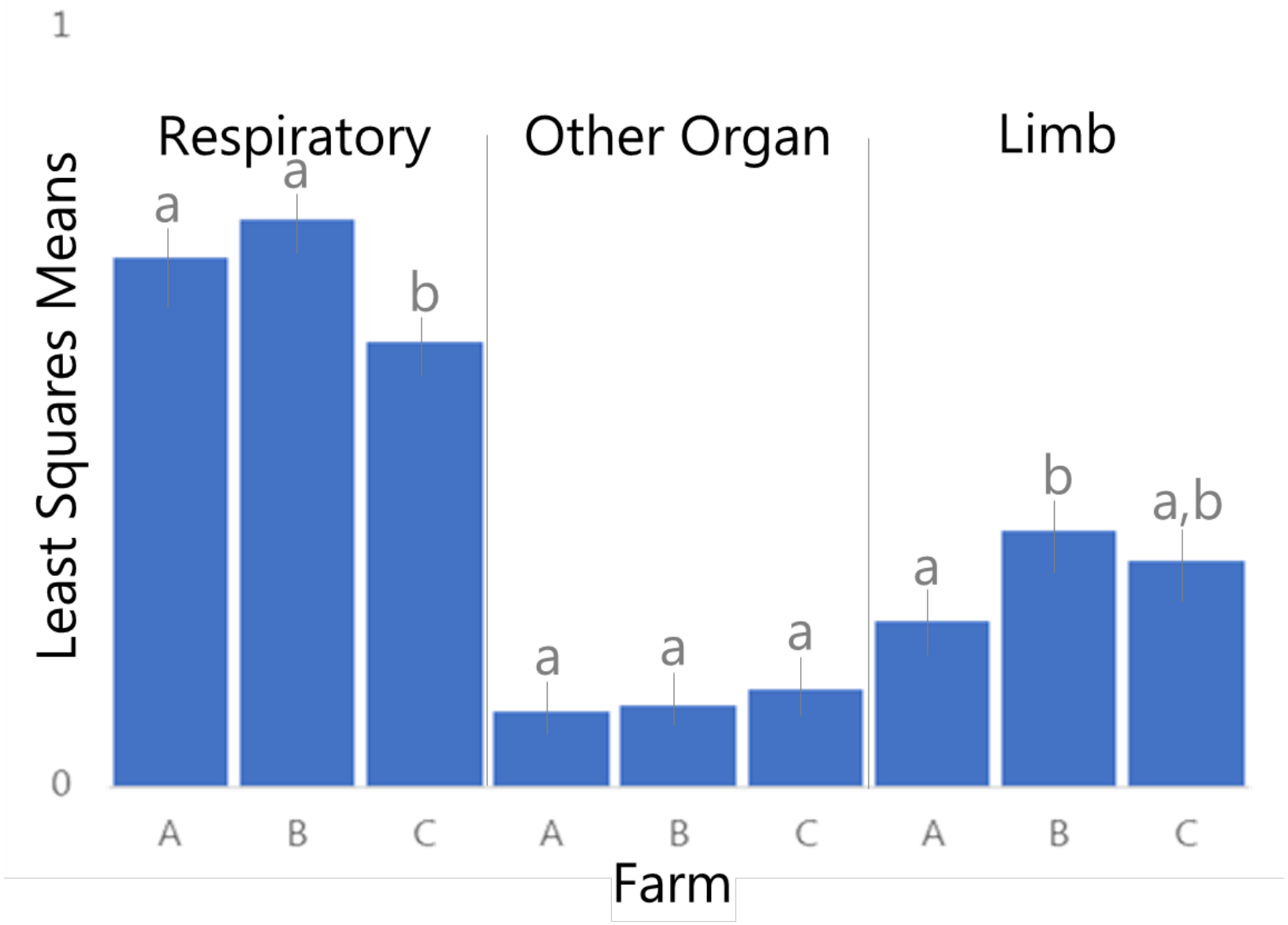
Study design: Data collection and aggregation



Part 2: Influence of the slaughterhouse indices to the on-farm indices?
Farm index (0,1) = Farm (A,B,C; fix) + Slaughterhouse indices (0,1; fix) + e_r

Results & discussion: Part 2 (Influencing effects)



Conclusion

End of fattening: agreement slaughterhouse & on-farm

Health issues in farrowing make pigs susceptible to diseases

Many other influencing effects, especially time effects (recovery)

