

# An Overview of Biological Risk Management

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Author: Danelle Bickett-Wedde, DVM, MPH

Portions Reviewed By: Roberta Dwyer, DVM, MS; Dee Griffen, DVM, MS; Mark Kirkpatrick, DVM, MS; John Wenz, DVM, MS; Alice Wolf, DVM, PhD



**Center for Food Security and Public Health**  
**2160 Veterinary Medicine**  
**Ames, IA 50011**  
**515-294-7189**  
**[www.cfsph.iastate.edu](http://www.cfsph.iastate.edu)**

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## Introduction

The threat of introduction of disease agents, whether foreign or domestic, is very real in today's society. It is imperative that veterinarians, their clients and community members are aware of these various diseases, especially those with zoonotic potential, and are able to quickly recognize and appropriately respond in the event of an outbreak. While we are vulnerable to diseases, there are things we can do to help minimize our risk.

Biological Risk Management (BRM) is a term used to describe the overall process of evaluating a veterinary clinic, farm, or an animal housing facility based on the risk of infectious disease entry and spread. Improved infection/disease control is becoming the standard of care, not only for foreign animal disease threats but endemic diseases as well. Biological risk management tools help veterinarians assist their clients and colleagues meet today's standards. These tools allow for an objective assessment regarding the potential of an infectious disease entering and spreading within a veterinary clinic or animal facility and provide the tools to control the situation.

Biological Risk Management is not the same as biosecurity. Biosecurity efforts are intended to exclude disease agents, and could be considered a failure if any disease enters. Alternatively, BRM recognizes that disease risk cannot be completely eliminated, but that the risk can be managed through effective control measures. As animal caretakers, veterinarians need to be knowledgeable about the animal, its environment, infectious agent interactions and do everything possible to minimize the risk of disease influencing the health of an animal and jeopardizing the safety of humans. Many different solutions exist and because all operations, veterinary clinics, and animal facilities are different, there is not a one-size-fits-all answer.

## The Biological Risk Management Toolbox

To address the concerns regarding an infectious disease entering or spreading within a veterinary or animal housing facility, the CFSPH has designed a biological risk management toolbox. It consists of educational materials, an online database containing assessment questions, management recommendations, and resources that enable veterinarians to objectively evaluate their clinic or their client's animal facilities for the risk of infectious disease and to identify opportunities for improvement. The database and all other BRM Toolbox materials can be accessed at: [www.cfsph.iastate.edu/BRM](http://www.cfsph.iastate.edu/BRM). Registration is required to utilize the online database. Our vision for the use of these resources is as follows:

- A veterinarian begins by reading this general overview document.
- Next, read the section on the species (beef, dairy or equine) or veterinary practice (mobile or stationary) information of interest. This information is designed to refresh knowledge regarding general management practices and routes of transmission that influence disease management.
- The next step involves the completion of a pre-assessment questionnaire. This is designed to provide detailed information about the stationary clinic or animal operation to guide the veterinarian during assessment question selection. The pre-assessment may identify opportunities or areas of concern needing further investigation.

- If a veterinarian is assessing his/her own veterinary practice, he/she completes it.
- If the veterinarian is working with a beef, dairy or equine client, the client should complete the pre-assessment questionnaire prior to the on-farm evaluation.
- After reviewing the initial questionnaire, the veterinarian then evaluates his/her clinic or client's facility using a question set created in the online database. The questions are based on routes of disease transmission and designed to be answered yes/no/maybe, with yes being the ideal response.
- By entering the responses to the questions into the online database, several different reports can be generated.
  - Management recommendations will be provided for all questions answered no/maybe. These provide guidance to the producer for implementing improvements.
  - Current prevention practices will highlight the areas of strength on a facility for all the questions answered yes.
  - Routes of transmission charts are generated based on all responses (yes, no, maybe) to identify which routes are most neglected by the operation and identify opportunities for improvement.
- The final step for the veterinarian is to communicate this information to colleagues and staff or to clients and their employees. Together, they can design a management plan based on the information provided in the BRM Toolbox to minimize disease risk.
- Goals can be set based on current needs and short- and long-term objectives. Continued assessments should be conducted to chart progress. Resources, human labor, economics, and animal/human health risks need to be considered in the design and implementation of any management plan. More details will be discussed in the management and communication sections of this overview and within each specific topic.

The goals of this overview are to:

- Illustrate the importance of biological risk management;
- Introduce the concepts of risk perception and risk assessment;
- Discuss various routes of transmission that could introduce disease pathogens;
- Provide veterinarians with tools to implement practical disease management plans for practice owners, clients and producers; and
- Increase awareness regarding disease introduction and spread.

