BVDV

Bovine Viral Diarrhoea Virus

MANAGEMENT GUIDE

- Beef Edition -

Australian Cattle Veterinarians
a special interest group of the Australian Veterinary Association

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ABOUT THE BVD MANAGEMENT GUIDE

The BVDV management guide is a resource to provide Australian Cattle Veterinarians practical BVDV management strategies to help control and manage BVDV for their clients. The aim is to enable veterinarians to develop appropriate programs to define, manage and monitor BVDV on their clients' farms, accounting for Australia's varied farming practices.

The BVDV Special Interest group (BVDV SIG) has provided the technical and management content for this BVDV management guide based on the best international and local evidence and research available at the time and is intended to remain a living document, updated by the SIG as appropriate.

WHAT IS BOVINE DIARRHOEA VIRUS (BVDV)?

Bovine Viral Diarrhoea Virus (BVDV) is one of the most costly endemic diseases within Australia. Animals exposed to the virus suffer immune suppression and/or reproductive losses. Estimates have varied from $20 to $90 per breeder unit on beef and dairy properties harbouring the disease. 90% of Australian herds have animals with evidence of exposure to BVDV. It is reasonable to assume that well over half of Australian beef and dairy farms are harbouring a PI and are therefore actively infected with BVDV.

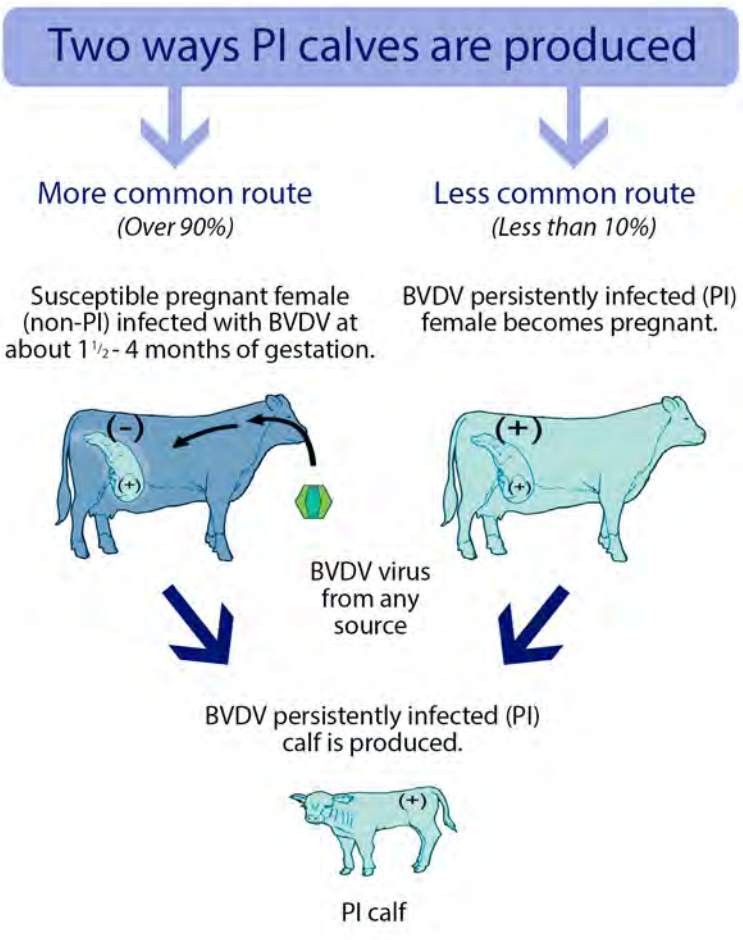
The variability in the cost of BVDV relates to timing. When previously unexposed or unvaccinated animals make close contact with a *Persistently Infected* animal (PI), they almost invariably contract BVDV, resulting in significant reproductive losses and/or immune suppression. Reproductive losses can occur at any stage of pregnancy, but are most significant during mating or early pregnancy. Immune suppression can be significant if the affected animals are under stress or other disease challenge such as during weaning or the early phases of lot feeding.

