

# Perspective on Planned BVD Control Strategy

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## Abstract

Control of bovine viral diarrhoea virus (BVDV) requires design and implementation of integrated control plans in cattle operations. Individualized plans result from assessing herd risk and risk tolerance as well as related goals of cattle enterprises. BVD control plans utilizing surveillance, biosecurity, biocontainment, and vaccination strategies can be used to achieve herd goals. Using these approaches, veterinarians can design individualized BVD control plans that both benefit cattle production and are cost-effective.

## Résumé

La lutte contre la diarrhée virale des bovins (BVD) requiert la conception et la mise en oeuvre d'un plan de lutte intégrée dans les fermes bovines. Pour dresser un plan individualisé, il faut évaluer le risque auquel s'expose troupeau, la tolérance envers ce risque et les objectifs de la ferme en matière de gestion des maladies. Un plan de lutte au BVD qui comprend des stratégies de surveillance, de biosécurité, de bioconfinement et de vaccination peut servir à atteindre ses objectifs. En suivant cette approche, les vétérinaires peuvent élaborer des plans de lutte contre le BVD individualisés qui profitent à l'élevage des bovins et sont rentables pour la ferme.

## Introduction

Biosecurity and biocontainment strategies provide opportunities for veterinarians to implement increasingly effective animal health programs.<sup>5,28,32</sup> These enable use of population-based approaches for disease control and strongly address both pathogen exposure and host immunity. Development and implementation are largely dependent upon initiative by veterinary practitioners for adoption by livestock owners. Use of biosecurity and biocontainment strategies in production management settings provides framework for goal setting and decision making, leading to development of individualized herd health plans and strategies. Assessment of risk and tolerance of risk, whether done formally or otherwise, is part of this planning process.<sup>30</sup> Bovine viral diarrhoea (BVD) virus can be controlled using these strategies. Control plans for BVD can also potentially be used as models for control or reduction of other pathogens.

Biosecurity may be defined as the sum of all interventions designed to prevent entry of a disease

agent or agents into a unit of interest. This includes individual operations as well as larger geographical areas, including states and countries. Biocontainment may be defined as the sum of interventions designed to control a disease agent or agents already present in a unit of interest.<sup>5,28</sup>

## Disease Overview

Bovine viral diarrhoea virus (BVDV) was first reported over 60 years ago, but its effects continue to result in production and economic losses to the cattle industry in North America.<sup>17,28</sup> BVD is reported to be the most economically important disease of beef cattle.<sup>12</sup> A broad range of clinical and subclinical effects are directly and indirectly caused by BVDV in dairy and beef operations. These range from reproductive and respiratory losses to costs associated with immunosuppressive effects of the virus.<sup>10,17,25</sup> Birth of calves persistently infected (PI) with the virus is one particularly significant outcome. It is recognized that calves PI with BVDV are the primary source of virus in infected herds. These PI BVD animals are derived either from birth to females undergoing acute BVDV infection with gestational exposure and fetal infection occurring at about one and one-half to four months' gestation, or by exposure and infection from dams already PI themselves.<sup>10,17</sup> Beef herd data suggests over 90% of PI BVD calves are the result of acute gestational exposure.<sup>34</sup>

Control and eradication plans focus ultimately on prevention and elimination of PI BVD cattle. Elimination of PI BVD animals reduces risk for exposure and resulting clinical and subclinical losses in herd mates and other cattle contacts. Potential risk for exposure from other animal species, including deer, must be considered and addressed in biosecurity and biocontainment plans.<sup>6,24</sup> Exposure risks from other sources must also be considered, including acutely infected cattle, contaminated facilities, trailers and trucks, and others.<sup>21</sup>

Vaccination targeting prevention of birth of PI BVD calves has proven effective in substantially reducing incidence.<sup>8</sup> However, vaccines do not prevent birth of all PI BVD calves when exposure occurs. Vaccine-induced immunity reduces BVD disease risk in the event exposure occurs in comprehensive BVD control plans. Ability of immunity generated from field infections to protect against birth of PI BVD calves when exposure occurs has not been quantified at the level of detail addressed in vaccination challenge studies.