## Importance of BRM

Why is biological risk management important? There are several reasons – increased interaction with animals, the rise in emerging and re-emerging infectious diseases, the importance of the economics of agriculture, increasing globalization and changing food production practices.

***We interact with animals more than ever, increasing the chance of zoonotic diseases.***

Animals have been and continue to be an important part of our lives with approximately 60% of U.S. homes containing one or more companion animals. The bond between humans and animals has long been recognized to offer substantial emotional and physical health benefits. The American population, and more specifically- farmers, is aging and the number of chemotherapy patients, organ transplant recipients, persons with HIV/AIDS and people with diabetes in our society is growing. These groups are more vulnerable to zoonotic disease, and therefore make disease awareness of the general public more imperative today than it was 20 years ago. Veterinarians understand the potential health risks associated with zoonotic transmission of infectious diseases. With hundreds of potential zoonoses, educating clients and staff on practices that protect from zoonotic disease is an important professional task.

In addition to educating clients, veterinarians need to educate animal caretakers about BRM tools. If animal caretakers are prepared, they can help prevent a zoonotic or infectious disease from spreading throughout a household, clinic, or animal facility.

***There has been a rise in the occurrence of emerging and re-emerging diseases.***

In the last 25 years, some serious animal and human diseases have emerged or re-emerged.

- In 1982, *E. coli* O157:H7 and Lyme disease (*Borrelia burgdorferi*) first appeared.
- HIV emerged in the United States in 1983;
- The first case of bovine spongiform encephalopathy (BSE) was identified in the United Kingdom in 1986;
- Cat scratch fever (*Bartonella henselae*) was recognized in 1992;
- Hantavirus (Sin Nombre virus) was recognized in the four corners region of the U.S. in 1993.
- In 1996, variant Creutzfeldt-Jakob Disease (vCJD) appeared in humans in the U.K.
- Nipah virus emerged in swine and humans in Malaysia in 1998;
- West Nile Virus appeared in the United States in 1999.
- In 2003, SARS appeared in humans in Asia and Canada, Monkeypox was transmitted from prairie dogs to humans in the Midwestern United States, and the first case of BSE appeared in the U.S.

Veterinarians played key roles in the identification and diagnosis of many of these diseases. By helping colleagues and clients prepare for infectious disease outbreaks through awareness, proper planning and established control measures, the impact of new diseases can be greatly reduced.

***The economic ties to agriculture are far reaching.***

Beyond the scope of working directly in the agriculture industry, one in six jobs in America is related to agriculture. Much of the driving force comes from the animal production industry. The agriculture industry affects every man, woman, and child in America in some way. It is essential that we realize this and do everything we can to keep animals healthy to provide a safe food source and employment opportunities. Instituting biological risk management plans

at livestock facilities can help mitigate the economic consequences a foreign animal disease could inflict on our nation.

### ***Global travel and import/export is at an all time high.***

The increasing global nature of personal travel and import of animals increases the risk that a disease can enter the U.S. and disrupt our economy and livelihood. On any given day, over 1.3 million people and over 38,000 animals enter the United States. Approximately 730 million people travel on commercial aircraft each year and 11.2 million trucks and 2.2 million rail cars cross our borders annually. Additionally, 7,500 ships from foreign countries make 51,000 calls in U.S. ports annually. Each of these modes of transportation could bring a foreign animal disease into the U.S. either within an animal, within a food product carried by a traveler, or the traveler could be harboring a disease that is then spread directly or indirectly to U.S. animals.

In fiscal year 2000, 14 million animals were imported into the U.S., primarily from Canada and Mexico. Approximately 40,000 people employed by the Department of Homeland Security protect our 5,525 miles of border with Canada, 1,989 miles with Mexico and 95,000 miles of shoreline. It is a daunting task -- over 2 million agricultural items are intercepted annually at airports alone. We must all do our part to be aware of diseases and discuss these topics with clients who may travel themselves or send animals overseas for shows or breeding purposes.

### ***Food producing animals are reared in larger groups than ever before.***

Each year we see fewer and fewer farms, yet strong growth in the number of animals that remain on those farms. This intensity in animal production and species specialization has allowed livestock farmers to efficiently provide food for America and the world. Changes in animal production management present opportunities and challenges that were not there only a few decades ago. Susceptible animal populations could be located in a fairly small geographic area so that a single equine or cattle disease could have devastating economic effects. The way we raise and interact with animals has drastically changed, so too must our concept of how to prevent disease introduction and continue to ensure animal well being and a safe food supply.

## **Risk Perception**

The concept of biological risk management involves multiple components. Before a sound, applicable individual program can be established, it is important to first understand what your or your client's perception of risk really is. Risk means different things to different people. It is imperative to first identify what your client or colleague views as threats to their operation or facility. The general public often relies heavily on previous experience, the media, and their environment. What risks are deemed acceptable or tolerable also varies between individuals.

