RISK MANAGEMENT OF BVD AND IBR

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What Is Risk?

The two components that contribute to risk analysis are likelihood and hazard. In the context of infectious diseases likelihood may be thought of as the probability of infection being present in a herd and hazard as the resulting consequences. Where both of these factors are low, the risk is also low and herd owners can logically decide that no further action is necessary. Otherwise, increasing levels of risk indicate the need for appropriate management interventions to reduce the overall risk by implementing measures to reduce the likelihood of infection being introduced and/or the severity of the disease should introduction occur.

In the case of bovine viral diarrhoea virus (BVDV) and infectious bovine rhinotracheitis virus (IBRV), data from several sources indicate a high likelihood of infection at the herd level. A Northern Ireland survey of bulk tank milk samples in 1999 found only 1% with no evidence of BVDV infection, and around 90% of herds had evidence of either current or recent infection. The same study also found 68% of dairy herds to have serological evidence of IBRV infection. In 2003 and 2004, over 170 isolates of BVDV were made (Figure 1) from diagnostic samples submitted to VSD, with a similar total forecast for 2005. Figures for samples submitted to the Veterinary Research Laboratory in Abbotstown show that BVDV was found in 450 sera tested in 2004, reflecting the larger cattle population in the Republic of Ireland.

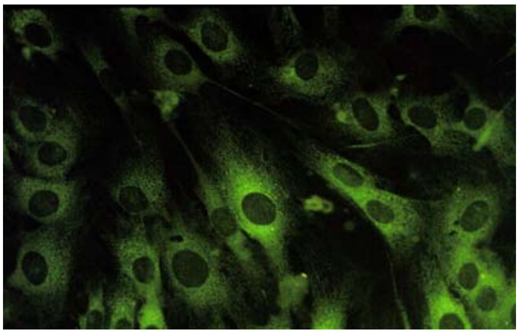


Figure 1. Immunolabelling of BVDV isolated from a serum sample by cell culture

The hazards associated with these infections are also well recognised. Acute infection of naïve immunocompetent cattle with BVDV can have a variety of negative outcomes. In calves in particular it can induce a pronounced immunosuppression, which is known to potentiate the effects of concurrent infection with a wide range of bacterial and viral pathogens, including those that cause respiratory and enteric disease. In older animals associations have also been shown with reduced milk yield, increased risk of clinical mastitis and retained foetal membranes and increased somatic cell counts. However the most significant impact of BVDV infection on a susceptible population is considered to be associated with reproductive losses. Depending on the stage of gestation, these can include failure to conceive, early embryonic loss, abortion, mummified foetuses, congenital defects and the birth of persistently infected (PI) calves (Figure 2). In contrast to transiently infected cattle, these PI animals are recognised to be highly efficiently transmitters of infection and to be a key element in the control of BVDV. These PIs often go on to develop fatal cases of mucosal disease.

Figure 2. Two calves born on the same day. Calf on left is persistently infected with BVDV. (courtesy of Prof. S. Alenius)

The principle hazard associated with IBRV is severe and possibly fatal respiratory disease. In addition, infection in dairy herds is often accompanied by a marked reduction in milk yield. While some strains of IBRV can cause abortions, this is rarely diagnosed in Ireland. An additional hazard associated with these infections is their negative impact on trade. At the national level bulls may be excluded from AI stations as specified in EU Directive 2003/43/EC. There are already restrictions on the export of cattle to IBRV-free regions within the EU (2004/558/EC), with the possibility of future restrictions in relation to BVDV.

In summary, for both of these viruses the associated likelihood and hazard are high, supporting the need for active management of this risk. In practice, management measures must seek to reduce likelihood through biosecurity (also referred to as the zoo-sanitary approach) and to reduce the hazard through vaccination.

BVDV

Hazard Reduction

Vaccines offer a practical method to reduce the detrimental effects of BVDV in a herd and in particular to provide foetal protection such that the birth of PI calves is avoided. There are currently at least 3 vaccines licensed for this purpose in UK and Ireland (Table 1). In herds where a vaccination strategy is implemented this must be maintained year-on-year. When vaccination is stopped successive year classes will enter the herd without protection, creating a population that is increasingly susceptible to disease.

Table 1. Details of BVDV vaccines

Name	Virus	Primary	Booster
Novartis, Bovidec™	Inactivated ncp[1] type 1a	x2, 3w interval, 1w pre-gestation	x1, annual
Intervet, Bovilis BVD™	Inactivated cp[2] C86 type 1a	x2, 4w interval, 4w pre-gestation	x1 annually (6m for herd immunity)
Pfizer, Pregsure™	Inactivated cp 5960 type 1	x2, 3w interval, 2w pre-gestation	x1, annual

[1]Non-cytopathic biotype
[2]Cytopathic biotype

In addition, a realistic expectation of vaccine performance must be maintained. An efficacy of 100% is unrealistic, and VSD has detected two cases where PI calves were born to vaccinated dams in dairy herds that practiced routine annual vaccination. Thus while reliance on vaccine alone will reduce the impact of infection in an individual herd, under current conditions it is unlikely to have a significant impact on the overall national level of infection. This has been recognised recently in the United States, where despite 40 years of vaccination BVDV continues to be a major problem.

