An overview of infection control strategies for equine facilities, with an emphasis on veterinary hospitals

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Many horses, like human beings, live a social and mobile lifestyle. Thus, the spread of infectious agents can occur rapidly and dynamically without proper infection control or biosecurity efforts. The occurrence of infectious diseases among horses can be costly and result in suffering of affected animals. The impact of an infectious disease outbreak depends on the (1) number of animals affected; (2) associated morbidity and mortality rates; (3) treatment costs for affected animals; (4) ability to prevent further spread or future outbreaks; (5) loss of performance potential for affected animals; (6) limits placed on movement of horses onto and off the affected premises; (7) zoonotic potential and severity of disease in human beings if it occurs; (8) public relations issues, such as potential loss of confidence and business of those who would bring their animal to the premises (farm, hospital, or clinic); and (9) potential for litigation. The emphasis of this article is on infection control strategies for hospitalized equine patients, but the principles of infection control apply to prevention of infection in patients in the field setting.

Hospital-acquired or nosocomial infections are a concern for the medical professionals who care for human and animal patients. Nosocomial infections seem to be on the rise worldwide. Some of the organisms...
associated with nosocomial infections in veterinary patients are multidrug resistant, making the control of such infections even more challenging [1,2].

Infection control entails preventing or minimizing exposure to infectious agent(s) or optimizing resistance to infection at the individual and population levels should exposure occur [3,4]. Based on a survey of directors of North American veterinary teaching hospitals (18 respondents), there were a total of 18 outbreaks of nosocomial infections in the period from 1985 to 1996 (W. Nelson, DVM, PhD, personal communication, May 2000). Of these, 14 were outbreaks of salmonellosis and 6 led to closure of the hospital. The associated cost of the outbreaks ranged from $10,000 to $428,174. Recognized nosocomial infections of equine patients include Salmonella spp [5-16], herpesvirus myelitis (S. Reed, DVM, personal communication, January 2004), influenza (P. Morley, DVM, personal observation, 1998, 2004), equine viral arteritis [17], streples (J.S. Weese, DVM, DVS, personal communication, July 2003) and methicillin-resistant Staphylococcus aureus (MRSA) [18,19].

Despite the visibility that outbreaks or epidemics of infectious disease may garner, endemic nosocomial infections among hospitalized human patients are more important in human medicine. It has been estimated that 5% of hospitalized patients develop a nosocomial infection, and nosocomial bloodstream infections are the eighth leading cause of death in the United States [20,21]. A good estimate of the level of endemic nosocomial infection occurring in equine veterinary hospitals is unavailable on a local or regional basis. Thus, we usually compare the occurrence of infection in our equine patients from year to year and focus on the occurrence of infections with a high profile instead reporting endemic infections. We also currently limit ourselves to the data from our own hospital versus looking at the occurrence of nosocomial infection rates across hospitals.

Because there have not been comprehensive reports on the occurrence of nosocomial infections in equine patients, we can only speculate on the number of such infections that occur. Despite the lack of accurate data, there is no reason to believe that veterinary patients are not experiencing a rate similar to that in human patients. Thus, there may be preventable infections that are accepted as normal, because a low level of these types of infections has always existed among hospitalized equine patients (endemic infections). An example of this would be the occurrence of incisional infections in postoperative patients, which may be overlooked. Perhaps if the rate of occurrence and circumstances surrounding these infections were monitored and reported, some of them would be found to be preventable if other methods of wound care were used. Potential methods of control might be changing bandages in a clean site, such as an examination room versus the stabling area, and monitoring the impact of such an intervention. Only if or when the rates of all types of infections are explored and intervention points are evaluated will the potential for reduction of the occurrence of endemic nosocomial infections be understood.