This is also the period where one may encounter many of the obstacles and challenges to educating about risk management. While it is difficult to prove and measure the benefit of things that do not happen, counter-arguments tend to fall into three categories: there is a risk, it is economically worthwhile to prepare, and the overall impact must be considered. By acknowledging concerns and addressing them effectively, colleagues and clients will be more willing to listen to suggestions for developing a comprehensive biological risk management program.

## Risk Assessment

After an understanding of risk perception has been established, the risk assessment can begin. This is a non-biased look at the clinic, facility, or operation to evaluate the various strengths and weaknesses related to a biological disease agent(s) entering and spreading. A set of questions to address aspects of the facility or animal operation has been designed for each major species covered (dairy, beef, and equine) and for stationary and mobile veterinary clinics.

Current scientific data that exists for biological risk management is fairly sparse and ambiguous. As new information becomes available, theories and practices will change. Veterinary professionals with an understanding of science and a working knowledge of premise evaluation will be able to work within this evolving framework. Predicting illness or disease is a complex series of conditional events. Disease predictions are not as simple as yes or no, but the various risks that predispose to disease occurring often are. Environmental conditions such as cleanliness and the animal's nutrition and stress levels can help or hinder a pathogen's existence. Risk assessments are living documents that change over time depending on the situation at hand. At best, they are a snapshot in time of a particular hospital, facility or operation. But if that snapshot is never taken, how do you measure improvement and forward progress? There will be challenges, but this is the first step in the right direction.

## Routes of Transmission

The approach taken in the development of these biological risk management tools was to look at diseases, not based on their names or clinical signs produced, but rather on the route of transmission to the animal or human (in the case of zoonotic diseases). An advantage of this approach is that it will also help protect against new or unanticipated infectious agents. While disease agents and the infections they produce vary depending on if they are a bacterium, virus, parasite or prion, they all have one thing in common: the animal must be exposed to them to develop disease. It is important that animal caretakers understand that certain pathogens can be acquired orally and others are acquired by aerosol transmission. Those are visual things that people can grasp and better yet, have a sense of control over. From a management standpoint, it may be easier to identify risk areas and then design protocols to minimize exposure.

Veterinarians and their clients often become complacent about endemic diseases, while foreign animal diseases or bioterrorism/agroterrorism attacks grab their attention. Management protocols designed to protect against the exotic and less common diseases will have the much needed benefit of also protecting against everyday endemic diseases.

Pathogenic agents can be spread from animal-to-animal or animal-to-human and vice versa, through a variety of transmission modes. For the purposes of the biological risk management resources, a definition is provided so participants understand how and why materials were grouped accordingly.

- **Aerosol transmission** – Occurs when pathogenic agents contained in aerosol droplets are passed from one animal to another, or from animal-to-human. Most pathogenic agents do not survive for extended periods of time within the aerosol

droplets and as a result, close proximity of infected and susceptible animals is required for disease transmission.

- **Oral transmission** – Involves the consumption of pathogenic agents in contaminated feed, water or licking/chewing on contaminated environmental objects. Feed and water contaminated with feces or urine are frequently the cause of oral transmission of disease agents. Contaminated environmental objects could include equipment, feed bunks, water troughs, fencing, salt and mineral blocks, and other items an animal may lick or chew.
- **Direct contact transmission** - Requires the presence of an agent or organism in the environment or within an infected animal. A susceptible animal becomes exposed when the agent directly touches open wounds, mucous membranes, or the skin through blood, saliva, nose to nose contact, rubbing, or biting. It is important to note that depending on the disease agent, it is possible for direct contact transmission to occur between animals of different species, as well as to humans.
  - **Reproductive transmission** – a subtype of direct contact that encompasses those diseases spread through venereal and in-utero routes. Venereal transmission is the spread of pathogenic agents from animal-to-animal through coitus. In-utero transmission is the spread of pathogenic agents from dam to offspring during gestation.
- **Fomite transmission** – Requires an inanimate object to carry a pathogen from one susceptible animal to another. Fomite transmission often involves a secondary route of transmission such as oral or direct contact for the pathogen to enter the host. Examples of fomites include contaminated vehicles, shovels, clothing, bowls/buckets, brushes, tack, and clippers.
  - **Traffic transmission** – a subtype of fomite transmission in which a vehicle, trailer, or human causes the spread of a pathogenic agent through contaminated tires, wheel wells, undercarriage, clothing, or shoes/boots by spreading organic material to another location.
- **Vector-borne transmission** – Occurs when an insect acquires a pathogen from one animal and transmits it to another. Diseases can be transmitted by vectors either mechanically or biologically. Mechanical transmission means that the disease agent does not replicate or develop in/on the vector; it is simply transported by the vector from one animal to another (flies). Biological transmission occurs when the vector uptakes the agent, usually through a blood meal from an infected animal, replicates and/or develops it, and then regurgitates the pathogen onto or injects it into a susceptible animal. Fleas, ticks, and mosquitoes are common biological vectors of disease.
- **Zoonotic transmission** – Occurs when diseases are transmitted from animals to humans. Human exposure will actually occur through one of the other five routes of transmission, but because of its importance, it is addressed as a separate route of transmission.