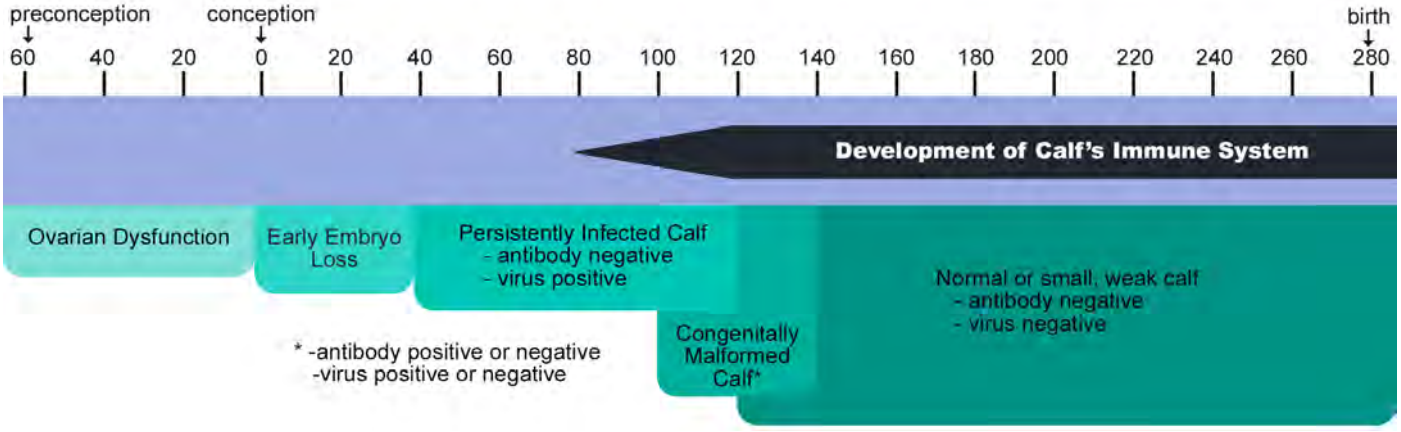
BVDV AND PI'S

BVDV is unique in that it is transmitted almost exclusively by PI animals. PI animals themselves were exposed to BVDV before they were born, whilst *in utero*. Either their dam was a PI herself, or, more commonly, she became infected with the virus whilst pregnant. When exposed between one and four months of gestation the calf's developing immune system mistakenly assumes that the virus is "normal". If the calf survives to birth, its immune system will continue to ignore the virus. They are born and remain *Persistently Infected* with BVDV for life.

From birth, PI calves continually excrete enormous amounts of virus. All animals they come in close contact with will be exposed to the virus, resulting in a high proportion becoming transiently infected with BVDV.

Transiently infected animals typically swiftly mount an immune response, neutralizing the virus. Some





transiently infected animals will show mild signs of illness. However, most exposed animals suffer transient immune dysfunction reducing their ability to fend off other infectious agents. Transiently infected animals usually don't spread the virus to other animals. Without the presence of Persistently Infected animals the virus simply ceases to propagate in most management situations.

Whilst only BVDV exposure between the 1st and 4th months of gestations results in the production of another PI, exposure to the virus at any stage of the reproductive cycle can have serious financial consequences. BVDV has been shown to significantly impair ovarian function, reducing conception rates directly. Animals exposed within the first 30 days of pregnancy usually suffer early embryonic death. Animals exposed from three and a half months to five months may be born with congenital defects, especially of the eyes and central nervous system. Finally, abortion or stillbirth is a risk at any stage of pregnancy.

$4,000 PI Bull diagnosed after sale day and after wasting away

Significant BVDV outbreaks are often associated with the introduction of new animals to existing management groups.

However, many endemically infected farms harboring PI's sporadically suffer significant and noticeable losses when groups of animals become exposed at critical times. Often producers are unaware that the virus is being maintained on their farm. Farms harboring PI animals are always at risk, and whilst the impact of the PI animals may not be consistently evident, maintaining the virus has been found to limit almost every aspect of production.

DIAGNOSING AND MANAGING BVDV INFECTION

There are 3 classes of tools available for managing BVDV.

ANTIGEN (VIRUS) TESTING

BVDV antigen testing is used to diagnose and identify PI animals, a direct indicator of PI presence. *PI animals are almost always BVDV antibody negative*. BVDV antigen testing is routinely conducted on ear notch samples, blood samples, hair samples, or milk samples.

ANTIBODY (IMMUNITY) TESTING

Antibodies to BVDV are produced as a result of an animal's immune system mounting a response from exposure to the virus. Antibodies protect the animal against future exposure, significantly reducing the risk of further infection to the virus. Positive BVDV antibody results indirectly indicate past or present PI presence, as most infections result from exposure to PI's. BVDV antibody testing is used to measure herd risk, identifying groups of animals without immunity or groups that may contain a PI. Antibody testing allows veterinarians to measure the status of individual management groups and to prescribe the most cost effective intervention. Antibody testing can be conducted on blood or milk samples.

VACCINATION

Currently, there is only one commercially available vaccine for BVDV in Australia, Pestigard. The vaccine requires 2 preliminary doses 1 to 6 months apart, followed by annual boosters. Whilst it is quite efficacious, up to 30% of vaccinated animals may still produce PI animals if exposed during pregnancy. Vaccination of a PI animal itself is ineffective, it does not change its status.

BEEF BVDV MANAGEMENT

Before implementing a control program for a given producer, each veterinarian may need to educate their client as to the epidemiology of BVDV, as well as the relative costs and benefits of embarking on a control program. Systematically managing BVDV is both cost effective and profitable for most beef producers. However, failure to maintain a control program can put producers in a vulnerable position, as a proportion of their accumulated production benefits could be lost.