Further categorization of the status of infection in the patient may assist us in understanding the occurrence of what we are reporting. Determination of hospital-acquired versus community-acquired infection is an important part of an investigation. Date of identification of infection with respect to date of admission to the hospital is most often used to differentiate community-acquired from hospital-acquired infection; however, this may be misleading if other factors are not considered. For example, if a horse is detected to be shedding Salmonella enterica serovar Infantis in its feces on the third day of hospitalization as part of a hospital monitoring program and yet is showing no signs of illness, is it a hospital-acquired infection or is it hospital-expressed community-acquired infection? If no other patients are identified as shedding this specific agent, a hospital-expressed community-acquired infection is likely. We would only be able to draw this conclusion based on having a surveillance program in place for fecal shedding of Salmonella spp by hospitalized equine patients. When reporting results of a monitoring or surveillance program, it is critical that we acknowledge what it is being reported (eg, the occurrence of clinical disease caused by Salmonella spp infection, the occurrence of subclinical infection caused by Salmonella spp infection, colonization with the agent). This would hopefully allow for the comparison of the same data across time and between different hospitals.

There are many lessons that can be learned from the human health care arena regarding infection control strategies for hospitalized patients. Many human health care providers wish the rate of nosocomial infections in human hospitals was as low as that seen in veterinary hospitals (J.S. Weese, DVM, DVS, personal communication, July 2003). There are organizations, such as the Society of Hospital Epidemiologists of America formed in 1980, whose sole purpose is to discuss and deal with hospital-acquired infections. Entire books have been written on the topic of hospital infection control [22]. Although there are similarities between human and equine hospitals, there are also stark differences between hospitalized equine patients and human patients. Some of these include the fact that equine patients are housed over most of their bodies and likely have higher resident bacterial skin bacterial loads than most human patients; they have large nasal passages that can harbor organisms like MRSA; and despite our best efforts at hygiene, our equine patients are in close contact with their bodily fluids and wastes. In addition, the most common nosocomial infections seen in equine veterinary medicine have not been the same agents as those that cause most hospital-acquired infections in people, with the exception of the recent identification of MRSA in hospitalized horses.

Current status of biosecurity programs for hospitalized equine patients

Biosecurity and biocontainment are integral parts of the operation of any veterinary practice whether it is a mobile practice or a hospital and are one part of an infection control program. The goal of the biosecurity and
biocontainment aspects of an infection control program would be to limit or prevent exposure of the animals in the hospital to infectious disease agents. There is not one universal biosecurity program that can be applied to every situation, however. Variables, such as the size of the operation, geographic location of the operation, number of animals hospitalized, type of animals, number of employees, clientele, design of the facility, and financial constraints, are specific for each veterinary clinic and dictate the design of a biosecurity program. Veterinary teaching hospitals, for example, would require stricter biosecurity protocols than a general practice operated by a few veterinarians. The reasons for this requirement include a large number of animals admitted during a year from many different premises, the fact that animals are often admitted for treatment of severe disease problems, a larger number of people attending to every animal (several students, clinicians, interns, and residents), increased numbers of visitors (education), and the inherent obligation of a veterinary teaching institution to provide the optimal or ideal level of care and introduce the students and others in training programs to the concepts of biosecurity and biocontainment.

Programs aimed at infection control in hospitalized horses have been implemented at several veterinary teaching hospitals. Biosecurity and infection control in hospitalized horses were the focus of a workshop hosted by the Dorothy Havemeyer Foundation in Lexington, Kentucky in October 2003 and a session at the annual conference of the American College of Veterinary Internal Medicine in 2004. These discussions about infection control among hospitalized equine patients give further credence to the concept that there is a need for all veterinary practices to have some form of infection control plan in place. An appropriate infection control plan must be tailored to the individual facility. For example, in a one-person practice with a small clinic, this program may be a discussion about biosecurity, which would likely include a review of the cleaning and disinfection protocols and personnel hygiene practices, with all personnel on a periodic basis as well as an informal syndromic surveillance system. Syndromic surveillance would be based on clinical assessment without making a more definitive diagnosis, which often requires laboratory testing as part of the diagnostic plan. In contrast, in a larger hospital with more personnel and patients, the program may have several people devoted full time to infection control, and extensive documentation of the program may be in place. Based on the recent workshop on infection control in equine patients, it seems that the infection control principles detailed in existing programs have a common theme and could be applied to any veterinary clinic.

