Can BVD (and bovine neosporosis) be controlled in Peru

-results from studies in Arequipa

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Outline

General background of BVD

Strategies for control

The Scandinavian model

Results from studies in Peru

Conclusions
Pestivirus

Flaviviridae

- Classical swine fever virus
- Bovine Viral Diarrhoea Virus BVDV-1
- Bovine Viral Diarrhoea Virus BVDV-2
- Border Disease Virus
Background

Worldwide distribution, seroprevalence 50-90%, 1-2% persistently infected (PI)
Considered as one of the most important virus infections in bovines
Causes reproductive problems and impaired health in infected herds
Control based on vaccination and/or herd biosecurity schemes
Experiences from the nordic countries shows that it can be controlled without the use of vaccination
BVDV can be cleared from a herd without intervention- self clearance
Background

BVDV infection

Subclinical/mild disease
Immunosuppression-
secondary infections in calves
Lifelong immunity

Embryonic/foetal death
Abortion, malformation
Weak born calves
Birth of PI calves
BVDV

No antibodies to BVDV

Not pregnant

Pregnant < 120 days

Pregnant > 120 days

Mother: AB VI

Foetus: AB VI

Antibodies to BVDV

Pregnant

Not pregnant

Mother: AB VI

Foetus: AB VI

Note: The image contains a diagram illustrating the presence or absence of antibodies to BVDV in cows based on their pregnancy status. The diagram shows different scenarios with antibody titers represented by 'AB' (Antibody) and 'VI' (Virus).
Background

BVDV transmission

Livestock trade
PI animals
Animals carrying PI foetuses
(Transiently infected animals)

Contact with cattle from other farms
(pasture)

Indirect transmission
Equipment, personnel etc.
Strategies for BVD control

Immunisation

Biosafety
Systematic control

Goal-oriented, systematic reduction in the incidence and prevalence of BVDV infection

Implies that progress is being monitored

Scale – sectoral/regional/national

Typically based on the "avoiding exposure" approach
Non-systematic control

Measures implemented on a herd-to-herd decision basis
Typically immunisation strategies using live or killed vaccines
The role of vaccination

Vaccination strategies have been used for > 40 years without reducing the BVD prevalence.

Vaccines (live and inactivated) will reduce clinical signs.

Vaccines will offer protection to the foetus and prevent the birth of PI s, this protection however is <100% (for inactivated vaccines significantly lower and of short duration).

The use of vaccines has been responsible for transmission of BVD.

The use of vaccines interferes with herd level monitoring.

The use of vaccines may give a false sense of security and it might be hard to motivate farmers to continue with necessary biosecurity measures.
General outline of the Scandinavian schemes

Use herd level tests (test strategies) for screening of herds with unknown status and for monitoring of free herds

General strategy

Establish probable herd status
Monitor and protect non-infected herds
Biosecurity framework controlling contacts / movements of animals between herds
Clear infected herds from the infection
BVDV Incidence
Effects of BVDV control

Immediate effect on calf health/mortality
Improvement in animal health
Increased milk production
Reduced replacement rate
Improved fertility
Programme cost efficient after 2 years (H. Houe, Biologicals 31 (2003))
Herd level tests
Separation between non-infected and infected herds using herd level diagnostics
Muestreo

Obtener la primera información en una sola muestra
En hatos donde hay animales PI, la mayoría de las vacas son seropositivas
Simple y económica
Antibody reaction in bulk milk compared to occurrence of PI animals

Number of animals

Abortions

First PI

Bulk milk reaction

Date

Swedish University of Agricultural Sciences
www.slu.se
<table>
<thead>
<tr>
<th>Clases de DVB</th>
<th>Densidad Optica</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clase 0</td>
<td>0-0,049</td>
</tr>
<tr>
<td>Clase 1</td>
<td>0,05-0,249</td>
</tr>
<tr>
<td>Clase 2</td>
<td>0,25-0,549</td>
</tr>
<tr>
<td>Clase 3</td>
<td>≥0,55</td>
</tr>
</tbody>
</table>
Decline of bulk milk antibody after virus elimination in 1805 Swedish dairy herds based on results from annual bulk milk screenings 1993 - 2004