Effective BVDV management centers around controlling PI animals. PI screening and vaccinating every animal from an entire production system, as well as any animal born or introduced into it, will effectively manage BVDV, however, blanket approaches to BVDV management can be unnecessarily expensive. Some producers and veterinarians may choose to manage BVDV by vaccination alone. Others may choose to manage BVDV by removing PI animals, screening all

replacements for reintroductions, and maintaining a reasonable biosecurity program. This guide incorporates both strategies, focusing on antibody testing to guide producers and their veterinarians towards the most cost effective option, optimizing both efficacy and cost. Regardless of the control method, it is critical that each new group of replacement heifers is screened **annually** for immunity to BVDV prior to being mated, both to invest wisely and to measure the success of a producer and their veterinarian's interventions.

The BVDV status of individual management groups within beef herds can vary significantly. By measuring the BVDV status of each individual management group within their individual client's herds, veterinarians can tailor each program to invest in BVDV control that is both cost effective and profitable for each of their clients. Assuming that each management group is relatively stable, assessing each management group's immune status is as simple as collecting blood samples from 5% or a minimum of 6 animals for analysis for antibodies to BVDV.

Stable management groups without evidence of sufficient naturally acquired immunity would be at risk of BVDV and would benefit from vaccination. Conversely, highly immune management groups would receive little benefit from vaccination, but may harbour a PI or PI's.

THE ROLE OF VACCINATION IN THE MANAGEMENT OF BVDV

Pestigard is currently Australia's only licensed BVDV vaccine, requiring two priming doses, administered from four weeks to six months apart followed by annual boosters. Whilst vaccination should reduce the cost of BVDV, vaccination doesn't prevent the production of all PI calves, doesn't change the status of PI animals already in the herd, and will provide limited protection to young calves due to maternal antibody interference. Animals immune to BVDV will receive limited additional benefit from vaccination. In most instances, the strategic use of the vaccine is more cost effective than blanket vaccination.

Providing immunity to animals without prior exposure to BVDV will improve each animal's individual risk as well as the overall biosecurity of an individual management group. Vaccinated animals are less likely to produce PI calves should they be inadvertently exposed to a PI or sufficient BVDV virus either from a transiently infected animal or contaminated equipment.