Motivation for an infection control program at an equine veterinary hospital

Outbreaks of infectious diseases with substantial financial impacts as well as negative impacts on the morale of the hospital personnel have prompted the development of most of the existing infection control programs at veterinary hospitals. It would be optimal if others could proactively develop preventative programs for nosocomial infections based on the lessons learned from these situations. Since an outbreak of salmonellosis in 1996, there has been a major commitment to the prevention of nosocomial infections in patients at the Colorado State University Veterinary Teaching Hospital (CSU-VTH). The biosecurity program has personnel whose sole role at the veterinary hospital is infection control, and all personnel and students are trained in infection control strategies. Detailed information on this program is available from the CSU College of Veterinary Medicine and Biomedical Sciences web site [23].

When developing an infection control program for hospitalized animals, it is important to keep in mind that horses housed at a veterinary clinic are different from those in the general equine population. Many of the hospitalized animals may be more likely to acquire or shed an infectious agent than those in the general population because of factors that include transportation stress, altered diet, administration of antimicrobials, invasive procedures (eg, catheter placement or surgical incision/wound), and underlying disease (these animals may be immunosuppressed and more susceptible to infection than animals in the general population). It is also important to keep in mind that each hospitalized equine patient represents a separate herd and that admixing of these patients from a hygiene standpoint means admixing different herds on a daily basis. Thus, efforts to prevent infection in this population must be more stringent than in the general population.

Outbreaks of salmonellosis and respiratory disease, such as streples and influenza, occur regularly on horse farms, racetracks, and other locations where horses congregate. Outbreaks of infectious diseases on horse farms can have major financial impacts and can negatively affect the morale of those on the premises who have to deal with the ill animals and their owners. Financial impacts would include expenses associated with the resolution of an outbreak, cost of treating the affected animals, lost use of affected animals, cost associated with the animals that die, and lost income for the operation if movement or value of other horses is affected. The animals that originate from a farm-based outbreak of infectious disease also pose a risk to the veterinary hospital facility and hospitalized patients when animals from the affected farm are referred for an advanced diagnostic procedure or treatment.

Considerations for control programs for infectious diseases, such as rotaviral diarrhea, salmonellosis, and streples, have been covered in recent publications oriented toward readers who are horse owners [24-29]. Veterinarians are a critical link to convey information on infection control to clients and must be aware of articles that their clients may be reading so as to serve clients by answering questions and tailoring recommendations to their specific situation. Such articles demonstrate that consumers of our
Key components of an infection control plan

Important components of an infectious disease control program include the following:

1. Determine which diseases are to be controlled and understand the ecology of these diseases.
   A. If fecal-oral spread is likely, all sources of spread of fecal material from animals shedding the agent must be taken into consideration (eg, rodent control, bird control, insect control, preventing contamination of feed and water sources, hand cleanliness of personnel, cleanliness of the facility).
   B. If aerosol spread is likely, an adequate distance must be maintained between infected or exposed animals and those not yet exposed. Consideration must be given to adequate ventilation within the housing area.
   C. If vector spread is likely, control of insect access to susceptible animals is necessary.
   D. If environmental contamination may play a role, routine monitoring and subsequent intervention if the agent is detected would be indicated.
   E. If fomites may play a role in the spread of a pathogen, implementation of protocols to avoid sharing of potential fomites (ie, rectal thermometers) is required or measures must be taken to ensure that potential fomites are adequately cleaned and disinfected before use on another patient.

