Biosecurity in the Dairy Herd

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Take Home Messages

- Infectious disease threatens all dairy herds, whatever size or location.
- The risks of disease entering a herd are high, particularly with the evolution of modern dairy husbandry systems and industry structures that increase animal movements and other specific risks of disease transmission.
- Identifying specific risks and hazards, analyzing their impact and applying controls to those that are significant can and should become an integral and practical part of any herd health plan for every dairy farm.
- Biosecurity management should be part of a comprehensive health management plan for any dairy herd, which should also include surveillance, resilience and vaccination, and control of disease spread within the herd.
- When biosecurity is included within a comprehensive disease management program, infectious disease can be effectively and efficiently controlled in any dairy herd. Disease is not an inevitable consequence of modern dairying.

Introduction

Biosecurity, for the purposes of this article, is defined as the risk of disease entering a herd. A commercial dairy herd can never be totally biosecure, but most major biosecurity risks can be managed to minimize the risks of disease entering the herd. Where biosecurity risks cannot be readily managed, they can be mitigated by managing other disease control points such as the risks of spread within the herd, or the resilience of the animals that comprise the herd.

The risks of a disease entering a herd should not be confused with the risks of disease spreading within a herd; biocontainment manages the spread of disease once it exists within a herd and is a process with which veterinary

surgeons and livestock farmers may be more familiar. The control of any existing disease depends upon limiting the spread of the disease and minimizing its impact on herd health, welfare and productivity. Biosecurity management is a process of managing disease by preventing its entry into a population; if the biosecurity is robust, using valuable resources to control disease within the herd is less imperative.

The overall management of infectious disease in dairy herds is dependent upon the strength of the various control points that have a critical effect on the disease status of the herd. These control points can be grouped into four main sections and regarded as four pillars that support the disease status of the herd, and the cattle in it. In the commercial world of modern dairy farming, biosecurity alone cannot ensure herd health, but must be supported by robust surveillance, maintaining resilience of the animals within the population, and control of disease within the herd. If all these pillars are strong, any infectious disease can be effectively managed in the herd and the disease status of the herd and the animals within it will be good. Any weak pillar may be supported by strengthening the others, but the overall disease status of the herd will inevitably be compromised.

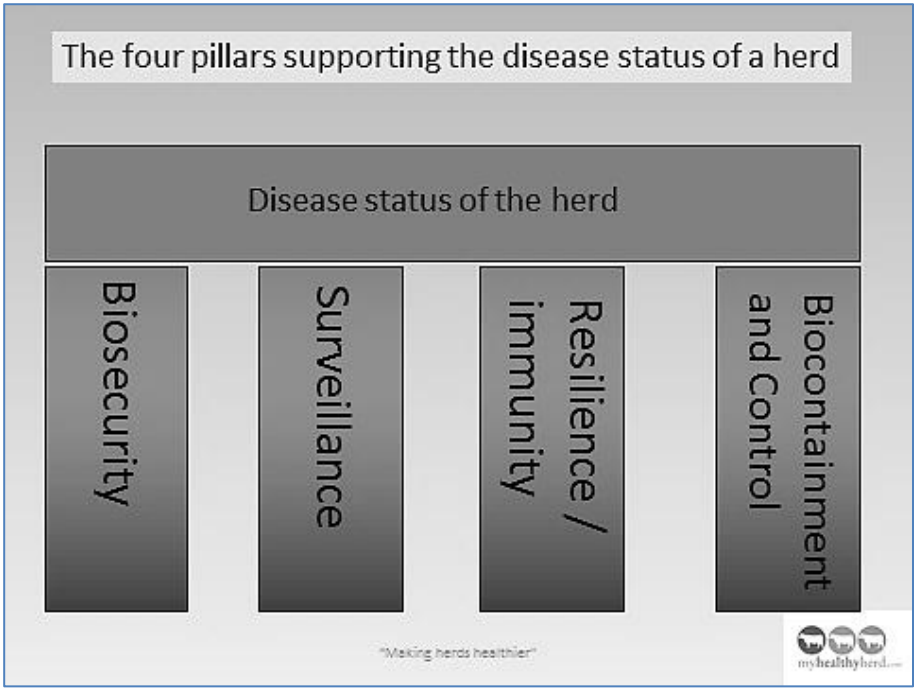

Figure 1: The four pillars that support the disease status of a herd: all four pillars need to be properly managed to ensure a healthy herd