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Conclusion

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Porcine Health Management

RESEARCH **Open Access**

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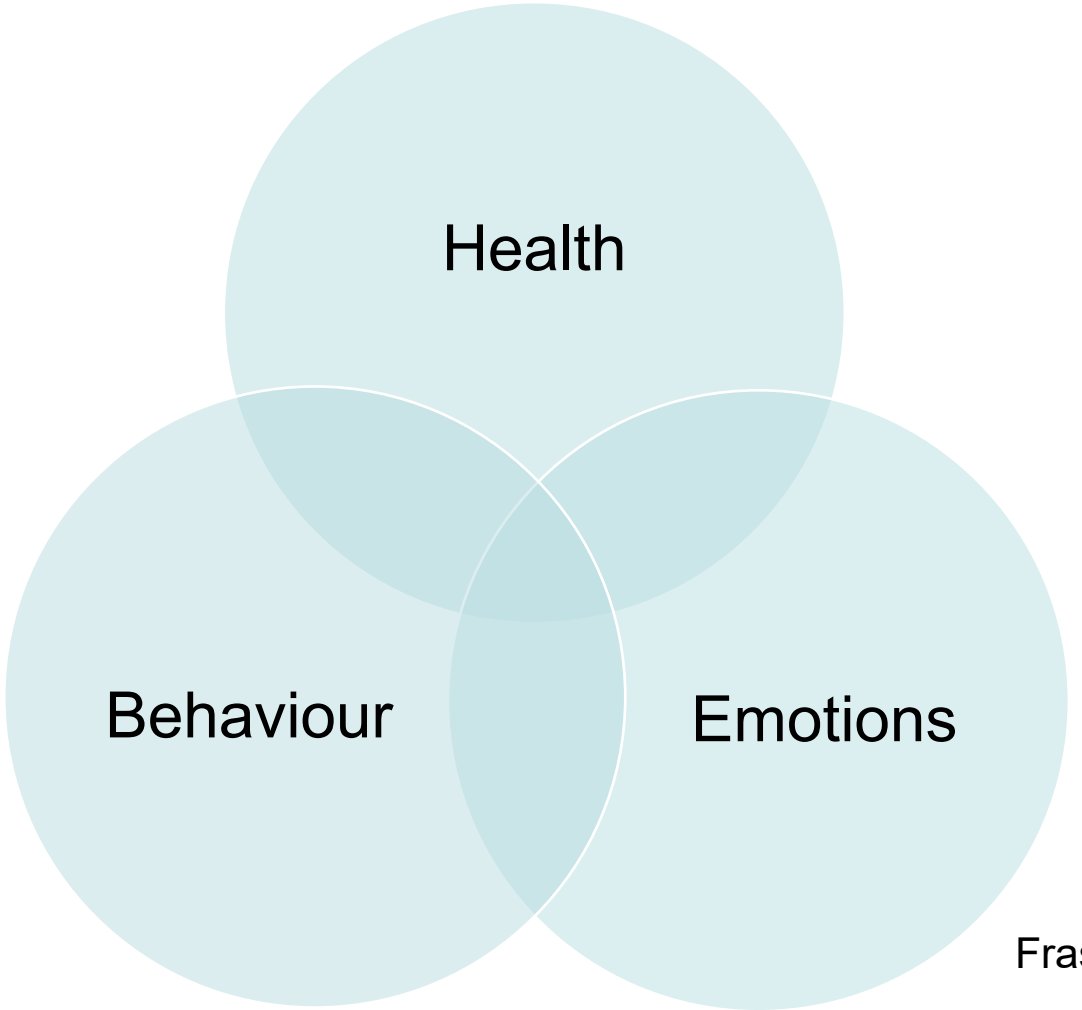
Introduction: Definition of animal welfare



Fraser (2008)

Search for additional indicators to objectively assess animal welfare on farms

Study design: Farms

Farm A

Organic

50 sows

Slaughterhouse A

Farm B

Conventional

1400 sows

Slaughterhouse B

Farm C

Conventional

60 sows

Slaughterhouse B

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628 assessed pigs (on farm and slaughterhouse indicators)

