Defining PMWS using multivariate statistical analysis

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INTRODUCTION

Post-weaning multi-systemic wasting syndrome (PMWS) emerged as an economically important disease of pigs in the late 1990's. Porcine circovirus-2 (PCV-2) is associated with the occurrence of disease although the virus has been detected in pig herds that do not have PMWS. The non-specific clinical presentation makes defining the disease in order to conduct epidemiological investigations difficult. This study was conducted to investigate whether multivariate statistical analyses could assist in the development of a case definition

OBJECTIVE The objective of the study was to develop and validate a new case definition for PMWS using multivariate statistical analysis of clinico-pathological data

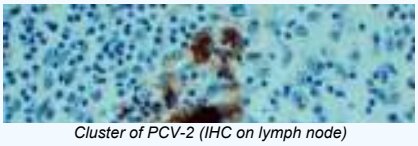
DATA USED Clinico-pathological data was collected at post mortem from four poor doing young pigs on each of a random selection of 85 pig farms as part of cross-sectional study to investigate risk factors for PMWS

Pigs with "PMWS"

STEP 1

Investigation of the relationship between clinico-pathological variables likely to be present in PMWS affected animals using multiple correspondence analysis

Enlarged inguinal lymph nodes

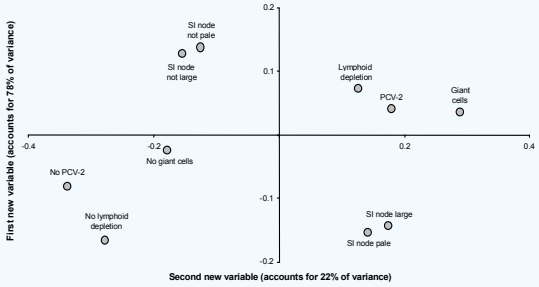


Cluster of PCV-2 (IHC on lymph node)

Conclusions from multiple correspondence analysis

There were two dimensions to the data defined by two groups of related variables:

- Group 1 associated with PCV-2 presence as indicated by presence of PCV-2 antigen, presence of giant cells and occurrence of lymphoid depletion
- Group 2 associated with reticuloendothelial insult as indicated by superficial inguinal lymph node pallor or enlargement



STEP 2

Develop criteria to classify each pig as PMWS positive or negative using multiple correspondence analysis results and refine classification in discussions with project team pathologists

Development of initial classification criteria based on results of multiple correspondence analysis

A pig has PMWS if it has evidence of both:

- PCV-2 presence indicated by presence of either PCV-2 antigen or giant cells or lymphoid depletion
- Reticuloendothelial insult indicated by pale or enlarged superficial inguinal lymph nodes

Final definition of PMWS (epipath) based on multiple correspondence analysis and modified following discussion with pathologists (reasons for modifications given in brackets)

A pig has PMWS if it has evidence of:

- PCV-2 presence indicated by presence of either PCV-2 antigen or giant cells (lymphoid depletion occurs in other conditions and not necessarily evidence for PCV-2 presence)
- Reticuloendothelial insult indicated by pale or enlarged superficial inguinal lymph nodes
- Low weight for age (wasting is a necessary feature of the disease and should be included as a criterion even though it accounts for little of the variation in this data set)

STEP 3

Classify farms using our new case definition (epipath) and various other case definitions developed during our analyses and used previously to define PMWS. Each farm classified as PMWS positive using each case definition if one or more pigs from the farm meets the criteria for being a PMWS animal

Case Definition	Based on	Signs present for animal to be classified positive			Farm PMWS Prevalence (%)
Epipath	Correspondence analysis & pathological considerations	PCV-2 or giant cells	Low weight for age	Large or pale SI lymph node	69 (58-79)
Epidem	Correspondence analysis	PCV-2 or giant cells or lymphoid depletion		Large or pale SI lymph node	81 (71-89)
Path	Pathological considerations	PCV-2 or giant cells		Low weight for age	86 (76-92)
Cluster	Cluster analysis	Two of PCV-2 or giant cells or lymphoid depletion			81 (71-89)
VLA	Previous definition for analysis of these data	PCV-2	Any lymph node large	Poor condition	61 (49-71)
Sorden	Literature definition (Sorden, 2000)	PCV-2	Lymphoid depletion	Low weight for age	67 (55-77)
Virus	Virus detection	PCV-2			83 (74-91)
Vet	Veterinary opinion	Clinical opinion of veterinary surgeon			73 (62-82)

STEP 4

Validation of case definition – comparison of each definition with veterinary surgeon's opinion about presence of PMWS using kappa statistic and detection of associations between PMWS status of the farm and selected potential risk factors using logistic regression, significant associations detected with only two risk factors for which results are summarized below, significant associations ($p<0.05$) shown in red.

Case definition	Epipath	Epidem	Path	Cluster	VLA	Sorden	Virus	Vet
Kappa statistic for agreement with veterinary opinion (values over 0.5 indicate good agreement)	0.51	0.44	0.40	0.37	0.47	0.36	0.22	-
Odds ratio (95% CI) for farms with two or more pig farms within 3 mile radius of farm compared to those with less than two	4.7 (1.2-17.7)	4.1 (0.8-22.4)	4.0 (0.7-23.1)	0.8 (0.2-3.0)	2.8 (1.0-8.0)	2.3 (0.8-7.1)	1.7 (0.4-6.45)	3.4 (0.9-12.9)
Odds ratio (95% CI) for farms using dedicated sick pens compared with farms that did not use sick pens	6.7 (1.6-28.9)	2.9 (0.7-2.5)	4.1 (0.9-20.3)	2.9 (0.7-11.3)	3.1 (0.8-12.1)	3.5 (0.9-13.6)	1.2 (0.3-5.6)	5.1 (1.3-20.8)

CONCLUSIONS

- Multiple correspondence analysis is useful for understanding the relationship between variables and developing criteria to define emerging diseases
- The apparent prevalence of PMWS varied considerably between farms depending on the case definition used
- Our new case definition (epipath) developed using correspondence analysis results with modifications based on biological features of the disease provided the best agreement with the veterinary surgeon's opinion about whether PMWS was present on the farm and detected more significant associations with potential risk factors than any of the other case definitions tested

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Reference: Sorden SD (2000) Update on porcine circovirus and postweaning multisystemic wasting syndrome Swine Health and Production 8, 133-136

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