■ Biosecurity at Different Levels

National, regional and local layers of biosecurity all help protect the health of a herd and the animals within it, with the strength of the layers determining the overall biosecurity of the herd. There are some particularly infectious diseases that cannot be readily or practically prevented at the local level, and rely on a more communal strategic approach to biosecurity. The outermost layer, or shell, of biosecurity is national biosecurity, which is critically important for highly infectious diseases such as Foot and Mouth Disease where the economic importance of such diseases justifies the robust strategic national biosecurity measures that are imposed to prevent this disease entering the country. If and when national biosecurity measures break down, local biosecurity has to be introduced and enforced, often at great cost and inconvenience.

Biosecurity can also be managed at a regional level to maintain the health status of groups of animals or herds within a specific geographic area. The movement controls imposed on animals moving between areas within the United Kingdom to reduce the risks of spreading bovine tuberculosis are an example of regional risk management. Regional disease control programs will require regional biosecurity, including movement controls and specific risk management measures that protect the status of the region. There is a potential to establish regional disease control programs within the country that will include biosecurity management between zones of different disease status.

■ Local Biosecurity for the Dairy Herd

Herd biosecurity is about risk assessment and risk management at the local level, where risk assessment and management are conducted by those responsible for the health of the herd. The risk of any infectious disease entering a herd can be assessed, measured and managed using local knowledge and a basic understanding of epidemiology. The resources needed to secure against disease incursion can then be compared to the impact of the disease should biosecurity fail and the disease enters the herd. In some cases, the resources will not be available, applicable or affordable, and identified risks may have to be accepted. In these cases, the other pillars that support the disease status of the herd will have to be strengthened: good surveillance to detect the presence of disease, management of the resilience of the animals by such measures as vaccination, and controls to limit the spread of the disease should it enter the herd.

Biosecurity risks should be assessed in a logical and structured way, starting with general risks that impact on all infectious diseases: these are risks that have a wide-ranging or universal impact on the likelihood of any infectious or

transmissible disease entering a herd. For the purposes of a structured and logical assessment, these general risks can be categorized into three areas of risk:

- Cattle risks – the risks of disease being introduced by cattle contacts
    a. introducing cattle on to the farm
    b. direct contacts with other cattle
- People risks – the risks of disease being introduced by people
- Object risks – the risks of disease being introduced on or in inanimate objects
- Wildlife risks and other animal vectors

Some biosecurity risks will have more significance than others, and a measurement and quantification of any particular risk needs to be applied to the assessment. The significance of any particular risk that is identified will be determined by the epidemiology of a particular disease to which the risk is applied, leading to the necessity to assess risks, and then analyze the risks specifically for particular infectious diseases.

For example, highly infectious disease such as Bovine Herpes Virus 1 (causing Infectious Bovine Rhinotracheitis, IBR), are highly transmissible, and so any cattle to cattle contacts (direct or indirect), or cattle contact with people or objects that could be carrying the virus, are significant risks. However, the BHV1 virus is relatively fragile such that many of the indirect transmissions of this virus into the herd can be managed relatively easily by disinfection and hygiene. The potential to spread the disease by objects and people is significant, but relatively small and easily manageable, whilst the risks of spread by carrier cattle are large and more difficult to manage. Meanwhile, having neighbours with cattle that have direct contact over fences or in shared pastures, or share watercourses from which cattle can drink, are high risks that may be unmanageable with limited resources.

Conversely, Neospora caninum is a parasitic disease that is not transmitted horizontally and so cattle to cattle contacts (either direct or indirect), and spread through objects and people are insignificant risks. Direct contacts with neighbours' cattle are insignificant risks for this particular disease, but the vertical transmission of this disease makes the purchase of infected animals into a herd a very high and significant risk. In addition, the risk of introducing the disease, and spreading it within the herd by young dogs is a specific risk for this disease that is of little significance to other infections.