# of years after last PI was identified
Prueba "spot"

Animales de determinada edad

Refleja la situación en el hato durante la vida de los animales seleccionados
Bovine Viral Diarrhoea Virus & Other Reproductive Pathogens

Epidemiological Studies in Peruvian Cattle


Swedish University of Agricultural Sciences
www.slu.se
Background

Dairy production in Peru

296 000 producers
635 000 cows in production
1.2 million tons milk/year
Background

Dairy production in Peru

“A major obstacle for these farmers, and for the national dairy production in general, consists of reproductive failures.

BVDV is considered one of the major causative agents for these failures”
Aims
to address questions regarding the epidemiology of BVDV of relevance to control, with particular focus on the situation in Peruvian dairy farms.

in addition, to address the importance of *Neospora caninum*, as a likely differential diagnosis to BVDV in herds with reproductive disorders.
Aims

To introduce methods for herd-level testing, and to use them to estimate the current status of BVDV and *Neospora caninum* in dairy herds (I-II).

To estimate the probability of self-clearance of BVDV infections, and to investigate possible herd and management factors associated with it (II).

To investigate the association between BVDV and *Neospora caninum*, and endemic abortions in a dairy herd with reproductive disorders (III).
Study populations

The Mantaro Valley (I)

Arequipa (II-III)
BVDV in dairy herds (I & II)
BVDV in smallholder dairy herds (I & II)

Material & methods

The Mantaro Valley (1998)
- Selection of 60 herds for Bulk Tank Milk (BTM) testing

Arequipa (2003-04)
- Selection of 221 herds for BTM testing and a subset of 55 herds for individual sampling (spot tests) and data collection. Prevalence of herds with strongly positive BTM but negative spot test was used as estimate of probability of self-clearance.

Logistic regression- was used to investigate possible associations between herd and management factors, and the probability of self-clearance.
BVDV in smallholder dairy herds (I & II)

BTM

<table>
<thead>
<tr>
<th>BVD-classes</th>
<th>COD</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 0</td>
<td>0-0,04</td>
<td>negative</td>
</tr>
<tr>
<td>Class 1</td>
<td>0,05-0,24</td>
<td>low-pos.</td>
</tr>
<tr>
<td>Class 2</td>
<td>0,25-0,54</td>
<td>mid-pos.</td>
</tr>
<tr>
<td>Class 3</td>
<td>≥0,55</td>
<td>strongly pos.</td>
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### BVDV in smallholder dairy herds (I & II)

**BTM**

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</tbody>
</table>

*Diagram: Proportion of herds (%)*

- **Region**: Mantaro, Arequipa

*QuickTime och en Ingen-dekomprimerare krävs för att kunna se bilden.*

Milk collecting centre in the Mantaro Valley.

Gloria S.A. milk collecting plant in Arequipa

Swedish University of Agricultural Sciences

[www.slu.se](http://www.slu.se)
BVDV in smallholder dairy herds (I & II)

spot tests

Regardless of herd size & vaccination practices

Ståhl K. et al, Bulk milk testing for antibody seroprevalences to BVDV and BHV-1 in a rural region of Peru. Prev Vet Med 2002
N. caninum and BVDV associated abortions (III)
Material & methods

Assessment of individual serological status to BVDV and *N. caninum* of all animals > 6 months

Calvings and abortions recorded

Assessment of herd level BVDV infection status through testing of young stock. PI animals eliminated

Survival analysis
**N. caninum** and BVDV associated abortions (III)

*results & discussion*

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Prevalence</th>
<th>Abortions</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N. caninum</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heifers</td>
<td>213</td>
<td>45</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; parity cows</td>
<td>158</td>
<td>56</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Older cows</td>
<td>167</td>
<td>44</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>538</td>
<td>48</td>
<td>137</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>BVDV</th>
<th>n</th>
<th>Prevalence</th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals &gt; 6 mo</td>
<td>538</td>
<td>97</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Calves 6-9 mo</td>
<td>22-73</td>
<td>-</td>
<td>81</td>
<td>56</td>
<td>50</td>
<td>23</td>
<td>0</td>
<td></td>
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</tbody>
</table>
### N. caninum and BVDV associated abortions (III)

