Defining syndromes: a challenging issue
Proposition of a statistical approach

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Context

Same issue as in human health with additionnal constraints

- Lack of coding systems
- No existing referential
- Complexity of the data collected e.g. meat inspection data

Syndrome definition method depends on the type of syndromic surveillance

Existing syndrome definition methods

Objectives

Detection of unknown diseases

Detection of known diseases

Non targeted Syndromic Surveillance

Targeted Syndromic surveillance

Traditional surveillance

Definition of Generic indicator

Existing referential

Expert opinion consensus

Statistics-based definition

Statistical approach of syndrome definition

Objective

Define a typology of cattle with at least one part of the carcass condemned based on

- Health-related data: reasons for condemnation, condemnation portions
- Animal characteristics: sex, age, production type

Material and method

- Data from 1,937,917 cattle slaughtered in 10 French slaughterhouses (2005-2010)
- 381,186 cattle with at least one part of the carcass condemned
- Principal component method associated with hybrid clustering

Method

Multiple Factorial Analysis
on 381,186 condemned cattle

Age Sex Production type	Reasons for condemnation Condemnation portions

Active variables

Year and month of slaughter

Farm location

Presence of clinical signs during AMI

Abattoir identification number

Supplementary variables

Method

Multiple Factorial Analysis on 381,186 condemned cattle → Principal coordinates of the 381,186 cattle

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K-means on the principal coordinates

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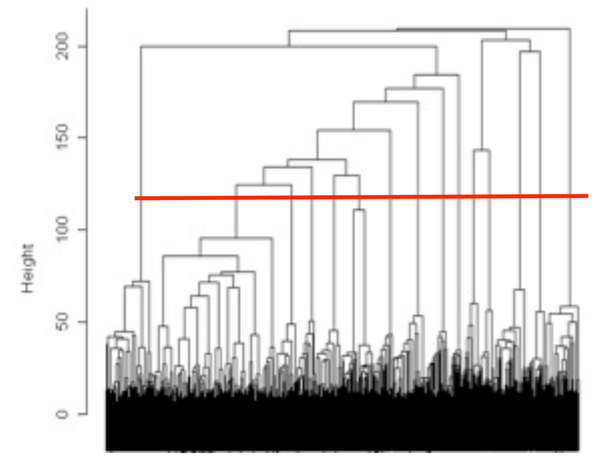
Hierarchical Ascendant Clustering on the principal coordinates of the K-means cluster centers → **Dendrogram**



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Choosing the cutting level

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Consolidation of the clusters: **K-means**

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Description of the 12 final clusters

Results

- Cluster interpretation
  - Characteristic variables
  - Biological interpretation

- Bronchopneumonia
- Lungs
- 8-24 months old
- Non-castrated male

Chronic bronchopneumonia

Animal health

Results

- Meat with abnormal maturation
- Whole carcass
- AMI abnormality= Yes

Dark Firm Dry meat

Animal welfare

- Steatosis
- Kidneys
- Liver
- Dairy Cattle
- 5-10 years old
- Female

Fatty liver syndrome

Farm management practices

Results

12 clusters

12 syndromes

Animal health and welfare (4)

Public health (1)

Quality of the slaughtering process (2)

Farm management practices (5)

Discussion: syndrome definition methods

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Targeted syndromic surveillance

- Useful tool to
  - Identify groups of existing lesions among complex and large dataset
  - Identify groups of lesions that would probably not have been found through expert elicitation process

Complementarity of statistical tool and expert elicitation for syndrome definition

Discussion

Non targeted syndromic surveillance

With this method:

- Each animal attributed to one cluster
- Each disease = typology of lesions
- All infected cattle showing similar groups of lesions and characteristics attributed to the same cluster

Consequently, monitoring the proportion of each cluster can help detecting emerging diseases

Conclusion

Principal component method associated with hybrid clustering is a new statistical approach to deal with syndrome definition when health-related data used are complex

Implemented on animal health data but can be used for human health data

Choice of a syndrome definition method according to

- **The type of syndromic surveillance system: targeted or not**
- **Historical data availability**
- **Data complexity**

Thank you for your attention

Reference

Dupuy et al, 2013, Defining syndromes using meat inspection data for syndromic surveillance purposes: a statistical approach with the 2005-2010 data from ten French slaughterhouses. BMC Vet. Res. 9, 88