Furthermore, diseases that are caused by pathogenic organisms that are robust and can survive in the environment outside the host are more readily carried from herd to herd by people and objects compared to fragile pathogens that cannot survive outside the host. Such examples as bovine

tuberculosis and foot and mouth disease virus are robust pathogens that can survive for significant periods outside the host and can be moved between farms on clothes, vehicles, and other objects as well as by carrier animals.

One of the most difficult biosecurity risks to manage is that of uncontrollable wildlife and insect vectors. For example, Blue Tongue Virus, spread by midges, creates a biosecurity risk that is almost impossible at a local level because of the transmission by midges that can travel long distances. The effective control and management of vectors such as midges and other biting insects, and wildlife such as deer, badgers and rabbits is fraught with difficulty. This makes biosecurity against diseases where such vector risks are significant very challenging, and where the resources are inadequate, or the will to control such risks is insufficient, biosecurity will be compromised. In these situations disease control will depend on the strength of the other control points; the pillars of surveillance, resilience and control within the herd will need to be very strong if the disease status of the herd is to be properly protected.

■ Biosecurity Risk Assessment of the Herd

Health management on dairy farms is a complex process that involves more than biosecurity. In the very first instance, the aspirations and objectives of a strategic health management program must be established and agreed upon. Disease management will require resource and enthusiasm that can only be achieved by agreement. Implementation of an agreed strategy will involve the use of a practical and effective health plan specific to the farm. Biosecurity is only one part of the process, and will not achieve effective health management without the other elements that control herd health.

Table 1: The aspiration hierarchy which will determine the strategy for disease management in a herd

High aspiration	Moderate aspiration	Low aspiration	No aspiration
Freedom from disease	Low prevalence or freedom from disease	Tolerance of disease	Other business priorities
High health status	Low or no impact of disease on health	Control within the herd to minimise impact of disease	Limited resources to deal with health and disease
Accreditation and certification	Robust surveillance, biocontainment and resilience programs	Surveillance and resilience weak	Disease out of control
Good biosecurity, surveillance, resilience and biocontainment			

As part of the health planning process, a broad discussion on disease management for the herd should prioritize health and disease control for the herd, defining the aspirations and objectives for herd health (Table 1). Infectious disease management will be an essential part of any health plan, and biosecurity will become the first element of infectious disease management within the plan, but any health plan needs to be practical and realistic. Seeder herds, producing pedigree cattle for sale into other herds, should have high aspirations and ensure a high herd health status, whilst commercial dairies may have other priorities. The intended position in the aspiration hierarchy needs to be defined from the start.

Biosecurity risks should be assessed and scored in a systematic and logical way at the outset of any biosecurity planning. Risks can be assessed, scored and ranked and their management prioritized for each of the diseases under consideration. This structured assessment of risk can then be readily developed into a risk management plan, which will form the basis for the infectious disease management plan specific to the herd. The significance of any particular biosecurity risk is not only dependent upon the disease, but also the frequency or size of the risk itself. For example, the existence of several neighbouring cattle herds of unknown disease status will exacerbate the risk of insecure fencing. The occasional introduction of a single animal into the herd from a herd of known disease status will present a very much smaller risk than the indiscriminate introduction of numerous cattle on a frequent basis. This quantification and ranking of biosecurity risks and the application of sound epidemiology and understanding of disease dynamics, can be applied using sophisticated mathematical models that score and apply weightings to known risks on any particular farm or herd.

Table 2: The biosecurity risks of Johnes entering UK dairy herds: data from myhealthyherd.com