2. Group animals based on their infection status.
   A. Monitoring to determine the status of the animal is required.
      1) On the farm, this may include performing physical examinations on arrival, testing on arrival or before arrival with a screening test (eg, equine infectious anemia, tests for other diseases), or knowing the status based on history or lack of history of exposure.
      2) For a veterinary clinic, this may entail screening of all patients before admission to the hospital for signs of contagious disease, such as an oral examination to detect vesicles or ulcers if a vesicular stomatitis outbreak is occurring in the region, or obtaining an accurate history on all animals so that if a disease like strangles is occurring on the farm of origin, the animal can be admitted directly to the isolation facility or a separate area of the hospital. This helps to minimize exposure to the remainder of the hospital population.
   B. Once animals are grouped together, it is important to maintain hygiene of the facility and personnel so that these animals and their bodily fluids and excrements stay separate from other groups. A key component of this is housing animals with likely or confirmed contagious infectious disease in a separate isolation facility. This isolation facility and associated hygiene protocols should allow each animal to have its own microenvironment while in the hospital that limits exposure to infectious disease agents from this animal to any other animal in the facility. The isolation process makes use of a separate facility as well as barrier precautions to reduce the likelihood of spread of infectious agents from animals in isolation to other animals in isolation or in the rest of the facility.
   C. Adequate facilities are required for segregation of animals into groups based on their status.
      1) This requires an isolation facility or designated area for patients with contagious diseases if the practice intends to care for animals with diseases like strangles, rotavirus, or salmonellosis.
      2) Ideally, the facility would allow for segregation of any patients that may pose an increased risk to the remainder of the hospital population. For example, there may be a separate area for colic patients. This area should be physically removed from other patients but should also use barrier precautions and staffing methods that limit the risk of movement of agents like Salmonella spp from the colic area to other areas of the hospital.

3. Monitor for occurrence of infectious disease through observation of clinical signs and through testing, if appropriate, for infectious disease occurrence. Affected animals should be isolated and appropriately treated if disease occurs.
A. This requires performing regular examinations of the animals, including determination of rectal temperature daily during the monitoring period at a minimum.

B. Collection of laboratory samples for monitoring or diagnostic purposes is often part of a comprehensive monitoring program of hospitalized patients.
1) For example, feces may be collected for culture to detect *Salmonella* spp in all colic patients on admission and three times a week.
2) If a patient is admitted with clinical signs of strangles, it should be standard practice for the admitting clinician to submit appropriate samples to determine if *Streptococcus equi* is present in nasal exudate or abscesses.

C. This practice requires that someone within the hospital system be responsible for the compilation of test results and be looking for trends. If nosocomial infection is detected or suspected, action should be taken.

D. A willingness to admit when there is a problem is necessary. Optimally, the background occurrence of various infectious diseases should be known for hospitalized patients, and a predetermined point at which action is to be taken (ie, an alert threshold) should exist. Likewise, a system to alert those who need to take action should be in place.

E. This requires appropriate action if it seems that infections are spreading within a group or among groups (eg, isolation of infected animals to prevent further spread). The person or committee in charge of infection control needs to determine the plan for dealing with the problem. If a particular disease agent has been a problem in the past, there should be a predetermined action plan in place. If the agent is a new one to the hospital, there should be a general plan of action (eg, person in charge would do a literature search and potentially contact specialists to determine the best way to deal with the problem at hand).

F. There should be written and verbal communication for personnel regarding infection control strategies. There should be a mechanism for communicating information regarding the infectious disease status of animals and appropriate written control methods. Communication regarding each hospitalized animal’s infectious disease status should be ongoing so that personnel involved in daily care of the animals can stay informed of the status of patients and the current biosecurity protocols being implemented. For example, development of a communication board, color-coded infection status of each animal, and, potentially, color-coding of clothing used in animal care areas can be employed. Each of these strategies can help to facilitate the implementation of infection control strategies. In addition, signs promoting hand hygiene can be posted to address this critical step in infection control.

G. Determine methods to improve compliance with biosecurity protocols or policies, such as an incentive program, and predetermine the consequences if personnel do not comply with protocols. One example that has been used is a "penalty system," whereby anyone observed to be noncompliant with biosecurity protocols has to bring pizza for all their coworkers the next day for lunch. This makes peer pressure a way of implementing biosecurity protocols while avoiding more severe disciplinary measures, which may be accompanied by decreased moral and resistance to new infection control measures.