Likelihood Reduction

Based on work done elsewhere in Europe, the risk factors associated with introduction of BVDV are now well recognised. The most important of these factors is livestock trade with a number of possible scenarios leading to PI animals in the destination herd:

- Purchase of a PI animal
- Purchase of a seropositive healthy dam that is carrying a PI foetus
- Purchase of a seronegative, pregnant animal that becomes infected during trade.
- Purchase of a seronegative non-pregnant animal that has acquired a transient infection during trade and then transmits this to a newly pregnant susceptible animal in the destination herd.

The last two of these scenarios can also lead to introduction of infection as a result of contact at boundary fences, on common pasture or at livestock shows.

There have also been a number of incidents where live vaccines have become contaminated with BVDV. This typically arises as a result of the use of contaminated batches of foetal calf serum (FCS) during the manufacturing process. Contaminated FCS used during embryo transfer can also result in the introduction of infection into herds by this route.

Finally, visitors may inadvertently bring infection into a herd. These can include tanker drivers, hauliers, contractors, AI technicians, foot trimmers and of course veterinary surgeons, with close animal contact equating to greater risk.

Knowing these risk factors, appropriate likelihood reduction measures can be implemented at the herd level. Ideally, this will include: maintaining a closed herd; a purchase policy that excludes seropositive pregnant dams and quarantines and tests other cattle of unknown status; adequate fencing and a suitable visitor policy. Further details of biosecurity programmes can be found in the Veterinary Ireland Herd Health Planning book, or the DARD Biosecurity Code for Northern Ireland Farms launched in May 2004.

While these steps will greatly reduce the likelihood of infection being introduced, the significant disadvantage of this approach is that it creates naïve, susceptible herds that are liable to suffer significantly if infection enters a herd and (in the absence of monitoring) remains undetected for a sufficient period of time.

One of the outcomes of an EU-funded Thematic Network on BVDV Control (www.bvdv-control.org) has been the recognition that the key to successful risk management of BVDV is not found in the argument between preferences for vaccination or zoo-sanitary approaches, but rather in the implementation of systematic control employing one or both of these approaches. From this perspective, a non-systematic approach is one that operates at herd level only. As a consequence, there is no co-ordination of effort or benefit from simultaneous efforts in multiple herds. In contrast, systematic control operates at regional or national level and is based on the following core principles:

- Identification of herd status using serological screening
- Monitoring and protecting free herds
- Virus clearance in infected herds.

While vaccination can be a component of systematic control programs, on its own isolation is considered non-systematic. This has been recognised by the Vaccine Working Group of the Thematic Network, who state that, "vaccination alone is not suitable for the successful [systematic] control of BVD. Identification and elimination of PI animals must precede vaccination and all female animals in cleared herds must be protected by vaccination. An accompanying biosecurity programme and a high degree of compliance by all stake holders are additional factors for success." This has also recently recognised in the United States, where the Academy of Veterinary Consultants have issued guidelines for beef cattle veterinarians stating that, "Vaccination alone is not sufficient for a control program".

The European Situation

Several European countries have been successfully implementing systematic control of BVDV for a number of years. Sweden, Norway and Denmark (Figure 3) are moving toward the conclusion of successful national programs, with very small numbers of herds still to be certified free in each country. Austria and Switzerland also have successful regional programs, with a national program now beginning in Austria. Closer to home systematic control has eradicated BVDV from the Shetland Islands. Analysis of the Norwegian program has shown that it was cost beneficial. Key factors for the success of systematic control have been identified and include organised education on biosecurity, joint efforts of government, vets and farmers and legislative support for movement controls. Despite differences in herd sizes, cattle densities, management practices and industry structures all of these programs have succeeded using the zoo-sanitary approach alone, with the use of vaccine forbidden.

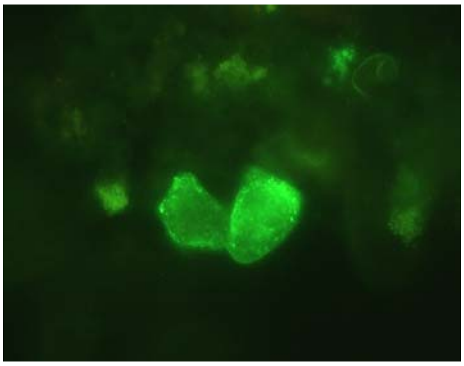


Figure 3. Immunolabelling of IBRV-infected epithelial cells in a nasal mucus sample

In contrast, a program running in Brittany, where the majority of French dairy production is based, includes vaccination. Likewise a systematic scheme just beginning in Germany incorporates vaccination in regions with a perceived high risk of re-infection.

IBRV

Likelihood Reduction

In common with BVDV, implementation of appropriate biosecurity measures can help prevent accidental introduction of IBRV into herds.