Many disease agents can survive for extended periods of time in soil or other organic material and can then be acquired by animals or humans through inhalation (aerosol), oral consumption, direct contact, or via fomites. While not a route of transmission, environmental contamination must always be taken into consideration.

Disease transmission can occur without animals exhibiting obvious clinical signs of disease. Awareness of the various routes of transmission is essential when assessing and developing a strategy to minimize the risk of disease for a facility or operation.

## Risk Management Plan

Once a facility or operation has been evaluated and the challenges identified, a tailored management plan can be proposed and implemented. Opportunities for improvement will be identified and depending on what was learned during the risk perception and risk assessment steps; these may be more challenging for some individuals than others.

When first working on opportunities for improvement, prioritize those items that are relatively easy to implement, inexpensive, yet yield rewards. There is no common formula for what that entails, and rewards will be different for everyone. As the herd veterinarian or clinic owner, it is your responsibility to guide and direct management decisions. Most individuals cannot process more than three new tasks at once, so keep that in mind when establishing a management plan. Just as the risk assessment is a living document, the management plan should be modeled to reflect current challenges and long-term goals. It will be beneficial to establish immediate, short and long-term priorities to give all parties time to absorb and process the information gained during the assessment. A number of possible implementation strategies for each of the areas identified in the assessment are included. Just as the Microsoft® Excel™ question set is not 100% comprehensive, these are just possible solutions, and other solutions can be developed. Your suggestions for improvements are always welcomed to build a better toolbox.

## Risk Communication

The cornerstone of the biological risk management plan is effective communication of risk with the stakeholders. One of the major barriers to effective risk communication is inadequate planning and preparation. Before designing an educational program, it is important to consider who is best suited to communicate the message, what message will be most effective, and when and where the information should be communicated. The success of the plan lies in how it can be carried out and who is responsible for making each section happen. Risk management plans must be understood, supported, and adopted by everyone involved for effective implementation.

Characteristics of effective risk communication:

- It must be adapted to meet the needs of the audience.
- It should present the important information in more than one way (visual and auditory).
- Sessions are more valuable if they are timely and the participants can apply the new information immediately.
- Sessions should cover what, when, where, how, by whom, and why.
- Participants should be given the opportunity to discuss, share information, and provide input.
- Meetings should be scheduled earlier in the day to be the most productive.

Proper communication of the risk management plan is of utmost importance for effective infectious disease control. When communication is effective, disease spread can often be minimized and controlled. However, few management plans are successful if records are not kept. Part of the risk communication process includes ensuring that a system is in place to measure progress.

## Role of the Veterinarian in BRM

Veterinarians have an essential role in biological risk management. They focus on keeping animals healthy and educating clients about disease prevention. They are trained in disease diagnosis and zoonotic awareness and prevention. They protect their livelihood by running a business with their clients and colleagues best interests at heart. Biological risk management has the same goals. It is taking a comprehensive approach to identifying the risk of disease entry and spread and developing a management plan. Who better to oversee and lead this effort than a veterinarian?

The veterinary-client-patient relationship can be strengthened by working as a team to provide a healthy environment for the animals, clients and employees. Expectations of clients continue to increase and as we look for better ways to serve their needs, biological risk management fits that long-term plan. Veterinarians are frequently asked to be an advisor and expert on infectious or zoonotic diseases for their clients or community. This can be a daunting task if not prepared. By having the right tools available and understanding the process of biological risk management, veterinarians can more completely provide this service to clients, colleagues, and their community. Biological risk management can do just that.

## Conclusion

We have discussed the importance of biological risk management for disease control within veterinary clinics and on various livestock operations. It is important to realize that everyone's perception and acceptance of risk differs. This should be considered when working with colleagues and clients to develop BRM practices. There are many ways which diseases can be introduced or spread. However, while disease risk cannot be completely eliminated, it can be managed. Everyone can play a critical role in minimizing infectious disease introduction and spread.

**"Decide what you want,  
decide what you are willing to exchange for it.  
Establish your priorities and go to work."  
Haroldson Lafayette Hunt, Jr. (or H.L. Hunt)  
American oil tycoon**