Welfare Quality Assessment Protocol for Pigs

Welfare principles	Welfare criteria
Good feeding	Absence of prolonged hunger
	Absence of prolonged thirst
Good housing	Comfort around resting
	Thermal comfort
	Ease of movement
Good health	Absence of injuries
	Absence of disease
	Absence of pain induced by management procedure
Appropriate behaviour	Expression of social behaviours
	Expression of other behaviours
	Good human-animal relationship
	Positive emotional state

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On-farm animal welfare indicators

Abdominal wall	1	Abnormal (tense)
Back line	1	Abnormal (arched back)
Body condition	1	Thin: visible spine, hip, pin bones
Bursitis	1	One/several small bursae on the same leg or one large bursa
	2	Several large bursae on the same leg or one extremely large or eroded bursa
Claw lesions	1	Evidence of alterations (injured, bleeding erosion (side wall), cracks (heel, sole, sole/heel junction, side wall), panaritium)
Fever	1	Temperature >39.9C°
Lameness	1	Severely lame, weight-bearing on affected limb
	2	No weight-bearing on one limb or unable to walk
(Lethargic) behaviour	1	Lethargic behaviour
Neurological problems	1	Evidence of neurological problem (head tilt)
Respiratory problems	1	Evidence of laboured breathing
Rectal prolapse	1	Evidence of rectal prolapse
Ruptures/hernias	1	Small hernia/rupture
	2	Hernia/rupture touching the floor or with bleeding lesion

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Slaughterhouse animal welfare indicators/ meat inspection indicators

Bursitis	1	Bursa >5cm diameter present
Gut alterations	1	Alterations present
Joint inflammation	1	Inflammations present
Liver alterations	1	Milkspot/s present
Pericarditis	1	Altered
(Pleuritis	1	<0% - ≤10% affected by pleuritis
	2	<10% - ≤30% affected by pleuritis
	3	<30% affected by pleuritis
Pneumonia	1	<0% - ≤10% affected by pneumonia
	2	<10% - ≤30% affected by pneumonia
	3	<30% affected by pneumonia

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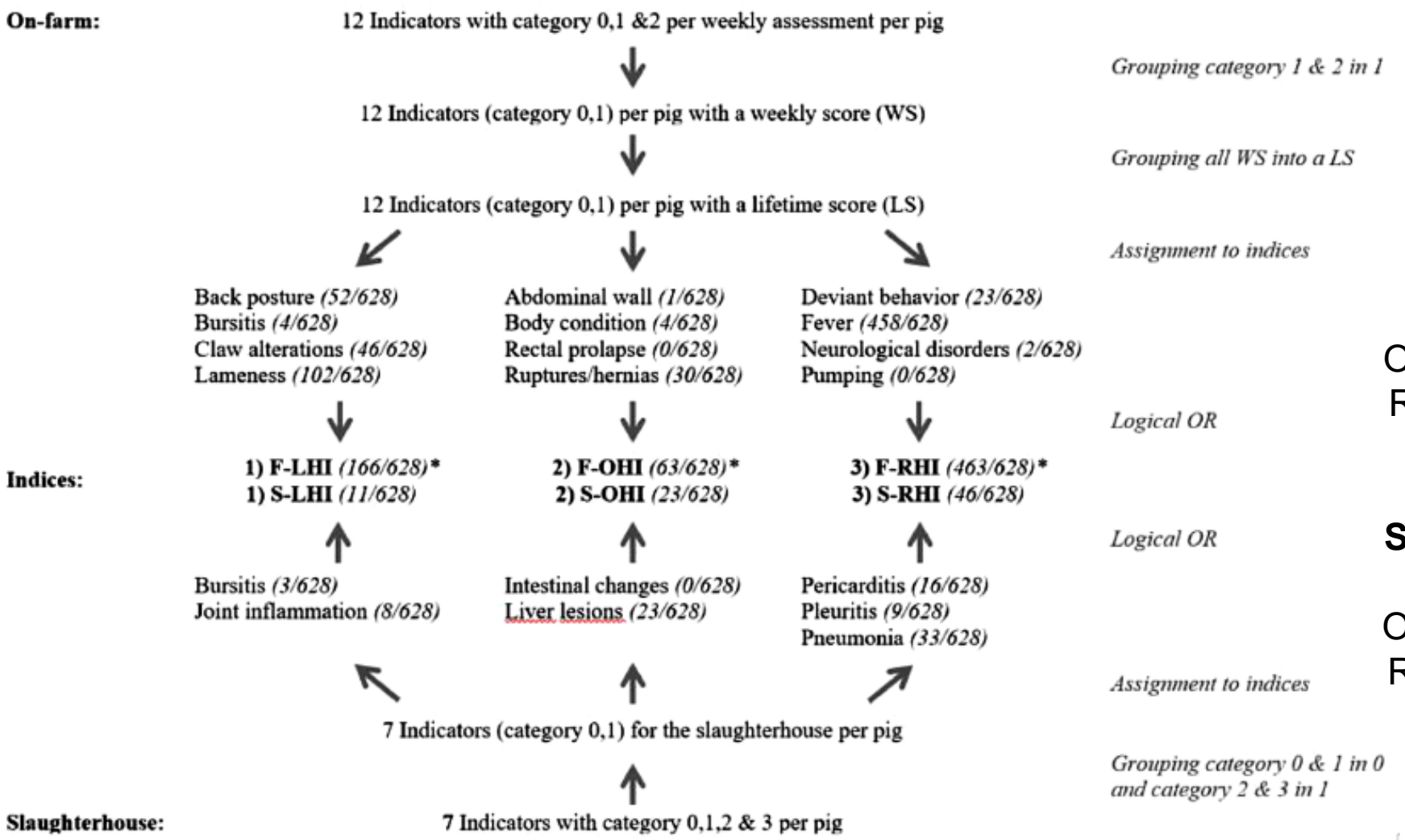
Index formation

