Defining syndromes: a challenging issue
Proposition of a statistical approach

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Context

Same issue as in human health with additional 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

Non targeted Syndromic Surveillance

Definition of Generic indicator

Targeted Syndromic surveillance

Existing referential

Expert opinion consensus

Detection of known diseases

Traditional surveillance

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

Active variables

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Production type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Reasons for condemnation</td>
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<tr>
<td></td>
<td></td>
<td>Condemnation portions</td>
</tr>
</tbody>
</table>

Supplementary variables

- Year and month of slaughter
- Farm location
- Presence of clinical signs during AMI
- Abattoir identification number
Method

Multiple Factorial Analysis on 381,186 condemned 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

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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
## Results

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

### Animal welfare

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

### Fatty liver syndrome

- Dark Firm Dry meat
- Farm management practices
Results

12 clusters

12 syndromes

- Animal health and welfare (4)
- Quality of the slaughtering process (2)
- Farm management practices (5)
- Public health (1)
Discussion: syndrome definition methods

Objectives

Detection of unknown diseases
- Non targeted Syndromic Surveillance
  - Definition of Generic indicator

Detection of known diseases
- Targeted Syndromic surveillance
  - Existing referential
  - Expert opinion consensus

Statistics-based definition

Traditional surveillance
Discussion

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