Epidemiological farm investigations
Subjectivity
HRP

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The preconditions for a strategic approach for outbreak investigations and implementation of measures are based on the biology of ASF.

The following basic knowledge about ASF enables a strategic approach:

- Clinical disease (clinical course and clinical signs)
- Mortality/lethality
- Contagiousity
- Tenacity of the virus
- Ways of transmissions
- Human factors
Epidemiological enquiry
(AHL, Art. 57)

1. The competent authority shall carry out an epidemiological enquiry in the event of the confirmation of a listed disease.

2. The epidemiological enquiry shall aim to:
   a) identify the likely origin of the disease and the means of its spread;
   b) calculate the likely length of time that the disease has been present \( (\text{High Risk Period}) \);
   c) identify establishments and epidemiological units therein, food and feed businesses or animal by-products establishments, or other locations….;
   d) obtain information on the movements of animals, persons, products, vehicles, etc. which could have spread the disease agent during the relevant period preceding the notification \( (\text{High Risk Period}) \);
   e) obtain information on the likely spread of the disease in the surrounding environment, including the presence and distribution of disease vectors.
Aim of the epidemiological work

**Tracing backward**

- How, where, when did the pathogen has been introduced into the holding
- Reconstruct the spread of the disease within the holding
- Estimate the HRP

**Tracing forward**

- Where did the pathogen escaped,
- Identifying of contacts…

*(not scope of this ppt.)*

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How did the pathogen entered the holding?

*A hypothesis-based practical guide for „tracing backward”*
Two-step approach

I. Anamnesis

Subjective (30 – 50%)

Quality of questioning

II. Relevant epidemiological knowledge

Patchy, incomplete (50 – 80%)

Epi-facts (epi-filter)

ANSWER
Combination of two incomplete parts

The sudoku principle

Starting point

Anamnesis

Correction

Epi-facts
Tap/check premises

Solution
There is a chance bad Info
I. Anamnesis

Subjective (30 – 50%)

Quality of questioning

II. Relevant epidemiological knowledge

Patchy, incomplete (50 – 80%)

Epi-facts

1) Tenacity
2) Routes of infection
3) Susceptibility
4) Contagiousity
5) Excretion,
6) Immunity (individual/heard)
7) Clinical course (individual/heard)
8) Case fatality, mortality, morbidity
9) Latency, persistence, carriers
10) Diagnostic information

11) …..
Epidemiological farm investigations

A) Postulate different hypothesis
B) Address each hypothesis separately
C) Exclude hypothesis one by one

Hypothesis for:

- **Way of entrance**: How (by which ways) did the pathogen entered the holding
  - **Biosecurity check**
- **HRP**: When did the pathogen entered the holding (date of entrance)

**Likely origin - way of entrance**

- H1: Trade of pigs
- H2: Contact with wild boar environment
- H3: Swill, contaminated food
- H4: Others (people, vehicles, instruments…)
- H5: Vectors (ticks, insects, ???)
- H6 …

**HRP Date of entrance**

- H1: <50: 1w
- H2: <150: 2-3w
- H3: >150: >4w
- H4 …

**Biosecurity check**

- Hardware
  - Buildings
  - Filters
  - Fences
  - …
- Software
  - Management
  - Awareness
  - …

**Toolbox**

- Map of farm (village)
- Laboratory results
- Timeline of clinical events (Vet activities)
- Mortality/morbidity data
- Record of movements (animal, persons, vehicles, equipment…)
- Etc…

**Likely escape (secondary infections)**
High Risk Period (HRP)

Farm mortality/morbidity threshold

Low contagiousity => low (initial) mortality
ASF remains undetected in large pig farms (below the normal mortality threshold)

HRP -> farm size
- *back yard*: rather short
- *large farm*: rather long

Magic of 150

Sociologists have found out that the magical upper limit of natural organizational ability of humans is at maximum 150 people.

*It is difficult* to oversee and control more than 150 individuals. *For “units” larger than 150 you need a good functioning operational system…*

*In analogy, farms with over 150 animals are more difficult to be controlled… a good functioning farm management is needed.*
Farm mortality 3%/week

A: 50 pigs
(M: <2)

B: 150 pigs
(M: <3)

C: 1000 pigs
(M: <30)

HRP => size of epidemiological unit

Hypothesis approach: HRP

<table>
<thead>
<tr>
<th>Farm size</th>
<th>HRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small/back yard (&lt;50)</td>
<td>1 week</td>
</tr>
<tr>
<td>Medium/small commercial (&lt;150)</td>
<td>2-3 weeks</td>
</tr>
<tr>
<td>Large /industrial (&gt;150)</td>
<td>&gt; 4 weeks</td>
</tr>
</tbody>
</table>
Lab results can be used for indicating the duration of infection

<table>
<thead>
<tr>
<th>PCR</th>
<th>Ab-Test</th>
<th>duration of infection (estimates)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pos</td>
<td>neg</td>
<td>&lt;12d (or the animal died/sampled before 12d)</td>
</tr>
<tr>
<td>pos</td>
<td>pos</td>
<td>&gt;12d (or the animal died/sampled after 12d)</td>
</tr>
<tr>
<td>neg</td>
<td>pos</td>
<td>&gt;24d (or the animals was sampled after 24d)</td>
</tr>
</tbody>
</table>

Likely origin - way of entrance

H1: Trade of pigs
H2: Contact with “wild boar”
H3: Swill, contaminated food
H4: others (vehicles, instruments…)
H5 vectors
H6 …

Biosecurity check

- Hardware
- Buildings
- Filters
- Fences
- Software
- Management
- Awareness

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Biosecurity check</th>
<th>Findings</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hardware</td>
<td>Software</td>
<td></td>
</tr>
<tr>
<td><strong>Wild boar</strong></td>
<td>Building</td>
<td>Personnel</td>
<td>No contacts with wild boar</td>
</tr>
<tr>
<td></td>
<td>Fence</td>
<td>Human activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gates</td>
<td>Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sanitary filters</td>
<td>Work flow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disinfectants etc</td>
<td>etc</td>
<td></td>
</tr>
<tr>
<td><strong>Contaminated food</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trade</strong></td>
<td></td>
<td>Swill feeding</td>
<td>+++</td>
</tr>
<tr>
<td><strong>Fomites</strong></td>
<td></td>
<td>No trade</td>
<td>excluded</td>
</tr>
<tr>
<td><strong>Vectors (ticks)</strong></td>
<td></td>
<td>No sanitary filters</td>
<td>++</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No vectors</td>
<td>excluded</td>
</tr>
</tbody>
</table>
No signs

Few signs

Clear signs

Entrance for humans

Loading ramp for pigs
Loading ramp for pigs

Entrance for humans