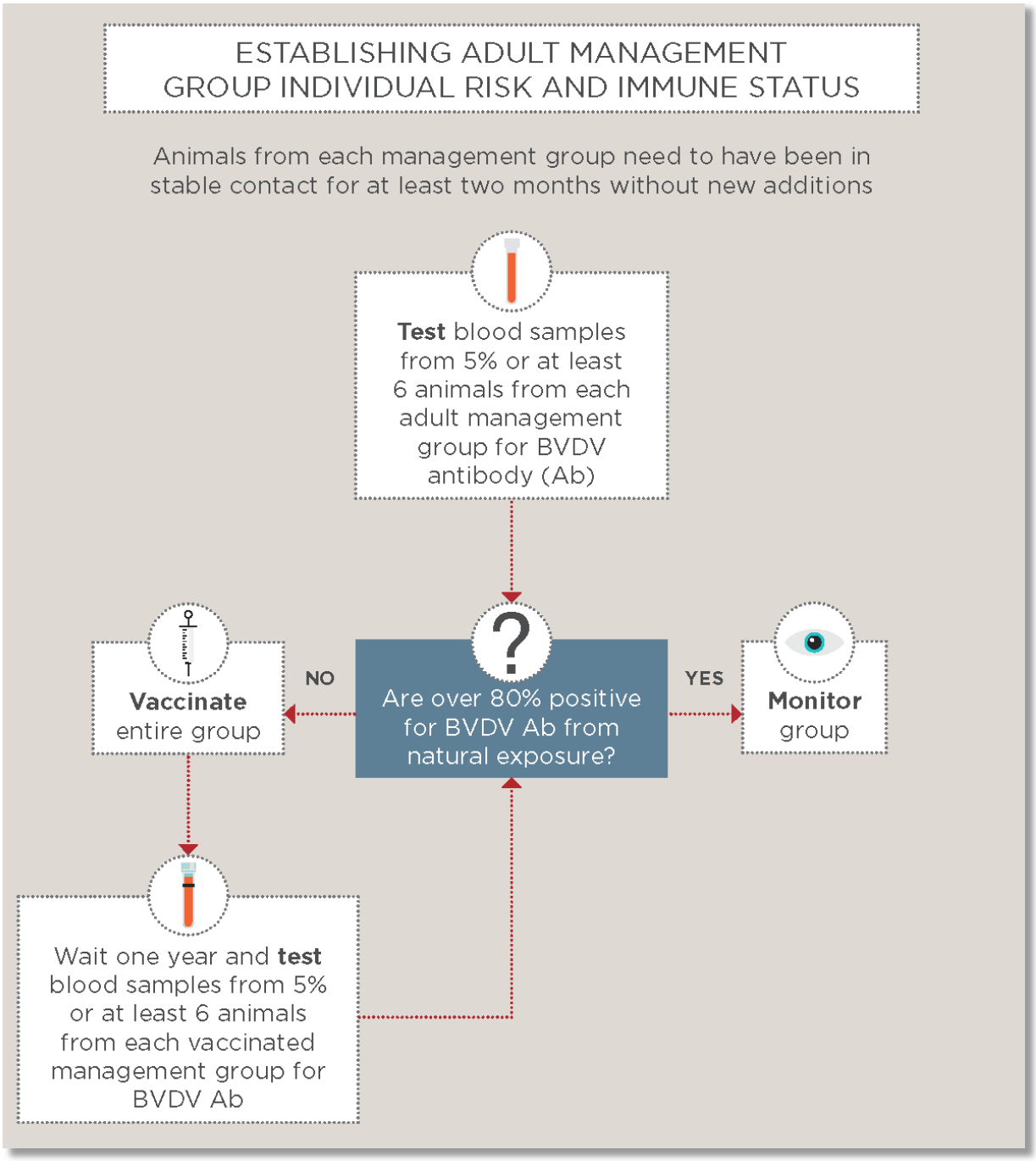
SYSTEMATIC MANAGEMENT OF BVDV

The goals of Beef BVDV herd level eradication programs are:

1. Identify at risk management groups and provide them with immunity
2. Ensure annually that all replacement heifer management groups are both PI free and reasonably immune prior to their first joining
3. Ensure no adult PI animals exist within any of the pre-existing adult management groups
4. Maintain simple biosecurity procedures

The primary goal of a beef producer wishing to strategically manage their production system's immune status to BVDV via vaccination is to ensure adequate immunity in each existing stable reproducing management group and in every new group of replacement heifers prior to mating. Vaccinating any management groups wherein fewer than 80% of the animals screened demonstrated immunity to BVDV is a reasonable policy, though vaccination thresholds will vary from producer to producer and from veterinarian to veterinarian based on experience, production system, or appetite for risk.

Vaccinated management groups may continue to be exposed to BVDV, improving their level of naturally acquired immunity. Most BVDV antibody assays can be interpreted to discern immunity associated with vaccination from that derived from natural exposure. It is a reasonable option to continue to screen vaccinated management groups annually, until the proportion of animals immune from natural exposure reaches an acceptable level, at which point annual boosters cold be suspended.



In order to systematically manage and potentially even eradicate BVDV at the herd level, PI animals must be managed more actively than by vaccination alone. The process is relatively straightforward and once BVDV has been successfully eradicated from a property, ongoing surveillance is both simple and inexpensive.

Once the adult management groups with insufficient immunity have been identified and enrolled in a vaccination program, rather than directing effort towards ensuring that each highly immune adult management group is PI free, the emphasis on early control could be focused on managing the BVDV status of each years' replacement heifer population. By managing replacement heifers annually, with a goal of ensuring that each new group of replacement heifers is both immune and PI free prior to mating, producers and their veterinarians will put significant and consistent pressure on the endemic status of BVDV within any production system. As most PI animals tend to die young, by ensuring none are retained as replacement stock, and by managing the immune status of replacements prior to mating, the cycle of PI production will be significantly impaired.

ANNUAL HEIFER PRE-MATING BVDV SCREENING

Once weaned and commingled for at least two months, and at a minimum of eight months of age, blood testing a random 5% or a minimum of six replacement heifers for antibodies to BVDV will usually clearly indicate either a need to vaccinate or to screen the entire group of replacement heifers to identify and cull any PI's.

Highly immune groups of heifers (over 80% immune) should be screened for the presence of PI's and would gain limited benefit from vaccination.

Groups of animals with little or no evidence of immunity (less than 50% immune) would benefit from enrolment in a vaccination program. Their immune status indicates that a PI animal is very unlikely to exist within the group, therefore searching for a PI would be an unnecessary expense.

Heifer screening may result in mixed results (between 50% and 80% immune), for which there are four common scenarios:

1. The heifers without immunity to BVDV are persistently infected. (PI present)
2. Some of the heifers were exposed to BVDV prior to commingling. (No PI)
3. One or more of the heifers is a PI. (PI present)
4. The heifers are being exposed to BVDV from outside of the group. (No PI)

The first scenario is confirmed by conducting a PI screening test on the antibody negative blood samples. If a PI is diagnosed, the entire group of heifers should be tested to identify and cull any other PI's.