General biosecurity risks relevant to Jones Disease n = 2993 dairy herds	Frequency	Occasionally	Never
The herd introduces cattle on to the farm	13.7%	62.1%	24.2%
Cattle share grazing or buildings with cattle of unknown disease status	2.9%	8.2%	88.9%
Slurry or farm yard manure is from another farm is spread on land	0.6%	4.9%	94.5%
Cattle have access to waterways that have passed through another livestock farm	14.5%	38.7%	46.8%
Cattle are fed with feeds that could have had contact with other animals	1.8%	16.1%	82.2%
Johnes Disease specific biosecurity risks n=2296 dairy herds			
The herd has introduced groups of animals of unknown Johnes status in last ten years	13.4%	39.6%	47.0%
The herd has introduced individual animals of unknown Johnes status over last ten years	11.0%	57.8%	31.2%
Slurry of farm yard manure from another farm is spread onto youngstock pastures	0.4%	4.2%	95.4%
Calves have access to streams or watercourses that have passed through another livestock farm	6.6%	28.2%	65.2%
Youngstock graze pastures that are heavily infected with rabbits	13.8%	48.9%	37.3%
Youngstock co-graze pastures with sheep of unknown disease status	8.0%	21.9%	72.1%
Calves are fed on colostrum from other herds that may be high risk of carrying MAP	2.0%	4.0%	94.0%

Table 2 shows the biosecurity risks that are significant and relevant to the introduction of Johnes disease into a dairy herd, based on data from over 2000 UK dairy herds that have participated in a Johnes management program that has the objectives of protecting the uninfected herds as well as controlling disease in infected herds.

The score and weighting systems used in mathematical algorithms such as used by myhealthyherd.com and which support biosecurity assessment and analysis are mainly based on observations and experience, with little hard published evidence to quantify risks and prioritize them for efficient biosecurity

management. Van Winden (2006) ranked biosecurity risks according to the level of risk and the impact that the risk would have on herd health. The paper concluded that the introduction of cattle into a herd was the most significant biosecurity risk for most diseases. Data from myhealthyherd.com shows that over 75% of UK dairy herds introduce cattle into their herds, with less than 25% truly “closed” herds.

■ Common Biosecurity Risks for Dairy Farms

Cattle Introductions

Truly closed dairy herds that do not, and have not, introduced any cattle into their herds are uncommon; the sale and movement of cattle has become an intrinsic part of livestock agriculture. It is unlikely that modern dairy farms will desist from introducing stock with the pressures of increased herd size, increased turnover of adult milking cows, and the forced culling of cattle leading to higher levels of cattle introductions into herds. The significant biosecurity risk of cattle movements into a herd may be unavoidable, but needs to be managed and mitigated as part of the biosecurity plan.

There is a common misunderstanding amongst farmers and their advisors as to what constitutes healthy stock when it comes to introducing them into a herd. The overt appearance of an animal is a poor determinant of its health status, as many of the transmissible diseases that affect cattle are carried by symptomless carriers. For example, one of the most common ways of introducing BVD virus into a herd is via a pregnant heifer carrying a persistently infected fetus. The heifer appears healthy, and indeed may test negative for the virus, but it acts as a “Trojan cow” carrying a fetus that is permanently infected with BVD virus and which will introduce massive amounts of virus into the herd once it is born. Introduction of these animals is a high risk which is not effectively managed by simply purchasing animals that either appear normal, or test negative for the disease. Protocols can be devised to manage this risk, but require careful planning and implementation.

Many bulls and heifers are purchased as young animals and introduced into dairy herds on the naive belief that they constitute a smaller risk to biosecurity as they appear healthy and have had little chance to become infected. However, they are a significant risk of carrying many infectious diseases without any clinical signs, and may be insensitive to many testing procedures. For example, Johnes disease is commonly introduced into herds by young bulls and heifers purchased from infected herds which are in the incubation phase of the disease. The management of the risk by testing prior to purchase is inadequate because of the insensitivity of the currently available tests for Johnes disease in young animals incubating and carrying the disease.

Specific infectious disease risks (such as for Johnes disease, BVD and many other infectious diseases) can be significantly reduced by purchasing animals from herds of known disease status. It may not be essential, or even necessary, to introduce animals from herds that are accredited free of specific diseases, but it is important to know the status of the herd of origin so that any risks can be managed and mitigated appropriately. The disease status of any herd can be defined, and the relative absence of disease can be accredited by a specified process of certification in accordance with a set of rules defined by responsible, authoritative bodies such as the Cattle Health Certification Scheme (CHeCS) in the UK. Several cattle health programs exist within such schemes, which provide a credible structure for disease control, eradication and accreditation. Relatively few herds manage to achieve the status of certified and accredited freedom from disease; thereby limiting the choice and selection for those farms purchasing and introducing cattle. However, many farmers know the disease status of their herds, and a few judicious enquiries of the herd of origin will enable the appropriate assessment and management of biosecurity risks of any animal derived from the herd.