4. Basic hygiene concepts need to be evaluated and implemented based on the goals of the infection control plan for the hospital or facility. These must be developed considering the likely routes of spread of disease agents. In most situations, addressing movement of infectious disease agents via personnel movement is part of a plan. In human medicine, many infectious agents are spread via hands of hospital personnel and equipment of personnel related to patient contact. Several articles in this issue address in more detail the concepts of barrier precautions and hand hygiene. Briefly, it is important to be certain that equipment required for certain biosecurity protocols is readily available to ensure compliance. For example, if foot baths or mats or frequent hand cleansing is to be part of the biosecurity plan, the facility needs to be equipped to allow for convenient use of such methods of infection control. If a sink is not available in the animal housing area, a temporary hand hygiene station would need to be improvised.

5. Institution of an immunization program during an apparent outbreak may be beneficial in certain instances. During an influenza outbreak in hospitalized equine patients at the CSU-VTH, owners of all newly admitted animals were advised that they should have their horses vaccinated against influenza before arrival, and all hospitalized horses were vaccinated with intranasal modified-live influenza.

6. Optimization of the overall health of the animals by minimizing stressors, optimizing nutritional status, optimizing specific immunity through vaccination, and minimizing treatments that may make the animal more susceptible to disease is important. Examples of optimizing health would include addressing the micronutrient and caloric needs of patients that may be anorexic as a result of their medical problem and implementing judicious use of antimicrobials, because antimicrobial use may alter the gastrointestinal flora and provide a selective advantage to multidrug-resistant bacteria.

Many of the protocols implemented at the CSU-VTH would apply to infection control at other hospitals and even on farms. They are summarized here as an example of methods that could be used to control infections in
horses. Selected specific examples of infection control strategies are given here.

At the CSU-VTH, colic patients and food animal patients were most likely to shed *Salmonella* spp in their feces as compared with equine patients hospitalized for other reasons. The approach to control of nosocomial salmonellosis among equine patients was based on the analysis of data from a *Salmonella enterica* serovar Infantis outbreak in 1996 [6]. A monitoring program for *Salmonella* spp shedding in the large animal hospital is in place, whereby fecal cultures are performed on all colic patients during their stay in the hospital. Any horse that is detected to be shedding *Salmonella* spp in the feces is moved to the isolation facility or discharged from the hospital. As well, any horse that meets the predetermined clinical criteria for enteritis likely caused by an enteropathogen, such as *Salmonella* spp, is moved to the isolation facility while culture results are pending. When admitting their animal, owners sign a consent form indicating that a portion of the hospitalized animals are sampled, that infections can occur in hospitalized patients despite all appropriate measures to control such infections, and that questions have been answered to the satisfaction of the horse owner or agent. This is an example of grouping animals by their level of risk for acquiring or shedding infectious agents within a hospital setting as well as an example of applying a monitoring program to the highest risk population. It is also an example of risk communication to clients regarding nosocomial infections in hospitalized animals.

At the CSU-VTH, cleanliness of the environment is monitored, with the main emphasis being the stalls where equine patients are hospitalized (methods described in detail on web site). Periodic "spot checks" of environmental areas likely to have been contaminated with *Salmonella* spp, such as drains and ceilings in the area of the hospital used to house the colic patients, are performed. The cleanliness and hygiene practices of hospital personnel are addressed through regular training on biosecurity, providing ready access to handwashing stations as well as dispensers of waterless hand disinfectants and strategically placed footbaths and having special clothing readily available to facilitate barrier precautions. The use of shared equipment, such as rectal thermometers, stethoscopes, and stomach tubes, between hospitalized equine patients is minimized unless adequate disinfection of the equipment can be accomplished.

Based on an average of three fecal cultures per colic patient, approximately 9% of these animals are identified as shedding *Salmonella* spp in their feces during hospitalization at the CSU-VTH [31]. The overall prevalence of fecal shedding of *Salmonella* by food animal patients has been much higher even though only a single sample is collected per animal. Some of the dairies in the vicinity of the hospital have had as many as 45% of their animals shedding *Salmonella* spp in their feces on arrival. The serogroup and antibiogram of each *Salmonella* isolate is available from our local diagnostic laboratory, and each isolate is sent for serotyping at the National Veterinary Services Laboratories. This monitoring system has allowed for early detection and prompt intervention when nosocomial spread of *Salmonella* spp seems to be occurring.