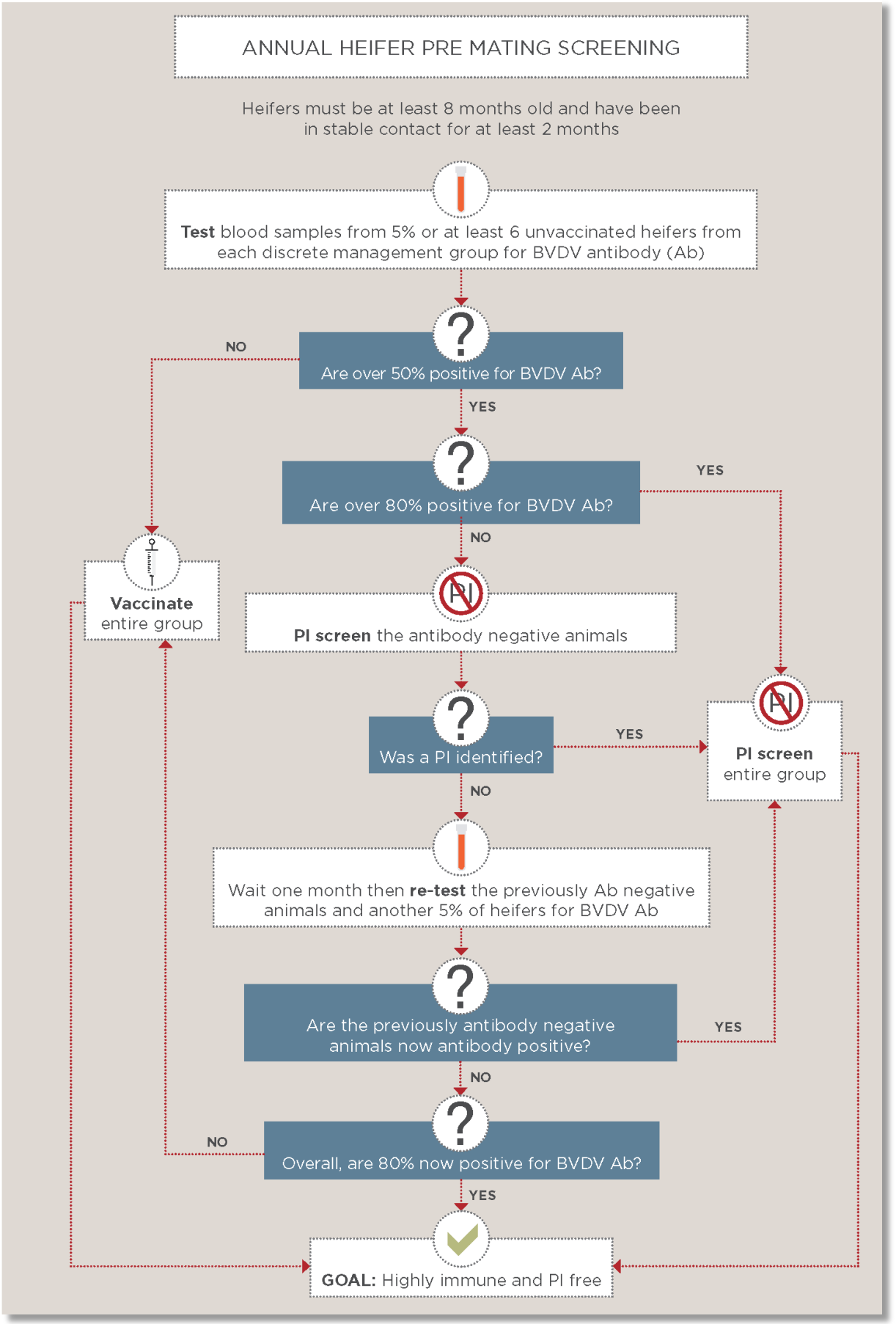
To differentiate the second scenario from the third and fourth scenarios, producers could wait one month and then collect a second blood sample from the previously antibody negative animals, as well as blood samples from an additional 5% or minimum of 6 random heifers. If the previously antibody negative animals remain antibody negative, it can be assumed that

the existing immunity is from historic exposure (scenario 2), such as exposure from a steer or culled heifer no longer present within the management group. The group can then either be vaccinated or monitored depending upon the final immune status calculation, rendered more statistically relevant due to the additional antibody testing.

If all or a proportion of the previously antibody negative animals have become antibody positive, then ongoing exposure is occurring, indicating that either a PI exists within the management group (scenario 3), or the group is undergoing outside exposure to BVDV (scenario 4). Regardless, it is a sound decision to screen the entire management group to ensure that none of the heifers are a PI. If no PI is found, effort should be given to identifying the source of ongoing exposure to the virus.

