Control and eradication of endemic infectious diseases in cattle

CPH Cattle seminar
14th November 2016

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Content

• Background – History
• Objectives
• Key elements to address in a successful control and eradication program
• The example of BVDV (MAP, S. Dublin)
Disease eradication in Denmark

**Estimated eradicated/Last seen:**

- Rinderpest: 1792
- Contag. pl.pn.: 1886
- Swine fever: 1933
- Trichinella: 1930
- Brucella abortus: 1979/1959
- Foot and mouth disease: 1983
- Bovine leucosis: 1991
- Aujeszky’s disease: 1991
- Bovine tuberculosis: 1959/1994
- IBR: 1992/2005
- Bluetongue: 2011
- BSE: 2011
- BVD: 2015

**Under eradication/control:**

- Paratuberculosis
- Salmonella Dublin

- Mycoplasma bovis?
Current status

- **BVDV**: officially eradicated from Denmark in 2006, few new cases since then, picked up by surveillance programme

- **Salmonella Dublin** eradication programme aims to stop transmission and reduce herd level prevalence to close to 0%. So far reduced from 26% in 2003 to 8% in 2016

- **Paratuberculosis**: Majority of farms infected. Voluntary control programme currently including 30% of all dairy cows. Within-herd prevalence reduced from 10% in 2006 to 3% in 2016, and fewer clinical cases of paratuberculosis occur
Disease eradication in Denmark

Objectives:
Use all the past experiences to:
- Outline the needed elements of a control and eradication programme
- Compile the elements for deciding to initiate a programme
Book about:
Systematic disease control of BVDV, *Salmonella* Dublin and paratuberculosis - experiences from Denmark
Definitions

**Disease control**
The purposeful reduction of specific disease prevalence to relatively low level of occurrence - transmission occurs frequently enough to prevent its permanent disappearance

‘Reduction to acceptable level’

**Disease eradication**
The purposeful reduction of specific disease prevalence to the point of continued absence of transmission within a specified area
A generic approach to effective control and eradication of endemic diseases

1. Motivation – socioeconomic aspects
2. Biosecurity: Which actions can mitigate transmission of the infection
3. Establishment of purpose specific and systematic test-strategies
4. Use of pilot studies
5. Resources for the administration and organisation of the programme
6. Decision on initiation of a systematic control and eradication programme
7. Communication between stakeholders
8. Follow-up investigations and adjustments of the control/eradication programme

Why?
What?
How?
Does it work?
Who?
When to start?
Acceptance?
Continuous evaluation
The required knowledge is obtained over many years

BVDV research history
Clinics

Pathology

Aetiology

Development of diagnostic techniques

Pathogenesis

Transmission of infection

Herd level diagnosis

Systematic large scale epidemiological studies

Financial losses

Pilot project

Control and eradication programme

Legislation

Re-introduction assessments

1946

2006
Motivation – socioeconomic aspects
Cattle disease had shock course

Family loses 200,000 DKK due to attack from virus diarrhoea

The family is in a shock condition......

During 5 months they have lost 5 cows due to BVD and 21 unborn calves due to abortion 5-6 months in gestation....

The losses are estimated to be around 200,000 including 100,000 DKK due to loss in milk production.....

Purchased heifers were carriers with BVDV......

The buyers of animals to the farm should obtain guarantee that the purchased animals are not carriers of the virus.

... The milk yield has dropped approximately 20 %. ....
Economic losses

- PI-animals
- Reduced repro-eff.
- Milk losses
- Disease
- Mortality
National level: 10-40 mill US$ per mill calvings
Major incentives for starting control program
Biosecurity

Uptake, pathogenesis, excretion, environmental survival, reservoirs, transmission routes
Susceptibility / vaccination
Host – agent - environment

Infection mechanisms, pathogenecity, virulence, host-adaptation, resistance patterns, agent genetics ……

Production system, climate, feeding, management procedures, hygiene, reservoirs ……

Age, breed, species, sex, size, conformation, immunity, resilience, genetics ……

Makes comparison of diseases difficult

Borrowed from Liza and to be continued by Liza
Summary - Infection with BVDV

- Cow Virus (NCP)
  - Acute Infection
  - Antibodies
  - Immune for Life
- Calf
  - Pregnancy
  - Tolerance
  - Abortion
  - Cong. Def.
  - Growth Ret.
  - Persistently Infected
  - Growth Ret.
  - Unthrifty
  - Increased Morbidity
- Mucosal Disease
- CP Virus

Dias 19
Sources of infection

- PI animals
  - Acutely infected animals
  - Small ruminants
  - Pigs
  - Wildlife

Methods of transmission

- Direct contact
  - Semen
  - Embryo transfer
  - Needles, nose tongs, rectal gloves
  - Live or contaminated vaccines
  - Blood feeding flies
  - Air

The full list of transmission routes may look similar between infections - But the ‘weights’ on the different elements vary substantially
Routes of transmission – S. Dublin (Liza R. Nielsen)

We only need a few grams of contaminated faeces from another calf or cow to become infected with *Salmonella* Dublin!