Biosecurity risk management procedures such as the selection, isolation, quarantine and testing of incoming cattle may not be as daunting as might be envisaged, and will depend on the disease status of both the herd of origin and the herd introducing the animal. Some examples are given in Table 3. A specific risk management program can be generated for most circumstances by a veterinary surgeon with an understanding of infectious disease or by using a health management program such as myhealthyherd.com. Consideration should always be given to the risks to the incoming stock from disease already indigenous in the herd, as well as the risks of diseases being brought in.

Table 3: Example of procedures for the biosecurity management of risks of BVDv entering a herd for a herd intent on introducing pregnant breeding females

Herd of origin: **BVD accredited free**
‣ Animals derived from credible BVD Accredited Free herds can be regarded as free of BVD infection, and can thus be introduced into the herd without quarantine or testing for BVD with minimal risk. ‣ It is essential to check the authenticity of the accredited status of the herd of origin, including any scheme membership status and the currency of any certificate provided or offered.
Herd of origin: **Unknown BVDv status**
‣ Isolate all pregnant females on arrival. Ensure, in particular, that there is no contact with any animal of breeding age. ‣ Take a blood sample from all pregnant females and submit to a laboratory for BVD antibody test, with a request to test any that are BVD ab-ve to be tested for BVD antigen. ‣ If any animals are BVD ab+ve, keep them in isolation and consider their calves as potential PI animals. Either test their calves, or remove the calves before they can contact the herd. ‣ If any animals are BVD ab-ve and BVD ag+ve, remove them from the group as PI animals. Retest if there is any uncertainty. ‣ Only release animals from isolation if they are: BVD ab-ve and ag-ve or BVD ab+ve and only then after calving

Where isolation, quarantine, and testing are not appropriate or practical, such as with Johnes disease or Neospora (where testing is insensitive or only sensitive at specific times within the disease dynamic), biosecurity management need not be abandoned, but more subtle management procedures can be taken to minimize and mitigate the risks of introducing disease.

Direct Contact with Other Cattle

Direct contact with cattle in other herds of unknown disease status may be difficult to manage in modern dairy farming systems, particularly large herds that exist in high livestock dense areas. Local stock densities, the number of farming neighbours with cattle, and the security of fencing will be significant.

There may be opportunities to manage local biosecurity risks more regionally, with co-operation between neighbours to create geographical zones for biosecurity and disease control. Until this is achieved, local, herd based biosecurity management of direct contacts between cattle is difficult and resource intensive, requiring robust and effective fencing and local management of movements.

Secure fencing is often cited as an achievable biosecurity measure by veterinarians or advisors, but creates practical difficulties at the farm level. The protection afforded by secure fencing will depend upon the disease, but for diseases that have significant air borne spread, at least three metre separation between infected and susceptible cattle is required. Secure double fencing to achieve this may be prohibitively expensive for many farms with adjoining cattle holdings. Notwithstanding the costs, the benefits of secure fencing and grazing management to prevent direct contact between a herd and neighbouring cattle are high, and can be achieved with some practical common sense and forethought.

Shared pastures and buildings are becoming a more common feature of modern farming, with many dairy farms contracting out the rearing of youngstock and the keeping of dry cows. Such high risk husbandry requires careful risk management, ensuring that any stock that are mixed or have contact are of known disease status, and the cattle returned to the herd are managed appropriately.

People and Indirect Contacts

The risks of people transmitting pathogens from cattle to cattle can be managed relatively easily as long as those involved understand the risks and engage in their management. Some people are of higher risk than others, particularly those that have direct contact with animals.