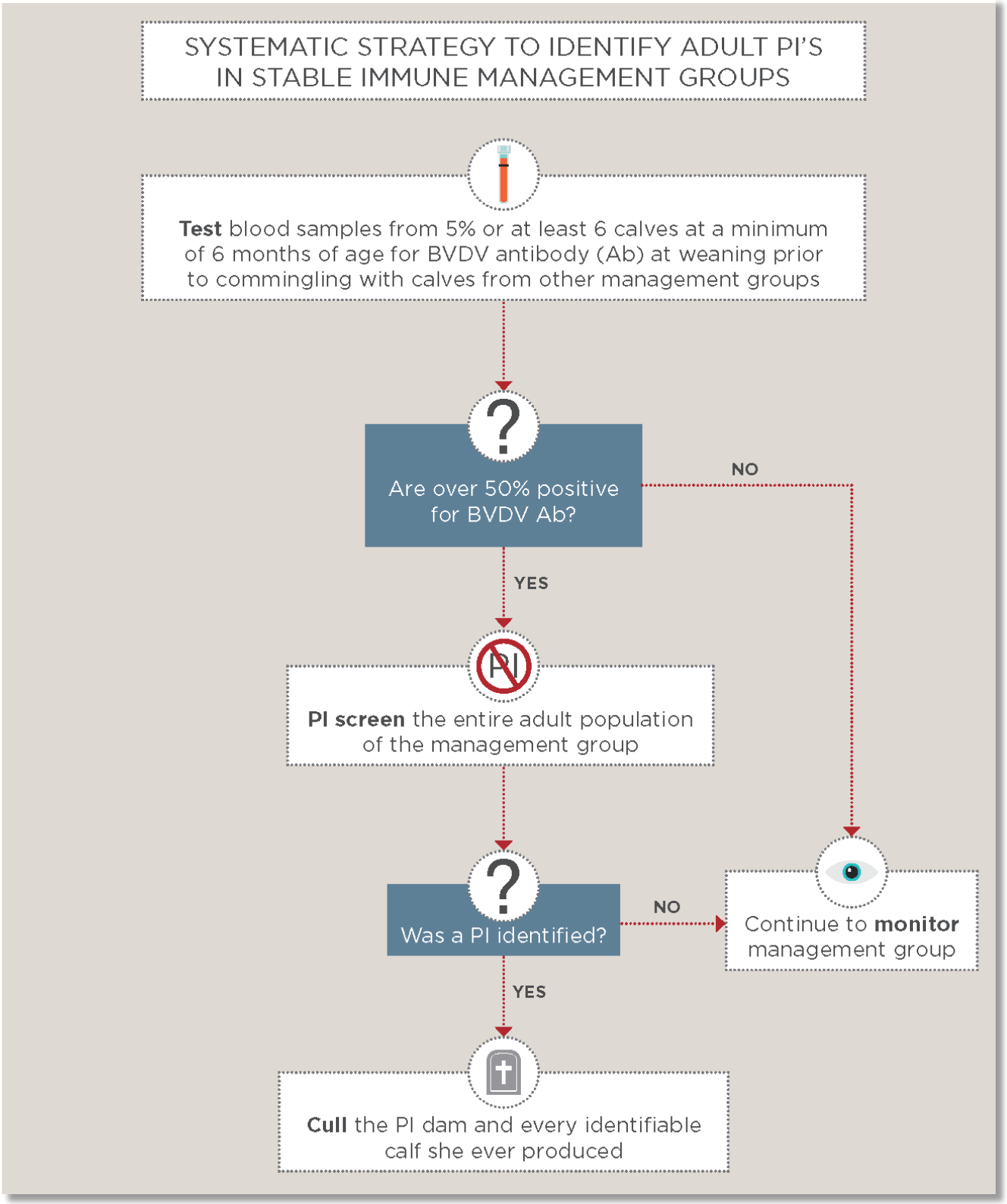
If each new replacement heifer group is both immune to BVDV and PI free at mating, they are significantly less likely to produce any PI progeny. When consistently implemented, PI calves may eventually cease being produced across the entire production system and the new replacement heifers may begin to render negative BVDV antibody test results when screened prior to mating. However, if the replacement heifers are found to continue to demonstrate pre-mating immunity to BVDV, an adult PI or PI's may exist within an older management group, warranting further investigation. There are both systematic and non-systematic approaches to reduce the expense of searching for adult PI's .

Four year old PI cow diagnosed through her ill thrifty PI calves with her third PI calf at foot.


ANNUAL HEIFER PRE MATING SCREENING
Heifers must be at least 8 months old and have been in stable contact for at least 2 months
Test blood samples from 5% or at least 6 unvaccinated heifers from each discrete management group for BVDV antibody (Ab)
Are over 50% positive for BVDV Ab?
NO
YES
Are over 80% positive for BVDV Ab?
YES
NO
Vaccinate entire group
PI screen the antibody negative animals
Was a PI identified?
YES
PI screen entire group
NO
Wait one month then re-test the previously Ab negative animals and another 5% of heifers for BVDV Ab
Are the previously antibody negative animals now antibody positive?
YES
NO
Overall, are 80% now positive for BVDV Ab?
NO
YES
GOAL: Highly immune and PI free