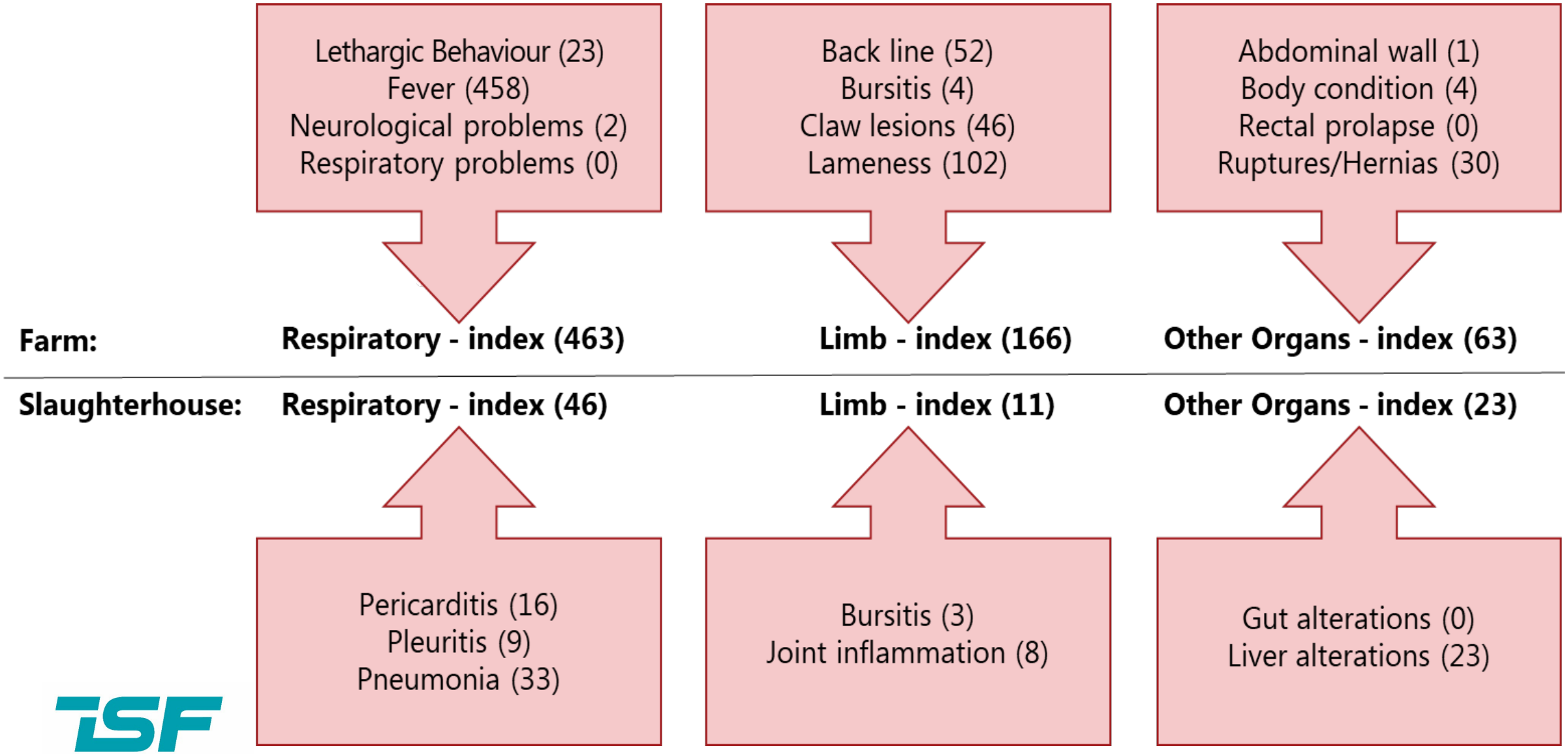


Farm Indices:
Limb index **(F-LHI)**
Other organ index **(F-OHI)**
Respiratory index **(F-RHI)**

Slaughterhouse indices:
Limb index **(S-LHI)**
Other organ index **(S-OHI)**
Respiratory index **(S-RHI)**

Fig. 1 Aggregation of the on-farm/slaughterhouse indicators (number of affected (=1) pigs of all pigs (n=628) in the study) to create the lifetime health indices (LHI=limb health index; OHI=other organ health index; RHI=respiratory health index) per pig on-farm (F) and at the slaughterhouse (S) with the logical OR-operator, (QS, 2020); *Not identical with the sum of the number of affected animals of the individual indicators, as animals can present with more than in one indicator

Study design: Data collection and aggregation



Study design: Statistics (Part 2: Influence)

Logistic regression:

$$y_{ijk} = \mu + F_i + S_j + e_{ijk}$$

y_{ijk} : Binary (0, 1) farm indices (respiratory, limb or other organs index) of the pigs

μ : General mean

F_i : Fixed effect of the i^{th} farm (i = A, B, C)

S_j : Fixed effect of the j^{th} slaughter findings (j = 0,1)