Examples of people that are a high biosecurity risk

- Veterinarians
- Foot trimmers
- Relief milkers and temporary staff
- Artificial inseminators
- Feed and nutrition advisors and consultants
- Other farmers

It has become a feature of expanding dairy herds to employ staff, many of whom work on other farms. Indeed, it is not uncommon for milking staff to work on two or more farms in a single day wearing the same overalls and

boots, without disinfection between farms. Management of this risk is simple and cost effective, with the provision of farm specific boots and overalls for all workers who have contact with the animals or the animal areas. Some education and guidance, with properly constructed and displayed standard operating procedures, will manage the risks from such workers simply and effectively.

Vets and other professionals that have direct contact with animals are a major biosecurity risk for many diseases such as BVD, bTB, and many other pathogens that can survive outside the host. Neighbours, representatives and other visitors are also significant but manageable risks. Simple disinfection procedures, and the use of proper protective clothing to protect the animals as well as the people, are effective and convenient biosecurity management procedures that can be readily implemented on any dairy farm.

Vehicles, Equipment and Other Objects

Within the category of object risks should be included equipment that is shared or has contact with other animals or animal products. Contractors with high risk equipment such as manure spreaders and slurry handling equipment which is brought on to the farm without proper cleansing or disinfection constitute a high risk for many diseases that can be carried between farms and where the pathogen can survive outside the host. With new environmental regulations and nitrogen management procedures, there is an evolving trade in slurry and waste from livestock farms, with associated biosecurity risks. Specific diseases such as botulism and salmonella have been brought in to cattle herds by chicken shed waste being stored or spread in cattle fields as a fertilizer.

Feedstuffs brought on to the farm can also be a source of pathogenic organisms. National and regional biosecurity measures help protect cattle against such diseases as salmonella and the transmissible spongiform encephalopathies, requiring feedstuffs to be produced and processed in accordance with regulatory standards. However, some feedstuffs are exempt from such regulation; for example, the trading of forages and feedstuffs can be a potential biosecurity risk.

Such risks can be assessed within the structured risk assessment, and management procedures agreed to minimize the risks where resources and farm management practices allow, or mitigate the risks and the impacts of disease where the biosecurity risks cannot be managed.

Wildlife, Animals and Other Vectors

There are highly significant infectious diseases of cattle that can be carried and transmitted over long distances by other animals. Bovine tuberculosis is known to exist in several wildlife species, particularly badgers and deer. Securing a herd against these vectors can be very challenging; geographical location may be the strongest defence, but many wildlife risks are unmanageable. Insect and arachnid vectors create specific risks for diseases such as Blue Tongue and Red Water disease. These risks can be assessed, and mitigated if not managed. The presence of significant and unavoidable biosecurity risks such as wildlife vectors emphasizes the need to include all the elements of infectious disease management in the herd health plan, as well as biosecurity.

A comprehensive checklist of general and disease specific biosecurity risks can be found at www.myhealthyherd.com. This web based health management program uses the answers to the assessments in an algorithm to analyze and quantify biosecurity risks and prioritize the management of those risks to create a specific and effective biosecurity plan as part of a comprehensive disease management plan for any herd.

Top Tips for Creating an Effective Biosecurity and Disease Control Plan

- Determine the aspirations of the farmer and understand the business objectives
- Define what diseases may be a significant risk to the health of the dairy herd
- Assess and quantify the biosecurity and biocontainment risks for each significant disease and create a risk profile for the herd
- Within the limits of resources available, create a farm specific biosecurity plan, detailing:
  - Purchase policy, including sourcing and any quarantine and test procedures
  - Biosecurity procedures such as disinfection, use of shared equipment, etc
- Consider biocontainment, disease surveillance and vaccination plans to limit the impact and effect of disease if biosecurity fails or cannot be achieved

New and Emerging Local Biosecurity Risks

The economics of modern farming in many countries is leading to larger herds kept in regions of high stock density. Increasing the size of herds, keeping them on multiple premises and in high livestock dense areas where there is direct contact with numerous neighbours, exaggerates biosecurity risks and makes biosecurity management more challenging. Such perilous situations can be recognized and the biosecurity risks identified with a structured approach to biosecurity assessment and management as part of the overall health plan for the herd. The risks may be higher, but they are not unmanageable. Disease is not an inevitable consequence of modern dairy husbandry.