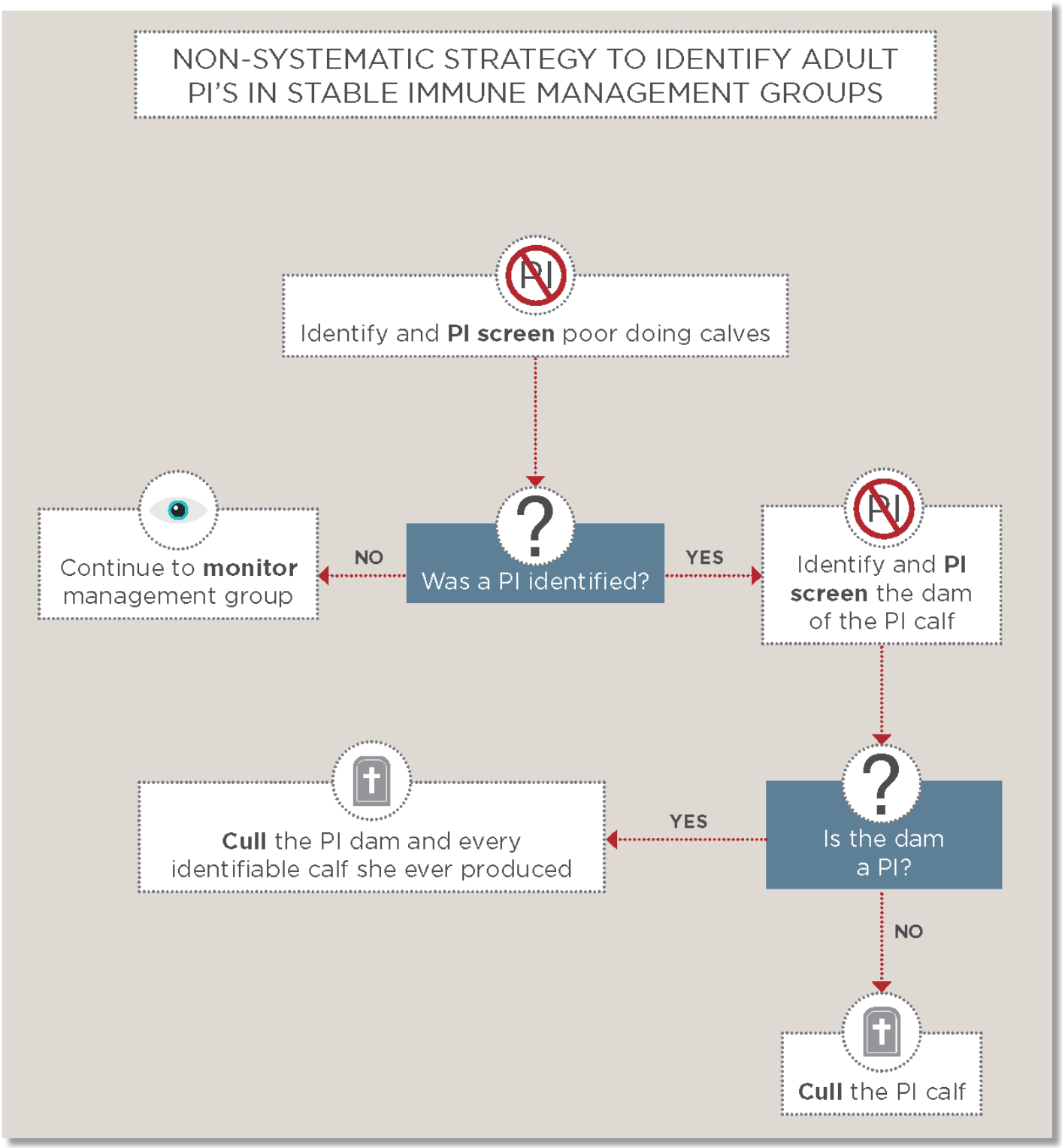
SYSTEMATIC APPROACH TO FIND ADULT PI'S

If an adult PI animal exists within a management group, a high proportion of the calves from that management group would be antibody positive to BVDV at weaning prior to being commingled with other calf groups. By collecting blood samples from 5% or a minimum of 6 calves over six months of age from each management group for antibodies to BVDV, the dams from highly immune management groups could be identified and tested to remove any PI cows.



NON-SYSTEMATIC APPROACH TO FIND ADULT PI'S

A less intensive, yet non-systematic, approach focuses on testing poor performing or sick calves to diagnose PI's. Any samples could either be screened immediately with a crush side PI test or the animal could be clearly identified (additional ear tag or spray raddle) and the sample sent to a laboratory for analysis. Any PI calves and their dams could then be identified in the paddock and the dams tested at the next convenient opportunity.



ONGOING MONITORING

Once replacement heifers are consistently annually BVDV antibody negative when screened prior to mating, it can be assumed that the herd is BVDV free. The focus should then remain on maintaining simple biosecurity practices and ongoing heifer pre-mating surveillance. In addition to screening the heifers annually, producers and their veterinarians should investigate any abnormal health or reproductive issues and screen any ill thrifty or dead calves for PI's. Should a PI be identified, if possible, its mother should be identified and tested as well.