e_{ijk} : Random residual error

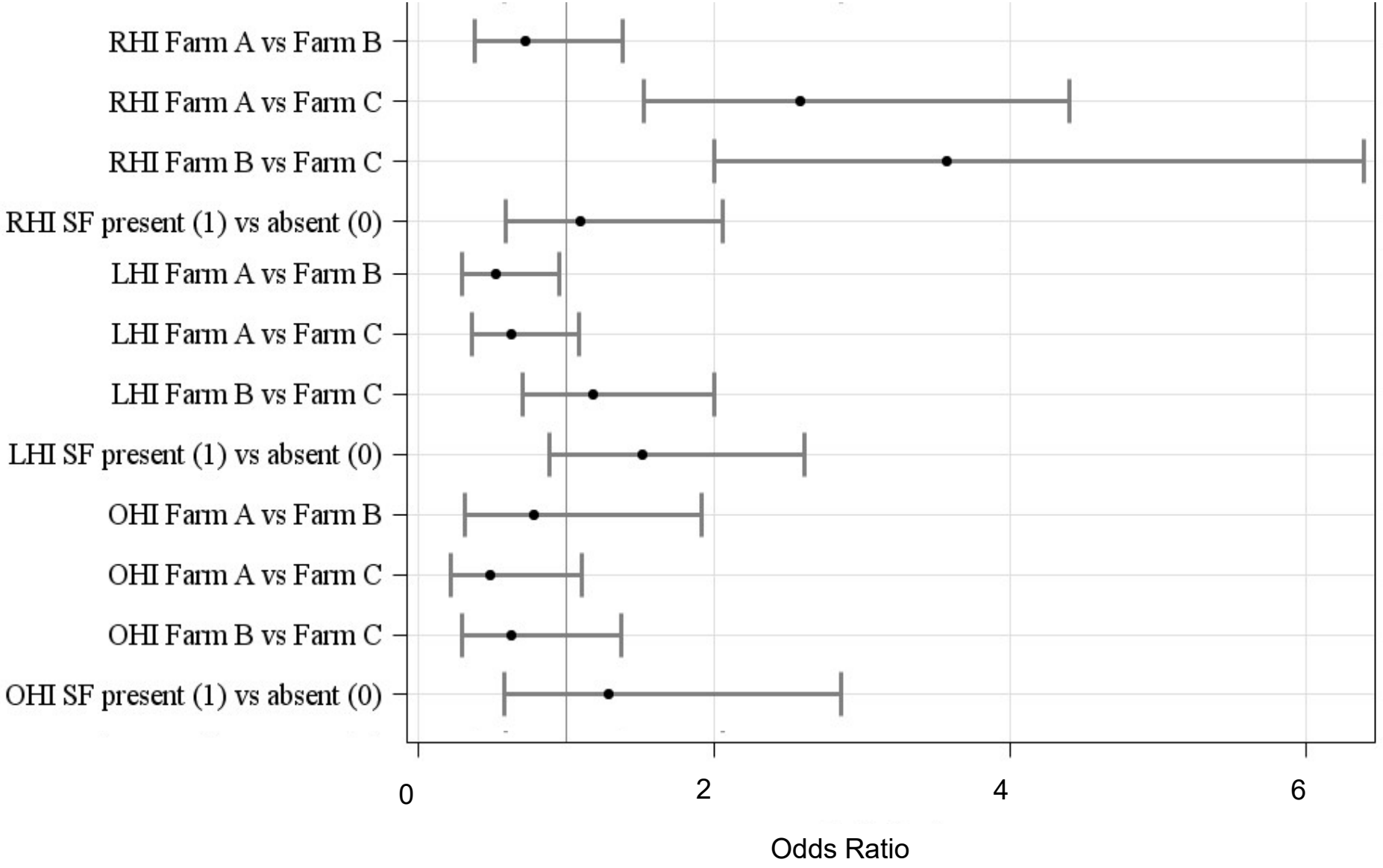
Statistical significance