Although the supporting pillar of biosecurity may be severely challenged in large herds and high livestock densities, the other pillars of disease management that support the health status of the herd can be strengthened to compensate for any compromised biosecurity. In any case, surveillance must be robust and thorough to detect any disease incursion quickly and effectively. Resilience and resistance to disease of the animals in the herd must be enhanced, generally by vaccination but also by ensuring good overall health management and minimal stress on animals in the herd. The risks of spread within the herd should disease enter the herd must be assessed and managed properly and effectively. A comprehensive infectious disease management plan is an essential part of any dairy herd, but is of particular value to larger herds in areas of high livestock density.

The Benefits Of Biosecurity

Absolute data to demonstrate measurable benefits of proper and effective biosecurity management is lacking. Dutch work (Van Schaik, 2001) has shown that there are significant economic benefits to being a closed dairy herd with good biosecurity, benefits mostly seen as better fertility and reduced culling rates. However, the economic costs of infectious disease are well established and documented, and there is little doubt of the benefits of avoiding them. There are few farmers who would welcome more disease in their herds, and there are plenty that regret they did not use more robust biosecurity measures in the past.

Biosecurity Management Systems

Biosecurity management lends itself well to the established procedures of health planning. The measure – manage – monitor philosophy of health planning works well for biosecurity management, which should be an integral part of herd health planning. Structured systems of herd health management should always contain procedures for the measurement, management and

monitoring of biosecurity and biocontainment risks within a herd, as well as specific plans for surveillance and vaccination. The process is dynamic and requires regular review as the aspirations, resources and risks change over time. Where large scale programs are involved, the procedures can be complex and may require special systems to manage them. There are numerous examples where vaccination programs have lapsed or been incomplete, and where breaches in biosecurity have led to disease disasters.

Herd-health management systems such as myhealthyherd.com (Figure 2) allow farmers and their veterinary surgeons to manage and maintain effective disease control programs, including continual assessment and management of biosecurity.

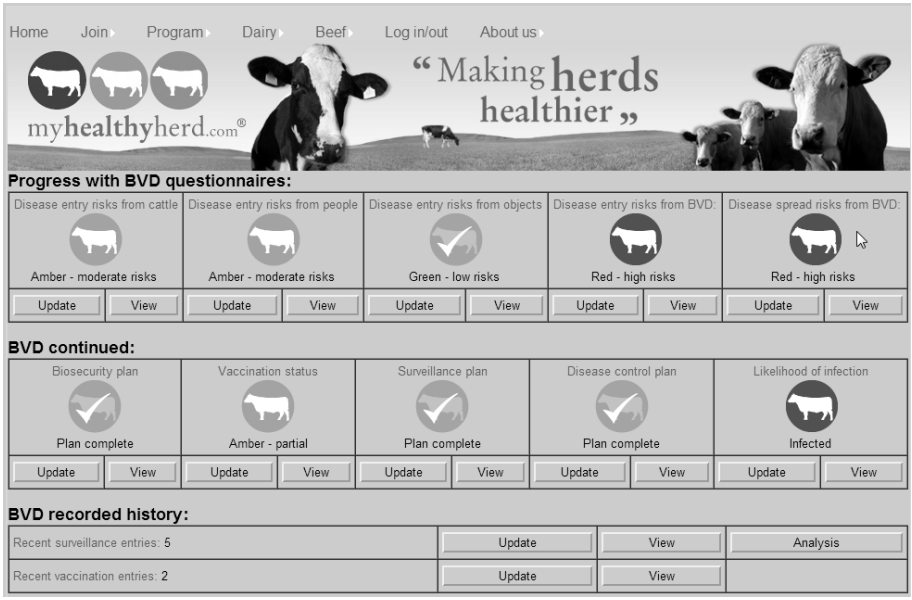

Figure 2: Screenshot of a summary of risk status, control planning and predicted prevalence of BVD in a herd taken from myhealthyherd.com. This summary is used as a measure of progress in controlling disease in a herd and protecting it from further infection.

The implementation of biosecurity on dairy farms can only serve to improve cow health, welfare and productivity. Even if resources are limited, they can be directed at the most appropriate biosecurity procedures to good effect, within the aspirations and objectives of the herd health plan.

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