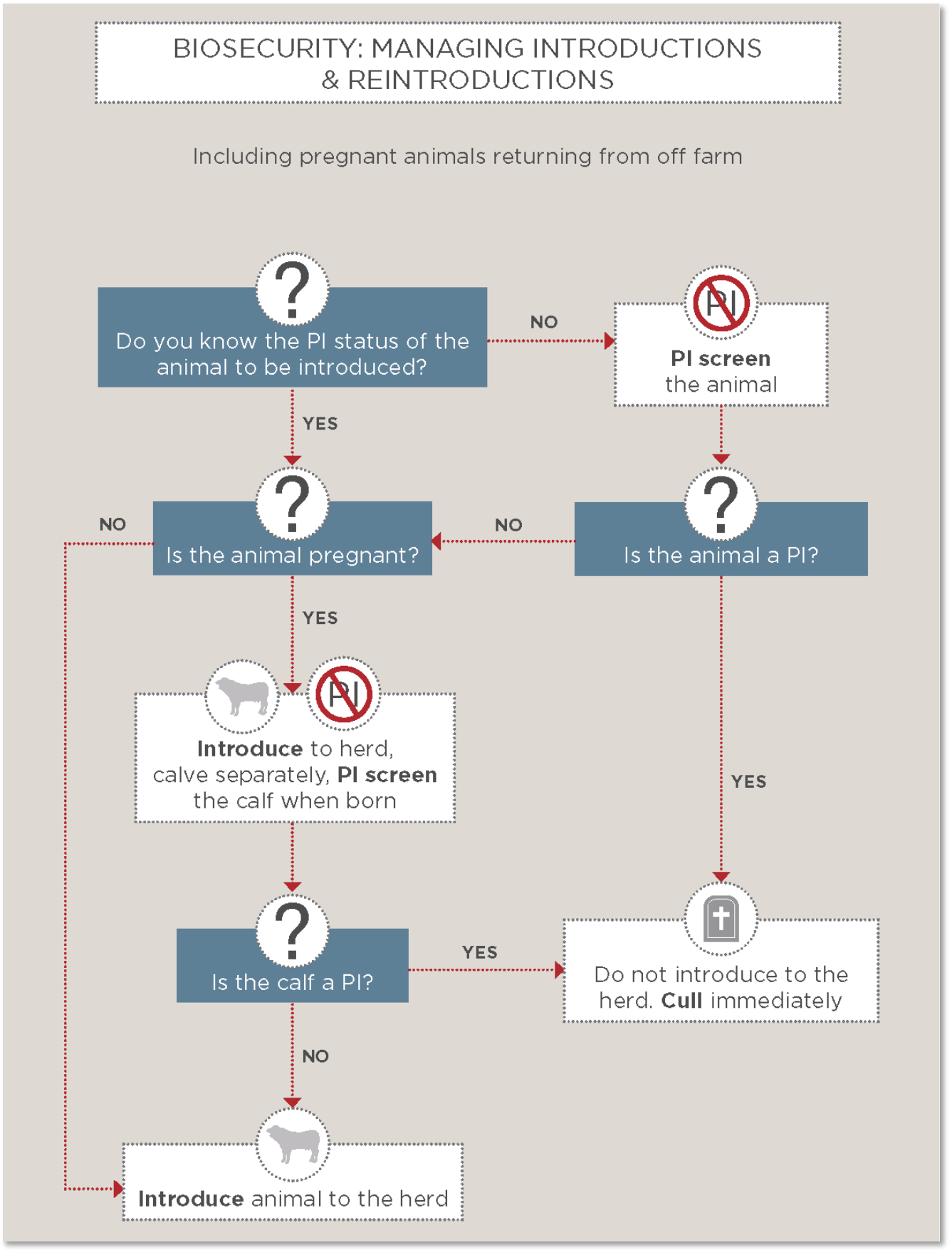
BIOSECURITY

BVDV biosecurity focuses on reducing the exposure of animals in early to mid gestation to outside animals or management groups of unknown BVDV status. All introduced animals should be screened to ensure that they are not persistently infected and if pregnant, their calves should be screened as soon as possible after birth. The unborn calves of pregnant animals agisted off farm, shown, or exposed to management groups of unknown status would also warrant screening at birth.

Most properties with incomplete biosecurity should strongly consider maintaining vaccination programs including annual boosters. By marking the management tags of animals from groups proven highly immune with a set of ear notching pliers, they can be easily identified and excluded from annual booster vaccinations.

Once free of BVDV, some producers and their veterinarians may decide to place greater emphasis on biosecurity than vaccination. Ceasing to vaccinate older management groups, often with longer vaccination histories, or management groups with some immunity from natural exposure is reasonable. Ultimately, for little cost, the success of a production system's biosecurity can be measured. If a PI is produced and retained, it will be discovered when the heifers are screened prior to mating and can be culled before being mated as a replacement heifer. If the replacement heifers continue to demonstrate little or no exposure to the virus, it can be assumed that biosecurity measures are effective. Regardless, ceasing to vaccinate, will increase risk and reduce flexibility regarding agistment or being able to capitalize on opportunities to buy in stock of unknown status.

The cost of BVDV varies from year to year on individual production systems and from production system to production system. Regardless, if a group of animals become exposed to the virus at an inopportune time, the outcome can be financially devastating. BVDV is complicated but predictable and the tools that exist to manage it are accurate. Measuring BVDV allows veterinarians and their producers to invest in managing it. Managing BVDV protects their investment, provides flexibility, and drives profitability.


BIOSECURITY: MANAGING INTRODUCTIONS & REINTRODUCTIONS
Including pregnant animals returning from off farm
Do you know the PI status of the animal to be introduced?
NO
PI screen the animal
YES
Is the animal pregnant?
NO
Is the animal a PI?
NO
YES
Introduce to herd, calve separately, PI screen the calf when born
YES
Is the calf a PI?
YES
Do not introduce to the herd. Cull immediately
NO
Introduce animal to the herd

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