Salmonella

- Aerosols
- People
- Calf housing
- Group mates
- Calving pen
- Carriers
- Housing environment
Systematic test-strategies
The common language of tests

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<thead>
<tr>
<th>Purpose</th>
<th>Target conditions</th>
<th>Case definition</th>
<th>Test result</th>
<th>Action</th>
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<td>Reduce transmission</td>
<td>Infectious animals</td>
<td>Excreting agent</td>
<td>Culture positive</td>
<td>Isolate animal</td>
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<td>Monitor infection</td>
<td>Infected animals</td>
<td>Detectable antibodies</td>
<td>AB Elisa positive</td>
<td>Follow up tests if positive</td>
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<td>Improve welfare</td>
<td>Diseased animals</td>
<td>Diarrhoea and antibodies</td>
<td>Diarrhoea and ELISA positive</td>
<td>Cull</td>
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- Culture positive
- Isolate animal
- Follow up tests if positive
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The common language of tests
Target condition: infectious animals

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<td>Continuous AB positive</td>
<td>Test positive &gt;1 by ELISA</td>
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<td>Test positive *1 by ELISA</td>
<td>Yellow</td>
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<td>AB negative</td>
<td>Test negative &gt;1 by ELISA</td>
<td>Green</td>
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<tr>
<td>BVDV</td>
<td>Continuous virus positive</td>
<td>Virus pos twice – 3 weeks apart</td>
<td>Red</td>
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<td>Virus neg</td>
<td>Virus neg once</td>
<td>Green</td>
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</table>

*1 by ELISA
Separate calving pen
No colostrum
No Action
No Action
Purposes at herd level

A. **Classification** of herd infection status
   (herds with no or limited information of prior infection)

B. **Follow up** in suspected positive herds

C. **Monitoring** shortly after clearance of infected herds
   for PI animals

D. **Monitoring** herds that have been documented to be free.
Classification of herd infection status
Herd without PI animals

Case definition: Presence of PI animals
Test result: Bulk milk – if positive followed by spot test among young stock
Stepwise testing.....

**Dairy herd**
- Testing bulk tank milk for antibodies
- Testing of young stock or young cows
  - For antibodies
    - Spot samples

**Beef herd**
- Testing of young stock or young cows
  - For antibodies
    - Spot samples

*If repeatedly negative herd classified free and monitored*

*Testing bulk tank milk for antibodies*
- High level AB
- Negative
- Virus clearance
- **Positive**
  - **Extended investigations**
  - **Ongoing infection confirmed**

...keeps testing costs low

*See Søren S. Nielsen PTB*

*From Moennig, Houe and Lindberg, 2005*
# Disease characteristics of relevance for control

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<td>Animal welfare</td>
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<td>Farming profitability</td>
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<td><strong>Biosecurity</strong></td>
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<td>Infection likely via live animals</td>
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<td>Spread via environment</td>
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<td><strong>Test performance</strong></td>
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<td>Test performance of individual animals’ infection status</td>
<td>XXX</td>
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<tr>
<td>Accurate herd level diagnosis</td>
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Pilot study – Does it work?
ERADICATION OF BVDV INFECTION IN AN ISLAND AREA (DENMARK, 1992)

• All animals >3 months tested
• 36 dairy herds: 9 herds with PI animals
• 75 beef herds: 3 herds with PI animals
• PI animals removed Infection prophylaxis

• First year follow up
  • PI animals: only animals <3 months or fetuses at first test

• Three years follow up
  • PI animals: few herds that had purchased animals without testing
Resources needed

✓ Administrative unit(s)
✓ Logistics and flow of data
  ✓ Sampling from animals
  ✓ Laboratory facilities
✓ Data ownership and handling
✓ Knowledge dissemination / education
✓ Legislation
✓ Financing

Farmers
Veterinary practitioners
Agricultural sectors
Government
Decision on eradication - or not?

Time to combine all the information on motivation, biosecurity, test-strategies, pilot project and resources

Strengths and weaknesses
Decision on eradication

✓ WHY is it important/relevant?
✓ WHAT should be done?
✓ WHICH knowledge gaps?
✓ WHO should be involved?
✓ HOW to organise the programme?
✓ WHERE to implement the programme?
✓ WHICH measures to monitor progress?
✓ WHEN has the goal been reached?
November 16, 1990

**Virus diarrhoea must be eradicated**

*Annual losses of 20-30,000 DKK*

......We should in Denmark take the only reasonable decision to eradicate BVD......
....all animals must be tested and PI animals slaughtered....
Hereafter it must be anticipated that the disease dies out...

......It is important that costs for laboratory tests are reduced and that herds are certified and animals being tested before trade


November 30, 1990

**BVD can not yet Be eradicated**

*Irresponsible with a control program for BVD*

......Before the eradication of Aujeszky’s disease and IBR experiences with limited control programmes were obtained. For BVD we do not have such experiences......
......In general, BVD is spread from herd to herd by infected animals

......It is important that costs for laboratory tests are reduced and that herds are certified and animals being tested before trade

But it can also be introduced by semen......It is not known if it is only the persistently infected animals that are responsible for continued transmission of infection

A vet. practitioner pushes the decision
Communication

All stakeholders need to be identified and addressed
Communication

• Purpose, strategy and plan for communication
• Identification of stakeholders
• Who communicates what
• Information to be communicated
• Educational efforts
• Long term communication – keeping the stakeholders motivated
• Communication forms
Follow-up and adjustments

Keeping an eye on unexpected events
# BVD-legislation in Denmark

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BVDV eradication programme - Denmark

The ‘tail’ is often long
For more information..
Thank you for listening 😊