at $P < 0.05$

Farm A (organic)

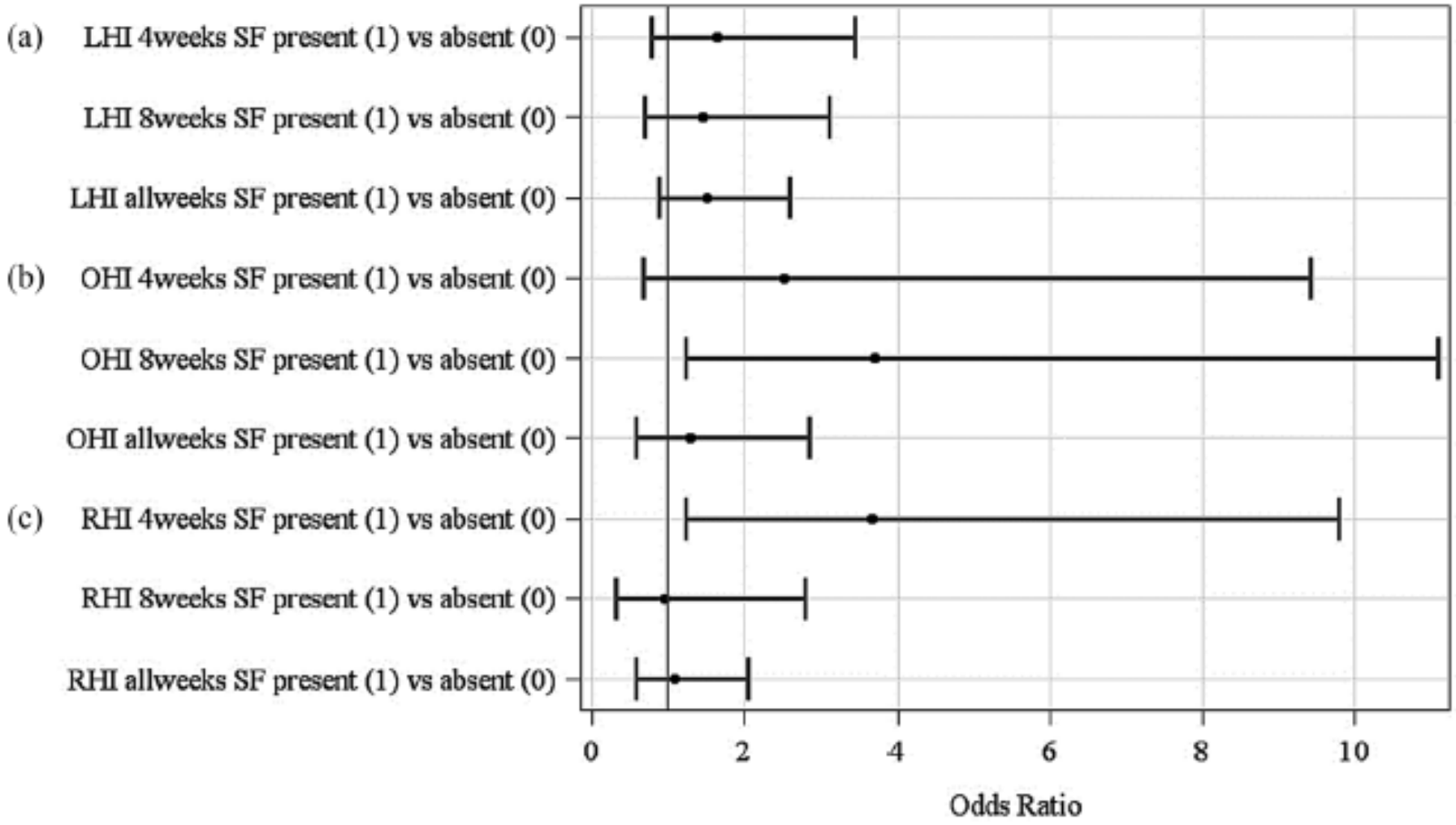
Farm B (con)