Hazard Reduction

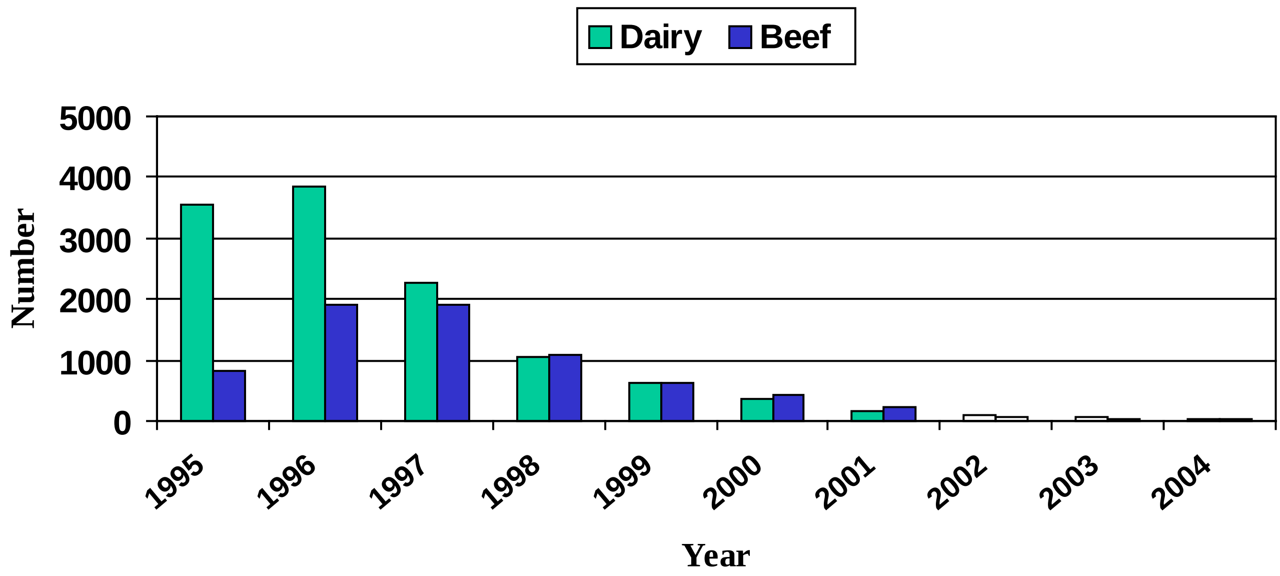
A number of live and inactivated vaccines against IBRV are available (Table 2) and can be used to minimize the severity of outbreaks. Due to their ability to induce interferon, vaccines containing live virus perform well even in the face of an outbreak. More recently, marker (gE deleted) vaccines have become available. In herds where these have been used, appropriate antibody tests can differentiate between antibody positive vaccinated and infected animals. These marker vaccines can be used as part of a strategy aimed at eradication of IBRV from herds.

Table 2. Details of IBRV vaccines (or IBRV components)*

Booster
12m
-
-
6m

[1]intra-nasal; [2]intra-muscular; [3]subcutaneous

Figure 4. Change in the number of BVDV-infected herds in Denmark (courtesy of Dr Ann Lindberg)



The European Perspective

While IBRV control in Northern Ireland has tended to be implemented non-systematically at the herd level, other European countries have applied systematic measures to eradicate infection. Denmark (Figure 4), Finland, Norway, Sweden, Austria, Switzerland and the Bolzano region of Italy are now free of infection and applying import controls. A number of other countries are either pursuing eradication, have banned the use of conventional vaccines or are running voluntary schemes.

Systematic Approach to IBRV

Key components of a systematic approach to eradication include screening, vaccination, monitoring and removal of naturally infected cattle, against a background of good biosecurity. The goal of vaccination in these programs is to eliminate spread of the virus within herds containing seropositive cattle latently infected with field virus. In time, the number of naturally infected cattle will decline to a point where they can be removed by culling, leaving the herd free of infection. Depending on the herd situation, vaccination may then continue using inactivated vaccine only, or stop completely.

Conclusions

BVDV and IBRV are significant viral conditions of cattle on both sides of the border in Ireland, with widespread distributions and the ability to cause significant economic losses. Risk management of these pathogens is required, but thus far has tended to be applied non-systematically, and in some cases non-continuously, at the individual herd level. This non-systematic approach, coupled with factors such as relatively high cattle density, high levels of cattle movements and inter-herd contacts and a lack of awareness of the potential for systematic control has resulted in little or no progress in controlling/eradicating these pathogens at regional or national level. It is evident from elsewhere in Europe that the systematic approach offers great potential for progress. However new thinking and co-operation between the veterinary profession, agri-food industry and government will be required to realise this progress. Accreditation schemes represent one practical method of doing this, offering certified free herds a trade advantage compared to infected herds. To this end, VSD is working towards introducing schemes to allow herds to achieve formal accreditation of freedom for not only BVDV and IBRV, but also for Johne's disease and leptospirosis. It is hoped that these will be available in 2006.