Several outbreaks of equine influenza have occurred at the CSU-VTH since inception of the biosecurity program in 1997. These outbreaks have been controlled by prompt identification and isolation of infected animals along with vaccination of in-contact animals and recommendations to clients that they have their animals vaccinated against influenza before hospitalization.

Reportable diseases, such as vesicular stomatitis, create new challenges. When there have been vesicular stomatitis outbreaks in Colorado, the CSU-VTH has instituted an oral examination policy for all equine admissions to prevent animals with vesicular stomatitis from entering the main hospital. This is particularly important considering that entrance of vesicular stomatitis virus into the main facility would result in quarantine of the entire facility. This protocol was developed with guidance of the State Veterinarian of Colorado. Since the institution of these protocols, infected animals have not been identified in the main hospital and the CSU-VTH has not been quarantined even though there were ongoing cases of vesicular stomatitis in Colorado and the surrounding states in the late 1990s.

### Infection control principles for horse farms

Many of the principles of infection control used in veterinary hospitals could be used to control infections in horses on equine farms. It is important to realize that an infection control program may not eliminate infectious diseases in horses but, hopefully, would limit the severity of the problem by minimizing the number of animals affected and the severity of the infection in those exposed to the agent. Biosecurity principles have proven successful in control of disease outbreaks caused by rotaviral diarrhea on equine farms [24].

Based on the National Animal Health Monitoring System (NAHMS) Equine '98 study (Table 1), 22% of operations added new resident equids during 1997, whereas 11.2% of operations had nonresident equine visitors for less than 30 days. Larger operations were more likely to have had visiting equids and to have added new resident equids [32].

One method of managing disease risk posed by introducing equids to an operation is isolation or quarantine of new arrivals for a period that exceeds the incubation period of targeted diseases. Approximately one third (34%) of operations that added new resident equids that were surveyed routinely quarantined these new arrivals from the resident equine population. As the size of the operation increased, larger percentages of operations routinely quarantined new arrivals. For operations that routinely quarantined newly added equids, the average routine length of quarantine was 28.5 days. The percentage of equine operations with new additions that routinely
Table 1
National Animal Health Monitoring System Equine '98 study

<table>
<thead>
<tr>
<th>Health requirement</th>
<th>Percentage required</th>
<th>Official health certificate</th>
<th>Veterinary examination other than for health certificate</th>
<th>EIA test, Coggins test, Swamp Fever test</th>
<th>Vaccination within past year</th>
<th>Deworming within past year</th>
<th>Anything else</th>
<th>Any requirements</th>
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<td></td>
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<td>1-2 (number)</td>
<td>3-5 (number)</td>
<td>6-19 (number)</td>
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<td></td>
<td>%</td>
<td>% SE</td>
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<tr>
<td>Official health certificate</td>
<td>31.5 (10.3)</td>
<td>31.9 (5.1)</td>
<td>49.2 (4.4)</td>
<td>69.9 (5.7)</td>
<td>Veterinary examination</td>
<td>36.4 (11.1)</td>
<td>36.5 (5.4)</td>
<td>40.7 (4.8)</td>
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<tr>
<td>EIA test, Coggins test, Swamp Fever test</td>
<td>52.0 (11.3)</td>
<td>42.6 (5.8)</td>
<td>68.2 (4.8)</td>
<td>76.0 (5.4)</td>
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<td>Vaccination within past year</td>
<td>44.7 (11.2)</td>
<td>51.9 (5.8)</td>
<td>50.4 (4.4)</td>
<td>77.9 (5.2)</td>
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<td>Deworming within past year</td>
<td>39.1 (10.9)</td>
<td>61.4 (5.6)</td>
<td>64.1 (4.8)</td>
<td>74.9 (5.7)</td>
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<td>Anything else</td>
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<td>7.8 (4.4)</td>
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<td>22.1 (5.3)</td>
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<tr>
<td>Any requirements</td>
<td>56.0 (11.3)</td>
<td>76.0 (4.7)</td>
<td>83.0 (3.9)</td>
<td>93.3 (2.2)</td>
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Abbreviations: EIA, equine infectious anemia; SE, standard error.