Survival analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>level</th>
<th>( \beta )</th>
<th>S.E.</th>
<th>P</th>
<th>HR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abortion after day 100 in gestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( N. ) caninum(^a)</td>
<td>negative</td>
<td>0.00</td>
<td>-</td>
<td>-</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>positive</td>
<td>1.86</td>
<td>0.54</td>
<td>0.00</td>
<td>6.40</td>
<td>2.20, 18.57</td>
</tr>
<tr>
<td>BVDV(^b)</td>
<td>negative</td>
<td>0.00</td>
<td>-</td>
<td>-</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>positive</td>
<td>-0.33</td>
<td>0.21</td>
<td>0.11</td>
<td>0.72</td>
<td>0.47, 1.08</td>
</tr>
<tr>
<td>Heifer</td>
<td></td>
<td>0.00</td>
<td>-</td>
<td>-</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>1(^{st}) parity cow</td>
<td></td>
<td>0.21</td>
<td>0.65</td>
<td>0.74</td>
<td>1.24</td>
<td>0.35, 4.38</td>
</tr>
<tr>
<td>Older cows</td>
<td></td>
<td>0.59</td>
<td>0.56</td>
<td>0.30</td>
<td>1.80</td>
<td>0.60, 5.44</td>
</tr>
<tr>
<td>( N. ) caninum ( \times ) heifer</td>
<td></td>
<td>0.00</td>
<td>-</td>
<td>-</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>( N. ) caninum ( \times ) 1(^{st}) parity cow</td>
<td></td>
<td>-0.54</td>
<td>0.71</td>
<td>0.45</td>
<td>0.59</td>
<td>0.14, 2.37</td>
</tr>
<tr>
<td>( N. ) caninum ( \times ) older cow</td>
<td></td>
<td>-1.23</td>
<td>0.63</td>
<td>0.05</td>
<td>0.29</td>
<td>0.08, 1.01</td>
</tr>
</tbody>
</table>
### Survival analysis

<table>
<thead>
<tr>
<th>N. caninum by parity</th>
<th>HR</th>
<th>P</th>
<th>95% CI, HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. caninum positive heifer</td>
<td>6.40</td>
<td>0.00</td>
<td>2.20, 18.57</td>
</tr>
<tr>
<td>N. caninum positive 1st parity cow</td>
<td>3.74</td>
<td>0.00</td>
<td>1.51, 9.30</td>
</tr>
<tr>
<td>N. caninum positive older cow</td>
<td>1.87</td>
<td>0.05</td>
<td>0.99, 3.53</td>
</tr>
</tbody>
</table>

Concluding remarks

The level of BVDV exposure in the studied population is very high, partly explained by high cattle density and livestock trade.

The probability of self-clearance is high, regardless of vaccination practices and herd size. Consequently, self-clearance is a process that should be taken into account when a control programme is under consideration.

The level of exposure to *Neospora caninum* is high, and infection with the parasite is associated with late abortions. The magnitude of the effect of infection is most prominent in heifers and decreases with parity, suggesting that maternal immunity to the parasite may increase with age.
Can BVD be controlled in Peru?

At a National/Regional/Local level

I would say YES, at a regional or local level!
But there need to be....

Motivation among producers, farmer organisations and industry
  - Awareness of the problem
  - Willingness to be involved
  - Someone must take the lead

Good laboratory infrastructure

Financial solution

Good understanding of epidemiology
Predictors for progress

Ability to...

- prevent new infections
- rapidly detect new cases of infection
- intervene in infected herds
- get acceptance of / compliance with the scheme
acknowledgements

Dr Hermelinda Rivera, friends & colleagues at UNMSM
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Daniel Lozada & the people at the farm Santa Gabriela
Farmers & cattle in Peru
Prof. Stefan Alenius, Ann Lindberg & other co-authors
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