Farm C (con)

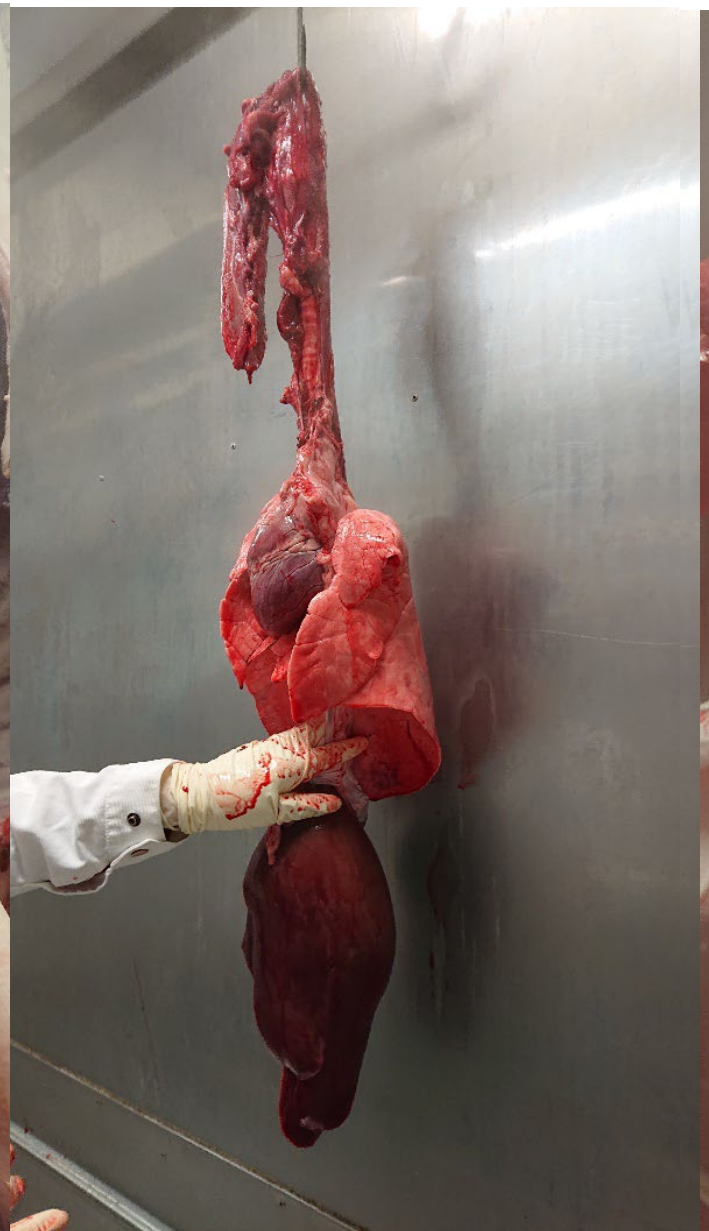
Results & discussion: Part 2 (Influencing effects) - Odds ratios



Results & discussion: Part 2 (Influencing effects) - Odds ratios



Slaughterhouse



Slaughterhouse