Reproductive effects in beef cow/calf operations have been quantified at a 5% increase in open cows when PI BVD calves were present.<sup>34</sup> Costs of PI BVD presence in beef cow/calf herds have been estimated to be \$14.85-\$24.84 per year, per cow exposed to a bull in a published 10-year farm profitability model.<sup>19</sup>

Effects of PI BVD animals in feedlot populations are somewhat mixed, according to research findings.<sup>2,13,20,22</sup> This suggests there may be risk factors associated with the extent of detrimental effects of PI BVD animals in populations. For example, animal source, level of commingling, and animal weight at entry have varied in published studies. Also, immunity to BVD virus at feedlot entry is known to reduce risk for subsequent bovine respiratory disease morbidity, and this factor was not measured in these published reports.<sup>4</sup> In these studies, extensive percentages of cattle in feedlot populations were exposed to BVDV from these PI animals either through same pen or adjacent pen exposure. Even though these animals are perceived to be relatively rare in most cattle populations, they shed large amounts of virus. They impose high biosecurity risks within the herd they are born into, as well as subsequent populations where they are either commingled or placed adjacent to other, presumably susceptible cattle. A recent feedlot study in high-risk cattle found fatality losses of \$5.26, performance losses of \$88.26, and costs of PI exposure in feedlot cattle ranging from \$41.84 to \$93.52 per animal.<sup>13</sup>

### Importance of BVD Control

BVDV causes significant production and economic losses in the cattle industry. Excellent diagnostic tests to detect PI BVD animals and improved vaccines that have targeted prevention of PI animals are tools available to greatly improve control of BVD.<sup>7,8,9,16,26</sup> Planned approaches using these tools for biocontrol of BVDV utilizes these resources optimally in cattle operations.<sup>15,29</sup> Implementation across the cattle industry can increase our ability to sustain cattle businesses and compete in domestic and foreign markets. Control of risk associated with production and economics is also of significant importance.

Loss of productivity from BVD, including economic costs, extends throughout all phases of production in cattle enterprises. Immunosuppressive effects of the virus affect animals acutely diseased with the virus. This potentiates losses from secondary infections, including bovine respiratory disease, especially in feedlots, increased risk for neonatal calf diarrhea, and other infectious diseases of cattle.<sup>17,25</sup> Control by individual operations at the reproductive level can positively impact all sectors of cattle production.

Cattle PI with BVDV are defective individuals who adversely affect other cattle. Control strategies,

especially preventive, reduce prevalence of PI animals in cattle populations, also decreasing their effects, costs, and risks to individual animal owners as well as the industry as a whole. It is possible that large numbers of the cattle population become exposed during their lifetime, even though PI animals are relatively rare.<sup>17</sup> In a recent feedlot study, a 0.4% prevalence rate of PI calves resulted in exposure to 62% of the animals in the feedlot population.<sup>13</sup> Some European countries are engaged in BVD eradication efforts so it is possible that international markets in the future may favor cattle from populations where BVD is eradicated.

### BVDV Control Plan Development

Higher levels of BVD control have been recognized and implemented in various forms by veterinarians, animal owners, and others in the dairy and beef industries. The Academy of Veterinary Consultants (AVC), American Association of Bovine Practitioners (AABP), the National Cattlemen's Beef Association (NCBA), the United States Animal Health Association (USAHA), and others have recognized the need for increased priority in controlling BVDV and have adopted statements endorsing control (Figure 1).<sup>1,3</sup> Additionally, even though prevention of PI BVD animals is ultimately targeted, increasing numbers of PI BVD animals are being identified. A statement focused on prudent, ethical disposition of PI BVD cattle has been adopted by organizations including AABP and AVC (Figure 2).<sup>1,3</sup>

Relatively new resources, including tests, improved vaccines, and better developed strategies for prevention are key for improved BVD control, and even eradica-

#### Position Statement on Bovine Viral Diarrhea Virus

The beef and dairy industries suffer enormous loss due to effects of bovine viral diarrhea virus (BVDV) infection. The highly mutable nature of BVDV and the emergence of highly virulent strains of BVDV contribute to limited success of present control programs. Also, persistently infected cattle are the primary source of infection and effective testing procedures are available to identify those infected carriers.

Therefore, it is the resolve of the Academy of Veterinary Consultants that the beef and dairy industries adopt measures to control and target eventual eradication of BVDV from North America.

Figure 1.<sup>1,3</sup>

### Statement on Disclosure of BVD PI Animals

The cattle industry has a moral, ethical and potentially legal obligation not to sell known diseased or damaged animals to other parties without full disclosure. Responsible disposition of animals persistently infected (PI) with BVDV is an important component of BVD control.

The dilemma of how to deal with known PI cattle becomes more critical as BVD testing becomes more widespread. Appropriate disposition of known PI cattle must take into account the adverse impact these cattle have on the health, welfare, and the economic return of other cattle and cattle operations they may expose to BVDV.

It is widely recognized that a PI animal is defective and once confirmed, the PI status should be thereafter disclosed – as exposure to these cattle has health ramifications for all cattle, especially those intended for reproductive purposes.

Marketing or movement of BVD PI animals in any manner that potentially exposes at-risk cattle is strongly opposed.