For operations that added new equids to the resident equine population during 1997 (excluding births), percent of operations, that always or sometimes required the following for new additions by size of operation.

quarantined new arrivals exceeded that reported for dairy operations in the NAHMS Dairy '96 study (13.6% quarantined at least one half of new additions) and was similar to that for cow-calf operations according to the NAHMS Beef '" study (38.9% quarantined all or some new additions) [32].

Other methods of reducing the risk of disease spreading from animal to animal are those that help to ensure the optimal health status of new arrivals through a veterinary examination, requiring vaccination and deworming of the newcomer before arrival and that the newcomer be tested for contagious diseases. Based on data from the NAHMS Equine '98 study, more than one half of equine operations that added new resident equids required a test for equine infectious anemia. Approximately 40% always or sometimes required an official health certificate, and approximately the same percentage required an examination by a veterinarian other than for an official health certificate. More than 50% of operations that added new resident equids required vaccination and deworming of new additions before arrival. Larger percentages of operations required an official health certificate, a veterinary examination other than for an official health certificate, and deworming of new residents as the size of operation (number of equids on the premises) increased. Approximately one in four operations with new arrivals (24.2%) had no health requirements for new arrivals. Resident animals could be at risk for infectious disease if a quarantine or program for testing newcomers on arrival is not used.

Many equine owners and operators of equine facilities look to veterinarians to provide information they need to make decisions about health care. Based on the NAHMS Equine '98 study, veterinarians were rated very important as sources of information for equine health care decisions by 84.1% of operations and somewhat important by another 12.6% of operations [32]. As an important source of equine health information and to serve as an example to our clients, veterinarians should strive toward optimal biosecurity principles in their clinic or hospital as well as serve as a source of such information for their clients.

References

[3] Dargatz DA, Garry FB, Tillotson K, Savage CJ, Salman MD, Gentry-Weeks CR, Rice D, Fedorka-Cray PJ. Official health certificate. More than 50% of operations that added new equids to the resident equine population during 1997 (excluding births), percent of operations, that always or sometimes required the following for new additions by size of operation.
Evolution of equine infection control programs

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Early history

Throughout history, contagious diseases of animals and people have played a major role in the development of civilization [1]. People first planted crops and domesticated livestock, which allowed them to remain in one location in permanent settlements, some 8000 to 11,000 years ago [1]. The horse was probably domesticated around 4000 to 5000 years ago in the Ukraine [1,2]. Whereas these advances allowed populations to grow because of a more predictable source of food than the nomadic hunter-gatherer societies had encountered, as the size of towns grew, so did the importance of infectious diseases. Early cities had no basic sanitation, and diseases like typhoid, cholera, dysentery, and leprosy killed many people. Epidemics of plague, smallpox, typhus, and measles periodically swept in and devastated populations. Similarly growing domestic equine populations were increasingly exposed to infectious diseases, such as strangles and glanders [2], and people recognized the need to isolate horses with contagious disease.

Military veterinary hospitals for horses appeared during World War I and seem to be some of the earliest equine hospitals [3]. The development of large equine veterinary hospitals is a twentieth century phenomenon, yet it reflects many of the same problems encountered by people as towns and cities grew for thousands of years. In equine hospitals, horses of varying levels of susceptibility are congregated in a setting where they are likely to be exposed to infectious disease organisms. Some of these infectious diseases are highly contagious disorders that appear as epidemics (eg, influenza, strangles, equine herpesvirus 1), whereas others are more endemic contagious disorders of stress and imperfect sanitation (eg, salmonellosis,