**Figure 2.**<sup>1,3</sup>

tion, if chosen. Excellent tests utilizing IHC, ELISA, and PCR technologies have become readily available to the industry.<sup>7,9,16,26</sup> Vaccine development has focused on prevention of birth of PI BVD calves and vaccines with data and labeling related to PI BVD prevention are available. Testing alone does not eliminate all risk for BVD virus infection, and vaccination alone does not prevent birth of all PI BVD calves in the event exposure occurs. Therefore, it is critical that control strategies utilize these resources in a planned, systematic manner to achieve production and health-related goals.

Goal setting is essential for development of a BVD control plan. Production and economic goals affect priority for health programs. Many factors influence these, including type of cattle enterprise, past BVD-related losses, risk for future BVD-related losses, risk tolerance, and others.<sup>30</sup> For example, for an infected herd, the goal might be elimination of BVDV from the herd and steps to reduce risk for reintroduction. In a likely uninfected herd, the goal might be to minimize introduction of BVDV into the herd. In other herds, minimizing BVD-related losses may be the primary goal. Seedstock operations may set goals to eliminate BVD from the herd, set high levels of biosecurity, and provide tested PI BVD-negative animals

for sale as a biosecurity service to customers. Appropriate levels of risk assessment as well as tolerance of risk are important components of goal setting consultations. It is possible to implement a BVD control plan that costs more than estimated costs of the disease, so appropriate decision making is very important.<sup>19,30,31</sup>

A cow-calf BVD risk assessment model is available through the software links section of the website [www.bvdinfo.org](http://www.bvdinfo.org).<sup>3</sup> The model addresses risks for introduction of BVD, results of testing options, biosecurity, and economics.<sup>30</sup> The website itself is an excellent resource for BVD information maintained by Dr. Brad White, Kansas State University, for the AVC ad hoc BVD Control Committee and the NCBA BVD Working Group.

Simple targeted BVD control, comprised of surveillance, biosecurity, biocontainment, and vaccination targeting PI BVD prevention as the components, can be an effective approach to designing BVD control plans for individual cattle operations.<sup>11</sup> Within each of these components, a number of options may be selected based on goals and risks of the operation. Surveillance is used initially to determine herd status, meaning presence or absence of BVD virus. It also is used subsequent to implementation of a BVD control plan to monitor herd BVD status and hence to provide direction for BVD control planning in future years. Various surveillance strategies may be implemented, depending especially on goals and needs of the operation.<sup>18</sup> These might include an approach using a whole-herd based testing protocol, testing of morbid animals and all mortalities, serologic approaches or other surveillance strategies, for example.<sup>18,33</sup> Recently, use of pre-colostral serum sampling has been proposed as a strategy to identify dairy herds infected with BVDV.<sup>27</sup>

Biosecurity, keeping BVD virus out, is an essential component whether or not herd BVD virus infection is present. It is believed transmission of the virus occurs most often through contact with a PI BVD animal. Herd introductions is an area requiring attention in most operations, including bulls, open and pregnant females, offspring of pregnant females, and other animals. Calves born to pregnant females represent the highest risk for PI BVD status and so testing of calves born to newly introduced pregnant females is an important biosecurity measure.<sup>15,18</sup> It is prudent to isolate these pregnant females until calving to prevent exposure in the event a PI BVD calf is born. Other effective contacts, including exposure across fence lines, risks associated with exhibited cattle, contaminated equipment, trailers and trucks, and others need to be addressed on an individual basis.<sup>21</sup> Biosecurity plans may be updated and improved as needed.

Biocontainment, controlling BVD virus if it is present, may require a BVD PI whole herd-based testing

protocol to eliminate PI BVD animals. For beef operations, this include, PI testing all nursing calves and all animals not nursing calves, including bulls, replacement heifers and females without nursing calves.<sup>15,18</sup> The use of biocontainment is required if surveillance indicates a herd is infected. In beef operations, data suggest that a minority of herds contain PI BVD animals at a point in time. Beef herd prevalence in the United States is likely less than 10%.<sup>34</sup>

Vaccination targeting prevention of birth of PI BVD calves reduces risk in the event exposure occurs.<sup>8</sup> It also reduces risk for clinical and subclinical disease when exposure occurs.<sup>14</sup> Design of vaccination protocols that achieve goals of operations, addressing risks innate to individual herds, are critical for successful BVD control. Vaccines with data documenting efficacy against birth of PI BVD calves should be incorporated into these protocols.

### Conclusions

Consultation with owners and managers of cattle operations to discuss goals, including discussion about risks associated with BVD, can lead to improved BVD control in cattle operations. Utilization of resources, including tests, vaccines, and control strategies and combination into comprehensive BVD control plans can reduce risk for losses as well as losses themselves. BVD control plans addressing surveillance, biosecurity, biocontainment, if needed, and vaccination can effectively reduce BVD risks and effects in the cattle industry.

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